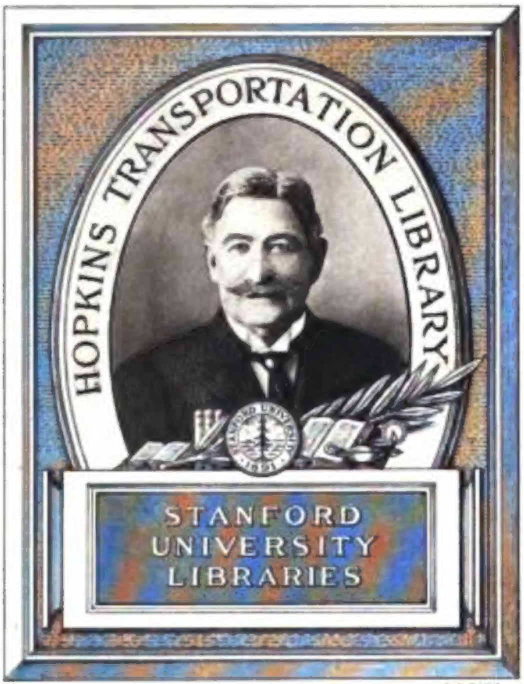
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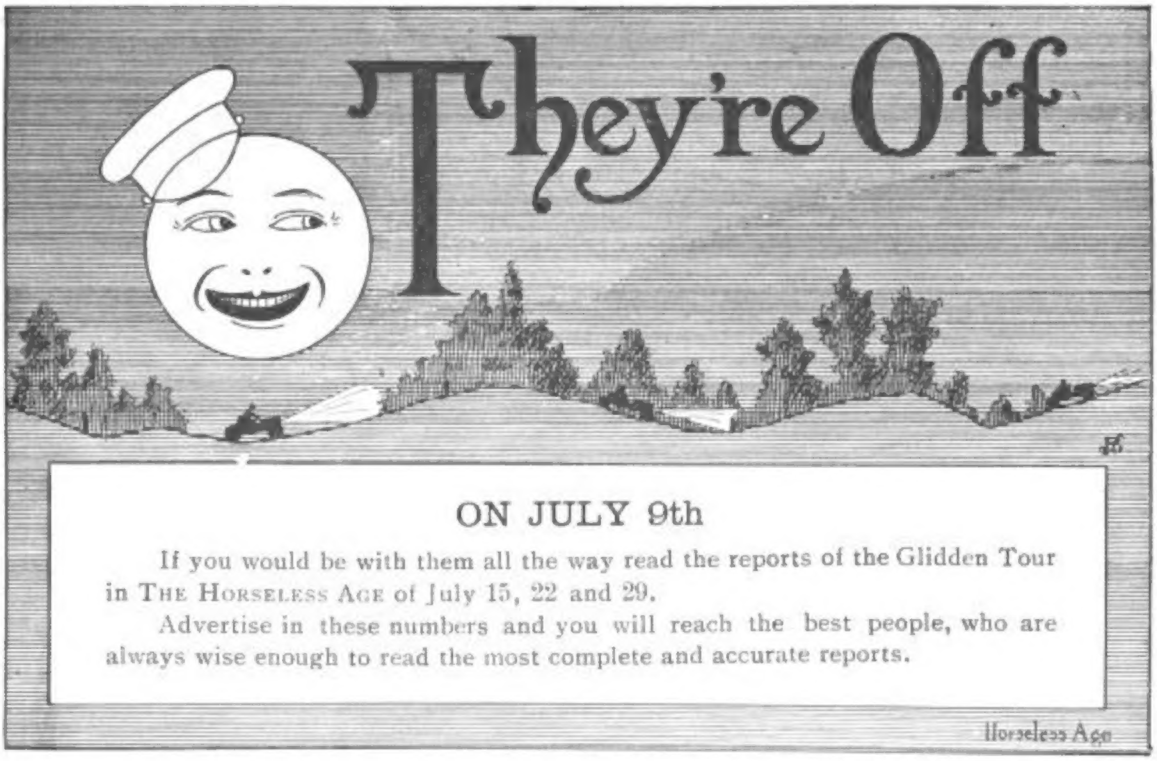

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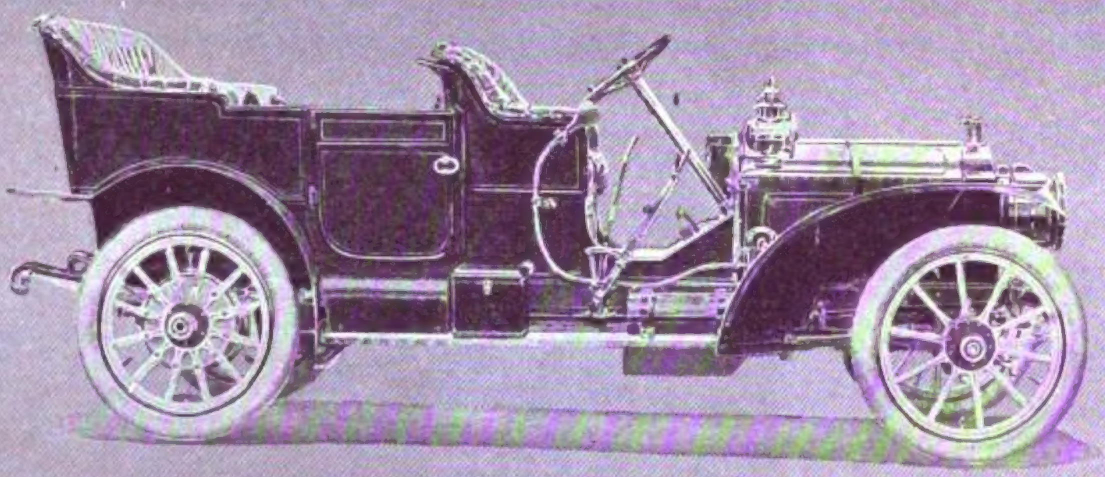

Touring Car

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The Horseless Age

First Automobile Journal in the English Language

VOLUME XXII 556034 NEW YORK, JULY 1, 1908 NUMBER 1

Worm Gearing—Its Use and Efficiency.

By Morris A. Hall.

Among the many new things, or, rather, old things in a new rôle, seen upon the modern automobile, may be mentioned the worm and worm gear, whose growing use demands an investigation into its peculiar properties. This transmission device has been used on automobiles in the past in only one place, viz., in the steering gear, where it is used probably in a majority of all vehicles.

The worm is commonly supposed to have a very high coefficient of friction, and consequently a low efficiency. Moreover, it is supposed to be absolutely irreversible. This latter feature makes it ideal for steering purposes, and the former does not matter much in that application, as the source of power (hand) is sufficient for all purposes. However, the erroneous ideas as to its inefficiency and irreversibility have prevented its use elsewhere.

Now, as its use becomes more general, and as designers become more familiar with its peculiar properties, it is becoming known that while it may be made so as to be irreversible, it may also be so constructed as to be absolutely reversible. This feature, while of no advantage for steering gears, makes its use practical in the final drive of an automobile.

It has been used in this connection as a substitute for bevel gears in a shaft drive with a live rear axle, where it possesses the great advantages of high reduction with very small sizes, of various and interchangeable reductions with the same centre to centre distance, same case, etc., of making the drive practically a straight line drive, and thus eliminating friction losses in the universal joints. The advantage of a high reduction being more of a necessity on commercial cars than upon pleasure vehicles, it is among the former that we find it used most, although the newest addition to the electric pleasure car list also has a final drive of this type.

Although the shaft drive is not generally considered best for very heavy work, we find that the strongest foreign advocate of the worm drive uses the live rear axle exclusively, and uses it, moreover, upon the heaviest type of vehicles, including a 5 ton truck, and has successfully done so for the past four years. It may be mentioned here that these cars have gained a reputation in England for quiet running. This means much in a country where the quiet steam vehicles enjoy such popularity. As the maker and others give the credit to the worm drive, it is seen at once that the worm has an additional point in its favor.

The straight line drive has been agitating the industry for several years, and the steps taken to secure it have been many and various. We have the drop frame, the double drop frame, the double reduction gear axle and other expensive means of attaining the desired result, which with a final worm drive is attained without any of these objectionable methods. The worm must be either above or below the worm gear, and in the overhead position the usual centre to centre distance is such as to bring the centre line of the worm shaft practically up to the horizontal centre line of the crank shaft.

The matter of changing the speed ratio is well worth considering here. Given a car with a worm drive, say a single threaded worm, to double the speed, all we need is a double threaded worm of the same diameter, same length, same linear pitch—in short, interchangeable, except double threaded instead of single threaded. If we wished to quadruple the speed an interchangeable four threaded worm is all that is necessary. Stated in another way, the velocity ratio depends upon the pitch (in the case of a multiple threaded worm this becomes lead, which is equal to the number of threads multiplied by the pitch) of the screw and not upon the diameter of the pitch cylinders, as it does with other forms of gearing.

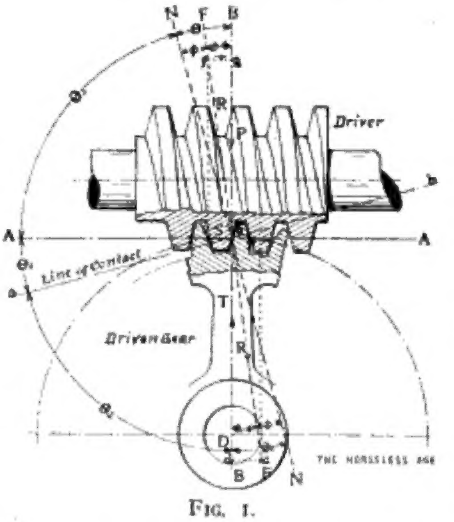


Fig. 1.

Another general law which will be proven later is that the efficiency varies directly with the pitch angle of the worm (also called thread angle and helix angle). As the amount of work lost depends upon the efficiency, and as the amount of heating and consequent wear depend upon the work lost, and, therefore, upon the efficiency, it is readily seen that a large pitch angle is very desirable.

It is to an increase in this angle, or, rather, the recognition of the law stated above, that we owe the recent rapid improvements in results and the corresponding increase in the number of worms in use. As will be shown later, the increase in the angle produces improved results up to an angle of very nearly 45 degrees, beyond which the situation is reversed and any further increase in the angle will lead to a decreased efficiency together with more heating and greater wear.

THEORY.

The most common form of the gear and the only form found on motor cars is with the two shafts at right angles, or more correctly, with the projection of the two shafts upon a horizontal plane at right angles. Thus, in Fig. 1 we have *c c* the centre line of the worm and worm shaft at right angles to the centre line of the worm gear shown as a point D. If these centre lines be projected into a plane and that plane rotated 90 degrees, so as to coincide with the plane of the paper, we may then consider these two centre lines or axes as passing through O, the point of contact of the teeth. We will then consider A A as the axis of the worm and B B the axis of the wheel. Then line *a b*, the line of contact, which is the common tangent to the pitch surface and the helices (or threads) at the pitch point O, will make an angle θ_1 with the axis of the driver and θ_2 with the axis of the driven gear.

PITCH RELATIONS.

The line N N drawn at right angles to the line of contact *a b* at the pitch point O will be the common normal, and F F making an angle with it of ϕ, tangent ϕ being equal to μ, the coefficient of friction.

Now let a_1, a_2 be the equally divided axial pitches and c_1 c_2 the equally divided differential pitches of the two wheels. Then for any pair of wheels whose axes are not parallel

$$a_1 = c_1 \cot \theta_1 \ldots\ldots\ldots\ldots (1)$$

$$a_2 = c_2 \cot \theta_2 \ldots\ldots\ldots\ldots (2)$$

from which it may also be shown that $c_1 : c_2 : : a_1 : a_2 : : \eta$.

When the shafts are at right angles, as in the present case; that is, when $\theta_1 + \theta_2 =$

90°, and $\cos\theta_2 = \sin\theta_1$, the equation

$$\eta = c_1 \cos\theta_1 = c_2 \cos\theta_2 \ldots\ldots\ldots\ldots \quad (3)$$

leads to the conclusion that the axial pitch of one wheel (the worm) equals the circumferential pitch of the other (the "wheel").

VELOCITY RELATIONS.

Commonly the worm has any number of threads from one to five, which work with a gear or worm wheel. If now, we let N_1 N_2 represent the number of revolutions of the worm and wheel, respectively, a_1 a_2 their angular velocities, and v_1 v_2 the number of threads on each (teeth in the case of the wheel), then

$$\frac{N_1}{N_2} = \frac{a_1}{a_2} = \frac{v_2}{v_1} \ldots\ldots\ldots\ldots (4)$$

Thus if the worm has one thread and the wheel twenty-five teeth, the velocity ratio is 25 to 1. This may be stated in another way as follows: The velocity ratio depends upon the distance the screw advances in one revolution and not upon the diameters of the pitch cylinders. Now, as the distance which the screw advances is one revolution depends upon the pitch and the number of threads, their product being the lead or distance advanced, we can readily see the influence of the thread-angle which influences the pitch, and of the multiple thread which multiplies the pitch.

If the worm is single threaded it must make as many turns as there are teeth in the wheel to revolve the latter once. If double threaded, the worm must make half as many turns, or if it makes as many turns the worm wheel will make twice as many revolutions as before. Similarly, triple, quadruple and quintuple threaded worms either multiply the worm wheel speed by 3, 4 and 5, or divide the worm speed by 3, 4 and 5 for the same number of revolutions of the worm wheel—whichever is desired. Ordinarily no more than five threads are used.

EFFORT AND RESISTANCE RELATIONS.

Now, to take up the ratio of effort to resistance, we find that in Fig. 1 the worm is in equilibrium under the action of an effort P, a thrust S along its axis, and a reaction R of the wheel. Similarly the wheel is acted upon by a resistance overcome Q, a thrust T along its axis and the reaction R of the worm. We are principally concerned with P, the available efforts of the worm, and Q, the resistance overcome of the gear.

From an inspection of the figure we see that

$$P = R\cos(\theta_1 - \phi) \ldots\ldots\ldots\ldots (5)$$

$$Q = R\cos(\theta_2 + \phi) \ldots\ldots\ldots\ldots (6)$$

and $\frac{P}{Q}$ is the ratio desired.

$$\therefore \frac{P}{Q} = \frac{\cos(\theta_1 - \phi)}{\cos(\theta_2 + \phi)}, \ldots\ldots\ldots\ldots (7)$$

in which it will be remembered that θ_1 is the inclination of the axis of the driver and θ_2 of the driven gear to the line of contact.

The two shafts are at right angles, so that $\theta_1 + \theta_2 = 90°$. Then $\cos\theta_2 = \sin\theta_1$ (or $90 - \phi_2$). Also, $\sin(\theta_1 - \phi) = \cos(\theta_2 + \phi)$. Substituting these values in equation (7),

$$\frac{P}{Q} = \frac{\cos(\theta_1 - \phi)}{\sin(\theta_1 - \phi)} = \cot(\theta_1 - \phi) \ldots\ldots (8)$$

This equation may also be written in the form

$$\frac{P}{Q} = \frac{1 + \mu(\tan\phi_1)}{\tan\theta_1 - \mu} \ldots\ldots\ldots\ldots (9)$$

EFFICIENCY.

The action of the effort P is along a line O g, Fig. 1, for a distance which we may call c_1, not being shown in its true length in this figure. Similarly the resistance Q acts along a line O c for a distance c_2. Now the work done upon the driven gear is equal to the force P times the distance c_1 through which it acts; that is, P c_1. Similarly, the useful resulting work is Q c_2. The efficiency is the resultant work accomplished divided by the work done upon the gear, or

$$\text{Efficiency } \eta = \frac{Q\,c_2}{P\,c_1} \ldots\ldots\ldots\ldots (10)$$

Inserting equation (8) and substituting in equation (10) we get

$$\text{Efficiency } \eta = \frac{c_2\cos(\theta_2 + \phi)}{c_1\cos(\theta_1 - \phi)} \ldots\ldots\ldots (11)$$

By transposing equation (3) we have

$$\frac{c_2}{c_1} = \frac{\cos\theta_1}{\cos\theta_2} \ldots\ldots\ldots\ldots (12)$$

Substituting these values in equation (11) we get our efficiency in the form

$$\eta = \frac{\cos\theta_1\cos(\theta_2 + \phi)}{\cos\theta_2\cos(\theta_1 - \phi)} \ldots\ldots\ldots\ldots (13)$$

As we have previously seen, $\cos\theta_2 = \sin\theta_1$ and $\cos(\theta_2 + \phi) = \sin(\theta_1 - \phi)$. Substituting these values in equation (13) and remembering the trigonometrical relations

$\frac{\cos}{\sin} = \frac{1}{\tan}$ and $\frac{\sin}{\cos} = \tan$, we get the form

$$\eta = \frac{\tan(\theta_1 - \phi)}{\tan\theta_1} = \frac{\tan\theta_1 - \tan\phi}{(1 + \tan\theta_1\tan\phi)\tan\theta_1}$$

$$= \frac{1 - \mu\cot\theta_1}{1 + \mu\tan\theta_1} \ldots\ldots\ldots\ldots (14)$$

but c_1 a_1 are the circumferential and axial pitches of the worm, and

$$\tan\theta_1 = \frac{c_1}{a_1} \ldots\ldots\ldots\ldots (15)$$

Now the axial pitch a_1 of the worm is equal to the circumferential pitch of the gear, or

$$a_1 = c_2 = p \ldots\ldots\ldots\ldots (16)$$

If there are v_2 threads or teeth in the worm wheel, then $p\,v_2$ equals the circumference on the pitch line. If the radius at the pitch line is r_2 then $2\pi r_2$ also equals the circumference; that is,

$$p\,v_2 = 2\pi r_2 \ldots\ldots\ldots\ldots (17)$$

In general for any screw or worm wheel of v_1 threads and r_1 radius

$$c_1 v_1 = 2\pi r \ldots\ldots\ldots\ldots (18)$$

Now, combining this equation with equation (15), we have

$$c_1 = \frac{2\pi r_1}{v_1}\tan\theta_1 = \frac{c_1}{a_1} = \frac{c_1}{p} = \frac{2\pi r_1}{v_1 p}, \ldots (19)$$

and inverting this,

$$\cot\theta_1 = \frac{1}{\tan\theta_1} = \frac{v_1 p}{2\pi r_1}, \ldots\ldots\ldots\ldots (20)$$

from which by substituting the values of $\tan\theta_1$ and $\cot\theta_1$ in equation (14) we have for the efficiency

$$\eta = \frac{1 - \mu\frac{v_1 p}{2\pi r_1}}{1 + \mu\frac{2\pi r_1}{v_1 p}} \ldots\ldots\ldots\ldots (21)$$

In practice we may write $r_1 = k\,p$, where k is a constant varying from 1 to 4 or more. Inserting this in equation (21) simplifies it. If at the same time we drop the term μv, which is very small for worms with few threads, we arrive at the final simple form:

$$\text{efficiency } \eta = \frac{v_1}{2\pi k\mu + v_1} \text{ (nearly)} \ldots\ldots (22)$$

For very slow speed worm gearing μ may be taken as .15, in which case equation (22) may be further simplified to

$$\eta = \frac{v_1 p}{v_1 p + r_1} \text{ (nearly)} \ldots\ldots\ldots\ldots (23)$$

This very simple form does, however, not do the worm full justice, as $\mu = .15$ only holds good (according to the experiments of Lewis) for one threaded worms below 10 r. p. m., and for two threaded worms below 15 r. p. m. It is an easy form to handle, and brings out very clearly the high efficiency of small diameter worms, showing as it does that as r_1, the radius, decreases, the efficiency increases. If we con-

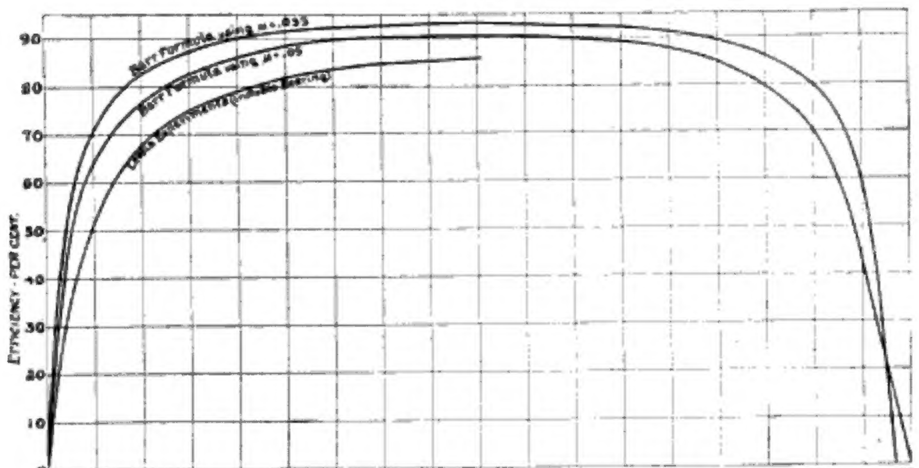


Fig. 2.—Variation of Efficiency With Pitch Angle.

For $\mu = .05$ the maximum efficiency (90.5%) is obtained with an angle of 43° 34″.

For $\mu = .035$ the maximum efficiency (93.24%) is obtained with an angle of 44° 0″.

TABLE I.—EFFICIENCY OF WORM GEARING.

R. P. M. of Worm in this Case = Vel. of Sliding of Teeth in Ft. Per Min.	Cast Threads and Teeth. Double Threaded Worm. $v_1 = 2p = 1\frac{1}{2}''$	$k = \frac{1}{2}$	Cast Threads and Teeth. Single Threaded Worm. $v_1 = 1p = 1\frac{1}{2}''$	$k = \frac{1}{2}$	Cut Threads and Teeth. Single Threaded Worm. $v_1 = 1p = 1\frac{1}{2}''$	$k = \frac{1}{2}$
	μ	η	μ	η	μ	η
10	.128	.65	.124	.49	.116	.51
20	.102	.70	.106	.53	.090	.57
40	.084	.74	.084	.59	.070	.63
80	.076	.76	.060	.67	.054	.69
			Average increase over cast.		12.1%	5.4%

The R. P. M. = velocity of sliding in ft. per min. because the circumference of worm = 1 ft.

Coefficient of friction μ figured from formula (21) $\eta = \frac{v_1}{2\pi \mu k = v_1}$.

sider r_1 reduced to zero, the efficiency is $\frac{v_1 p}{v_1 p} = 1 = 100$ per cent. If we assume that the radius of the worm is twice the circular pitch of the driven gear, that is $k = 2$ or $r_1 = 2p$, we find that the efficiency is,

with a single thread or $v_1 = 1$, $\eta = 33\frac{1}{3}\%$;
with a double " $v_1 = 2$, $\eta = 50\%$;
with a triple " $v_1 = 3$, $\eta = 60\%$;
with a quadruple " $v_1 = 4$, $\eta = 66\frac{2}{3}\%$;
with a quintuple " $v_1 = 5$, $\eta = 71.4\%$.

In practice the radius of the worm varies greatly, as may be noted in the table at the end of this article. The least value which it may have is $k = 1$ or $r_1 = p$. This is the radius, of greatest efficiency, but the usual size is 1¼ to 1½ p, and in special cases it is 4 and 6 p. Let us look at the efficiencies for $r_1 = p$.

For a single thread the efficiency $\eta = 50\%$.

For double threads the efficiency $\eta = 66\frac{2}{3}\%$.

For triple threads the efficiency $\eta = 75\%$.

For quadruple threads the efficiency $\eta = 80\%$.

For quintuple threads the efficiency $\eta = 83\frac{1}{3}\%$.

Thus we may say that at very slow speeds, such as from 25 to 5 r. p. m., the best efficiency which we may hope to get is 83⅓ per cent., which is not comparable to that obtained with the best chains and gears.

But this is taken at a very disadvantageous speed, for which the coefficient of friction μ is high. As the speed increases this coefficient decreases, and has been known to go down to .05 for an incomplete series of experiments with worms, and as low as .015 for a more complete set of experiments on spiral gears.

Using this value (.05) in equation (22), with a quintuple threaded worm whose radius equals the pitch of the gear ($r_1 = p$), we may get an efficiency

$$\eta = \frac{5}{2\pi(.05) + 5} = 94.3\%.$$

Judging from the Lewis experiments on this subject, the only requirements necessary to obtain this efficiency, other than those mentioned above, are that the worm and gear have machine cut teeth, and that the speed of the worm exceed 80 r. p. m.

In the case of a delivery wagon or truck the worm speed may easily be as high as ten or twelve times that figure. For instance, with 30 inch wheels, and a speed of 14 miles per hour, the wheels make 157 revolutions per minute. If the reduction is 5-1, the worm must turn 785 r. p. m.; if 6-1, 942 r. p. m., and with a 10-1 reduction, as in the new Maxim-Goodridge electric, 1,570 r. p. m.

With such speeds as these we may possibly realize a coefficient of friction as low as .035, with which and the assumptions made above, the efficiency figures out to

$$\eta = \frac{5}{2\pi(.035) + 5} = 95.8\%$$

We must say right here, however, that with such speeds the diameter must be kept down so that the velocity of sliding (which is the circumference at the pitch line times the revolutions) is low, for Lewis states as a result of his experiments that this velocity must not exceed 300 feet per minute, which at the speed of 900 r. p. m. would give a diameter of 1$\frac{5}{16}$ inches. However, other later experiments have had very good success, and no trouble with speeds up to 620 feet per minute, which at 900 r. p. m. would allow the use of a worm 2⅝ inches in diameter.

The last case figured could probably not be realized in actual practice, except under the most favorable conditions, but it is given to show that this method of driving compares very favorably with the chain, bevel or spur gear drive.

The triple thread is most used in commercial vehicle work owing to the fact that the multiple threaded worms are difficult to cut. The new Maxim-Goodridge has a quintuple worm, but the Mitchell delivery wagon, the Dennis (English) buses and trucks, the Franklin delivery wagon, the Greenwood and Batley (English) buses and trucks, and others have a triple worm. The machine tool builders use worms from a single thread up to a quadruple, the average of the twenty examples coming between two and three threads. However, if we eliminate the unsuccessful ones, the failures and those that were a doubtful success, we find that the remaining ten vary from two to four threads, with the average at exactly three.

In the case of a triple thread, the calculated efficiency under the most favorable conditions is

$$\eta = \frac{3}{2\pi(.035) + 3} = 93.2\%$$

Another authority gives a different formula in which the angle of the thread is taken into account. Without following the whole line of reasoning the final form is

$$\text{efficiency } \eta = \frac{\tan\alpha\,(1 - \mu\tan\alpha)}{\tan\alpha + \mu} \quad \ldots\ldots\ldots(24)$$

in which α° = the thread or helix angle, and μ = coefficient of friction. From this we find that efficiency is a maximum when

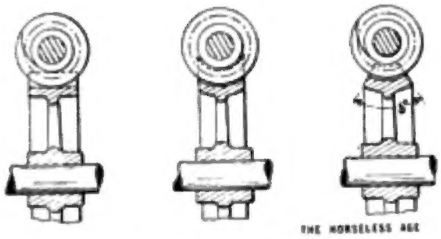
$$\tan\alpha^\circ = \sqrt{1 + \mu^2} - \mu \quad \ldots\ldots\ldots\ldots\ldots\ldots(25)$$

When $\mu = .05$, tan α° for maximum efficiency = .9512, and $\alpha^\circ = 43^\circ - 34'$, and efficiency $\eta = 90\frac{1}{2}\%$. Using our later value for μ, viz., .035, tan α° for maximum efficiency = .9656; $\alpha^\circ = 44^\circ$, and $\eta = 93.3\%$, which practically agrees with the results for the test case previously given for a triple thread, and is not much less than the maximum for a quintuple thread.

The diagram Fig. 2 represents the efficiency figured from this formula, and shows how the efficiency increases to a maximum, and then decreases again to zero. In this diagram the upper curve shows the efficiency figured on the basis of $\mu = .035$, the middle curve the efficiency figured from $\mu = .05$, and the lower, incomplete curve represents some results of the Lewis experiments. These last were taken at a speed comparing with the fixed assumed speed corresponding to $\mu = .05$. Also, as the Lewis experiments included only worms of 5°, 7° and 10° pitch angles, the remaining values necessary to complete the curve were figured from a formula advanced by Lewis. It must be said in defense of the lower values of this curve that the efficiency of the bearings is included, whereas the other curves refer to the gear efficiency only.

These curves show very conclusively the advantages of a high angle of thread. The increase in efficiency above 10° is not as great by any means as the increase below that figure, yet it is this former increase (above 10°) which has made the worm a competitor with spur and bevel gears and chains. Now the Lewis experiments were made only with angles below 10°, viz., 5, 7 and 10, so his efficiencies and conclusions, while valuable, should not be taken as final. Moreover, he used only single and double threaded worms, which may readily be seen to give results far below the maximum, practically obtainable by using triple, quadruple and higher threaded worms. Table I gives Lewis' results for worm gears. For $k = 2$ and $\mu = .15$, the maximum efficiency for a double thread is 50%, for a quintuple thread 71.4% (21.4% increase); for $k = 1$ and $\mu = .15$, the double thread shows 66.6%, and the quintuple 83.3% (an increase of 16.7%). Also, for $k = 1$, and $\mu = .05$, the double thread will give 76% (exactly what Lewis obtains), and the quintuple gives 94.3% (a gain of 18.2%).

Lewis concludes that for spiral gears the efficiency increases with the angle of the thread until it becomes a spur pinion when the axes will be parallel, when an efficiency of 96-98.6% may be expected. For worm gears the efficiencies at small angles are the same as for spiral gears, while at



Figs. 3, 4 and 5.

greater angles the efficiencies do not increase as rapidly as for spirals. The angle is limited to 45°, and with this there is a heavy end thrust, for which reason he recommends 30°.

Table II gives some of Lewis' results on spirals as a means of comparison with the table of worms previously given.

THRUST.

The end thrust of the worm or screw causes the rotation of the wheel, therefore we must give some attention to this and to the pressure on the teeth. Going back to our Fig. 1 we see that the pressure on the teeth is

$R = P \sec(\theta_1 - \phi)$ in one case.......(26)

$R = Q \sec(\theta_2 + \phi)$ in the other.......(27)

and that these two are equal, or

$P \sec(\theta_1 - \phi) = Q \sec(\theta_2 + \phi)$.......(28)

In designing gears, this pressure will have to be figured, but the effort P will usually be given or known before the pressure is required. Moreover, θ_1 and θ_2 are easily determined, and angle ϕ is assumed.

Table II.—Efficiency of Spiral Gearing.

R. P. M. of Pinion.	Efficiency = η Fifth Test. Two-Thirds.	Sixth Test. Four-Thirds.	Seventh Test. Six-Thirds.	Eighth Test.	Coefficient of Friction = μ Fifth Test.	Sixth Test.	Seventh Test.	Average.
10	.685	.77	.86	.94	.081	.064	.076	.074
20	.74	.82	.89	.956	.065	.050	.061	.059
50	.81	.876	.93	.973	.042	.035	.038	.038
100	.86	.91	.955	.982	.030	.025	.024	.026
200	.89	.92	.967	.984	.026	.018	.015	.020

Now, the thrust along the driving shaft is equal to

$S = P \tan(\theta_1 - \phi)$....................(29)

and along the driven shaft

$T = Q \tan(\theta_2 + \phi)$....................(30)

ϕ is the angle whose tangent equals the coefficient of friction, or

$\tan \phi = \mu$..............................(31)

As we have considered μ varying all the way from .15 down to .035, we will have to take ϕ as varying similarly from 8½° down to 2°. Table III gives all the possible values of both tan ϕ and μ.

For ordinary purposes, such as auxiliary hoists, cranes, some machine tools and the like, where the speed is low, 8½° is used, but for reducing the speed of electric motors, high speed machine tools and drives like the final drive for a delivery wagon or truck, a smaller angle must be used.

The pressure which can be carried diminishes as the velocity of rubbing increases. Lewis found with cast iron worms and gears that abrasion began within ten minutes when the product P V exceeded 1,000,000 to 1,500,000, in which P is the worm thrust in pounds, and V the velocity of rubbing in feet per minute (circumference of pitch line in feet × r. p. m.). Another experimenter, Flint, with hardened steel worms on cast iron gears found a sudden increase of friction when the product P V exceeded 200,000. This is a wide discrepancy and wholly unexpected, as one would naturally expect the hard steel worm to give better results than a cast iron worm, instead of poorer. The limit of safe thrust depends upon the number of teeth in contact with the worm, because the pressure on the teeth at any moment is distributed over several of the teeth. With a worm of the special form known as the Hindley worm, and having many teeth in contact, another experimenter, Sprague, found that up to P V = 2,000,000 no cutting, excessive abrasion or unusual heating occurred. This tends to agree quite closely with Lewis.

Table III.—Values of Tan. $\phi = \mu$.

μ	Angle φ	μ	Angle φ	μ	Angle φ
.0000	0° 0′	.0787	4° 30′	.1583	9° 0′
.0087	0° 30′	.0874	5° 0′	.1673	9° 30′
.0174	1° 0′	.0962	5° 30′	.1763	10° 0′
.0261	1° 30′	.1051	6° 0′	.1853	10° 30′
.0349	2° 0′	.1139	6° 30′	.1943	11° 0′
.0436	2° 30′	.1227	7° 0′	.2034	11° 30′
.0524	3° 0′	.1316	7° 30′	.2125	12° 0′
.0611	3° 30′	.1405	8° 0′	.2216	12° 30′
.0699	4° 0′	.1494	8° 30′	.2308	13° 0′

STRENGTH.

The worm is usually stronger than the wheel. If the worm is of suitable length two teeth are always in contact with the worm, and possibly more. This fact should be taken into account in figuring the strength of the teeth.

Then the driving effort at the pitch line of the worm is

$$P_1 = \frac{550\,H}{V} = \frac{63020\,H}{R\,N} = \frac{M}{R} \ \ldots\ldots\ldots\ldots (32)$$

in which P_1 = driving effort.

H = horse power transmitted.

V = velocity of pitch line in feet per second.

R = radius of the wheel in inches.

N = r. p. m.

M = moment exerted by the worm wheel in inch pounds.

p = the circular pitch of the worm wheel.

This must be modified as follows to fit the specific case in which several teeth are in contact at once:

$$p = k\sqrt{P_1} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (33)$$

in which k may vary from .28 to .35.

FORM OF RIM.

The rims of worm wheels may have several forms. Figs. 3, 4 and 5 show some of these. Fig. 3 is the simplest and cheapest to make, the blank being just like a spur gear blank. This form can only be used when contact is obtained at a single point in the medium plane of the worm wheel. Fig. 4 shows a form suitable when line contact is secured across the face of the worm wheel, and is used especially when the teeth are cut by a nob having the form of the worm. This is the most efficient shape. The special form known as the Hindley worm has this shaped worm wheel, and in addition the worm has this same shape in the plane at right angles to the paper; that is, the axial section of the worm is curved to fit the pitch line of the worm wheel. Fig. 5 is the same, except that the ends of the gear wheel teeth are cut off to a line radial to the centre of the worm shaft. This is the usual form of rim.

FORM OF TEETH.

Fig. 1 also shows a section through the worm in the direction of its axis. This shows the threads to have a form similar to involute rack teeth. The reason for this is that the worm is usually made in a screw cutting lathe, and as it is easiest to turn the threads with straight sides the involute form is used. In England, and in this country, too, the Acme or 29° thread is used a great deal, as it has the same advantages of straight tooth side, easy cut-

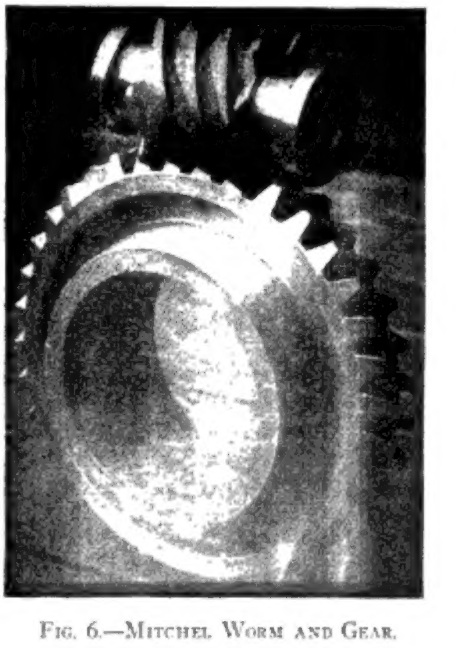


Fig. 6.—Mitchel Worm and Gear.

ting, etc. Table IV gives dimensions of the Acme threads from .16" to 1" pitch.

PITCH.

The circular pitch system is almost universally used because lathes are not provided with the correct change gears for cutting diametral pitches. In the case of worm gearing this is not inconvenient, for if the diameter of the worm wheel should come in odd or awkward figures the diameter of the worm can be made such that the distance between the centres will be an even or desired dimension. This is an advantage peculiar to worm gearing which is not found in any other form of gearing. Thus with spur or bevel gears the centre to centre distance is usually chosen and the gears are sized to give the required velocity ratio. If this ratio be changed the gears must be changed, and probably the centre distance as well. With worm gearing a change of speeds or of velocity ratio only means a change in the worm. Thus Mitchell can furnish gear reductions of 3, 4½ and 6 to 1, with a constant worm diameter, a constant gear diameter and a constant centre to centre distance.

TABLE IV.—DIMENSIONS OF ACME (29°) THREAD.

Formulæ: p = pitch = number threads per 1 inch. d = depth = ½ p + .010. f = flat on top of thread = $p \times .3707$.

No. of Threads Per Inch.	Depth of Thread.	Width at Top of Thread.	Width at Bottom of Thread.	Space at Top of Thread.	Thickness at Root of Thread.
1	.5100	.3707	.3655	.6293	.6345
1⅓	.3850	.2780	.2728	.4720	.4772
2	.2600	.1853	.1801	.3147	.3199
3	.1767	.1235	.1183	.2098	.2150
4	.1350	.0927	.0875	.1573	.1625
5	.1100	.0741	.0689	.1259	.1311
6	.0933	.0618	.0566	.1049	.1101

ANGLES.

The angle of the worm thread depends upon the pitch, for the greater the pitch the greater the angle, and vice versa, the less the pitch the less the angle. A comparatively large angle is desirable; in fact, there is no doubt that all of the later day successes with worms have been brought about through the use of a large pitch angle. It will be noted in Table 6—examples of worms in use—that the various builders progressed from failure to partial failure to partial success, then to success entirely through the medium of increased pitch angles. Thus Newton used an angle of 6° 20' for cold saw cutting-off machines and failed. Then he tried 12° 30' for the same service and found it better—satisfactory, but not perfect. Last at 18° 15' he found a worm which was pronounced very successful, and with which he could use speeds up to 685 feet per minute (impossible according to Lewis). These angles progress by increments of 6°. The writer would predict that an angle of 24° 30' would be correspondingly more successful and would still allow high speeds, besides which the 2½ per cent. increased efficiency to be gained would mean a more successful gear.

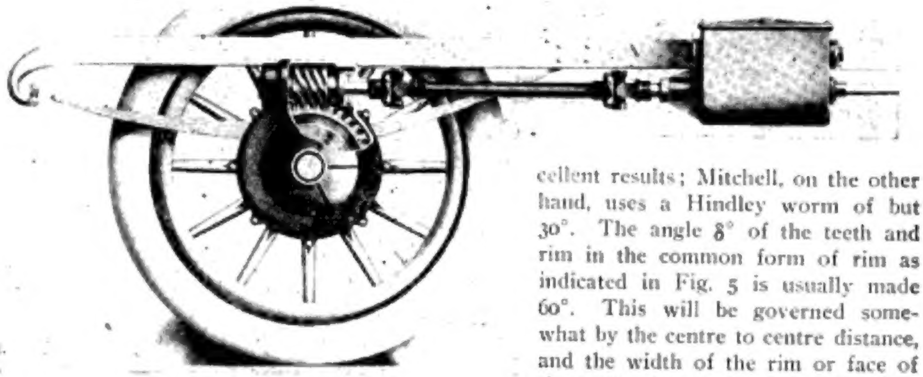


FIG. 9.—MORSE-WILLIAMS WORM GEAR.

In a drive like that to a truck axle it should be borne in mind also that a high angle approaching 45° means reversibility, which is here necessary, owing to the fact that at times the wheel will be driving the worm. The angle then must be large to secure this feature. Dennis, the English manufacturer, uses 43°, which gives excellent results; Mitchell, on the other hand, uses a Hindley worm of but 30°. The angle 8° of the teeth and rim in the common form of rim as indicated in Fig. 5 is usually made 60°. This will be governed somewhat by the centre to centre distance, and the width of the rim or face of the teeth. The width is usually made one-half the outside diameter of the worm, but may be from one-third to three-quarters of the diameter.

CUTTING.

In cutting the worm, as stated before, the work is usually done in a lathe and presents no particular difficulties, exceptional care only being necessary to secure a good job. One maker of whom the writer knows uses a worm of triple thread in the steering gear. In machining these exceptional care is used. An internal worm is cut from steel, great pains being taken to have it exactly accurate. It is then hardened carefully. After the worms are cut they are finished down, not to size but about four or five thousandths large. Then the worm as it is held in the lathe is covered with oil and very fine emery dusted on. After this is done the hard steel internal worm is fed onto the worm screw, the latter being rotated by the machine and the former being held by means of a long handled wrench. Thus the worm is screwed in and out by power, and while doing this the emery and oil take off the last few thousandths necessary to make a nice free running fit with no play. The worm may be said to have been used as lap upon itself. With modern tools for doing this work, such as the P. & W. thread milling machine, the cutting of accurate worms to any linear pitch becomes still less of a job.

In cutting a worm wheel by the hobbing method a worm is made of tool steel, which is a duplicate of the worm to be used, except of a slightly larger outside diameter to allow for clearance. It is then fluted and hardened similar to a tap, and is known as a hob. This hob is placed in mesh with notches in the face of the gear blank, which have been cut previously at the proper angle by an ordinary milling cutter and just deep enough to receive the points of the teeth of the hob. The hob is now made to drive the wheel, and is gradually fed into it, cutting deeper and deeper at each revolution until the teeth are finished. This was the older method, but I believe that the hob is not now made to drive the wheel, the hob and wheel both being positively driven in the proper velocity ratio.

The object of hobbing is to get more bearing surface of the worm wheel teeth upon the worm threads, making the outline of the

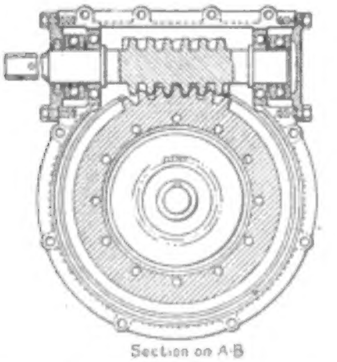


FIG. 7.—FRANKLIN WORM AND GEAR.

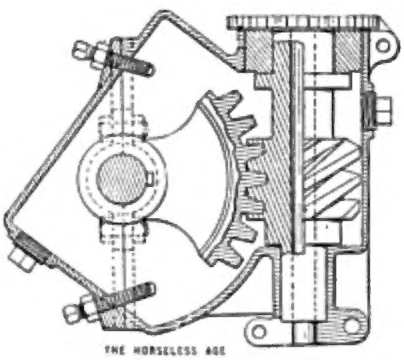
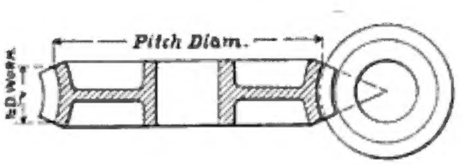
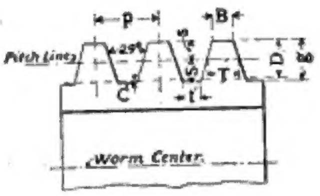
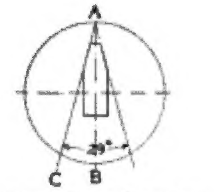


FIG. 8.—A WORM STEERING GEAR.







Worm Threading Tool.
BC = ¼ AB

THE HORSELESS AGE

TABLE V.—WORMS AND WORM GEARING PROPORTIONS.

This table is for single threads only. For multiple threads divide sizes for same pitch (p) by the number of threads, as 2 for double, 3 for triple, 4 for quadruple, etc.

Circular Pitch. p.	Threads Per Inch. N.	Diametral Pitch. D. P.	Tooth Above Pitch Line. s.	Working Depth. D.	Clearance. C.	Depth Below Pitch Line. S.	Whole Depth of Tooth. g.	Thickness on Pitch Line. T.	Width of Thread Tool. t^1.	Width of Thread at Top. B.	Circular Pitch. p.
p in inches	$N = \frac{1}{p}$	$D.P. = \frac{\pi}{p}$	$s = \frac{1}{D.P.}$	$D = 2 \times \frac{1}{D.P.}$	$C = \frac{1}{8} \times \frac{1}{D.P.}$	$S = s + C$	$g = D + C$	$T = \frac{p}{2}$	$t^1 = .3148p$	$B = .3354p$	p in inches.
2	1-2	1.5708	.6366	1.2732	.0795	.7161	1.3527	1.0000	6.296	.6708	2
1¾	4-7	1.7952	.5570	1.1141	.0696	.6266	1.1837	.8750	.5509	.5869	1¾
1½	2-3	2.0944	.4775	.9549	.0596	.5371	1.0145	.7500	.4722	.5031	1½
1¼	4-5	2.5133	.3979	.7958	.0497	.4476	.8455	.6250	.3935	.4192	1¼
1	1	3.1416	.3183	.6366	.0397	.3580	.6763	.5000	.3148	.3354	1
¾	1 1-3	4.1888	.2387	.4775	.0298	.2685	.5073	.3750	.2361	.2515	¾
⅔	1 1-2	4.7124	.2122	.4244	.0265	.2387	.4509	.3333	.2098	.2236	⅔
½	2	6.2832	.1502	.3183	.0199	.1791	.3382	.2500	.1574	.1677	½

teeth like the threads of a nut. A worm cutting machine which cuts worms using only a fly or flat blade cutter has been designed and constructed by an English engineer named Gibson, but none of these machines are used in this country.

When a worm is used with a wheel having a smaller number of teeth than it was designed for interference occurs. It can be avoided by rounding the tops of the threads of the worm, but it is easier to make the worm wheel blank slightly larger than is called for by the number of teeth. The teeth will then have very short flanks, and the action being entirely upon the faces no interference can occur. Table 5 gives a set of proportions for worms and worm cutting tools.

Table VI gives the data of all the worm gear drives which the writer has been able to gather together. Attention is particularly called to the relation of the last two columns of figures (pitch angle and pitch line velocities), to the last column in which is indicated the success or failure of the drive. It will be noted that no entirely successful gear has been brought out with a lower pitch angle than 12½°, and that all angles above that have been successful. Also that 600 feet per minute rubbing velocity is about the maximum successful speed. Some above this succeeded, but others below it failed.

TABLE VI.—EXAMPLES OF WORM GEARING.

Maker or Experimenter.	Pitch Diam. of Worm.	Pitch or Lead.	No. of Threads.	Material of Worm.	Material of Wheel.	Max. Speed.	Pitch Angle. Deg. Min.	Pitch Line Velocity.	Used on.	Remarks.
Reckenzaun........	6 in.	2 in. (pitch)	3	Steel	Phos. br.	......	17 40	......	Elec. motors	Very successful Effi. over 87 per cent.
Hewes & Phillips....	3½ in.	3 in.	2	Steel hard.	Cast iron	256 640	15 15	237 590	Planers	Successful
Hewes & Phillips....	6.16 in.	1¾ in. (pitch)	1	Steel hard.	Cast iron	446 1110	5 15	720 1780	Planers	Failure
Hewes & Phillips....	6.16 in.	3½ in.	2	Steel hard.	Cast iron	281 700	10 15	452 1130	Planers	Better, but failure
Hewes & Phillips....	2.63 in.	3 in.	4	Steel hard.	Cast iron	300 700	20 0	205 480	Planers	Successful
Machinen Fabrik Oerlikon........	3 in.	1.6 in.	3	Steel hard.	Cast iron hub Ph. br. rim	......	45 0	......	....	Successful Effi. over 90 per cent.
Newton.............	2⅞ in.	1 in. (pitch)	1	Steel hard.	Phos. br.	765	6 20	572	Cold saws	Not satisfactory
Newton.............	2⅞ in.	2 in. (lead)	2	Steel hard.	Phos. br.	500	12 30	375	Cold saws	Satisfactory
Newton.............	3⅞ in.	4 in. (lead)	3	Steel hard.	Phos. br.	680	18 15	685	Cold saws	Very successful
Thurston............	6 1-16 in.	1 in. (pitch)	2	C. I.	C. I.	......	6 0	......	....	O. K. up to 140 R.P.M.
Bertram............	3.18 in.	4 in. (lead)	4	C. I.	C. I.	186 744	22 0	155 620	Planers	Highly successful
....	12 in.	8 in. (lead)	4	Forg. steel.	Phos. br.	80+	12 0	250	Boring mach.	Failure
Christie............	5½ in.	1½ in. (pitch)	1	Steel	C. I.	150	5 0	215	Boring mach.	Failure
Christie............	4⅞ in.	2½ in. (pitch)	1	Steel	C. I.	150	9 15	190	Boring mach.	O. K. up to 150 R.P.M.
Christie............	6 in.	1½ in. (pitch)	1	C. I. Later Steel (hard.)	C. I. Phos. br.	500	4 30	785	Milling mach.	Ran but destroyed C. I. gears
Christie............	4½ in.	5 in. (lead)	4	Steel hard.	Phos. br.	280	19 30	328	Milling mach.	Successful
Hunt...............	2⅜ in.	¾ in. (pitch)	1	....	....	460	5 44	286	Lathe	Impossible to use
Hunt...............	2¼ in.	2 in. (lead)	2	....	....	460	15 48	271	Lathe	Successful
....	2¼ in.	7 in. (lead)	..	C. I.	C. I.	180 945	45 0	106 555	Milling mach.	Successful
....	2¼ in.	1.333 (lead)	3	Hard. steel	Phos. br.	200 1442	10 45	118 845	Milling mach.	Failure at first
Bach & Roser.......	76.6 mm. Outside diam.	72.6 mm. (lead)	3	Steel	Phos. br.	......	17 34	......	....	Successful
Mitchell............	....	....	3	Hard. steel	Phos. br	900	30 0	......	Delivery wagon	Successful

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The Development of Seating Accommodations.

Very early in the development of the automobile the surrey style of body appeared in answer to the demand for increased passenger capacity, and, slightly later, the tonneau body, built to accommodate two passengers on the driver's seat and two in the tonneau, became popular. Slightly later the tonneau seat was sufficiently widened to accommodate three persons, and the five passenger car was produced. The increase in engine power and the adoption of longer wheel bases, which were found to be desirable on account of their easy riding qualities, soon made practical the carrying of more passengers. The tonneau was then considerably lengthened and two removable or adjustable seats added between the tonneau seats proper and the back of the front seat. This gave a passenger capacity of seven persons. Probably the majority of fully powered cars are of this type. Even though such cars are on very long wheel bases, the tonneau seat proper is very nearly over the rear axle, or even overhangs the axle toward the rear, and it must be admitted that these seats often leave much to be desired in regard to easy riding qualities. Indeed, oftentimes the swing seats in the front of the tonneau are to be preferred in this regard (though they are usually less luxuriously upholstered and commodious) for the reason that the motion is more pivotal and less pronouncedly up and down. With a seven passenger car, if but four or five people are carried, the tonneau seat, with its high back and deep upholstery, will naturally be used, to the neglect of the swinging seats, and the front and rear passengers will be quite widely separated, so that conversation becomes difficult and the social feature of a pleasure trip is thus impaired. The effect of the reduction of the live load below normal, due to differences in spring action, is most noticeable upon the tonneau seat proper.

These considerations, and perhaps others, have led to the development of the "close coupled car" for four or five passengers, in which the auxiliary front seats in the tonneau are dispensed with and the length of the tonneau is so much reduced as to bring the front and rear seats into much more sociable relation. This is, in point of passenger capacity, a reversion to the type of car prevalent before the high power epoch, but with a very important difference. The close coupled body is mounted upon the long wheel base characteristic of the modern high powered chassis, and its tonneau seat, instead of being directly over or slightly to the rear of the axle, is considerably forward thereof, more in the location of the revolving seats of the seven passenger car. This seat thus rides much more comfortably, as it is nearer the pivotal point of the car, where the combined action of the front and rear springs tends to produce a point of comparative rest when the car traverses road obstructions. Its riding qualities are also less affected by changes in the live load carried. Auxiliary seats may, of course, be mounted to the rear of the tonneau back, and luggage space there provided. What is really accomplished by this type of body is the placing of the high backed, fully upholstered, and hence most used, seats in a position of reduced vibration, and locating the auxiliary seat or seats, if any, in a less comfortable portion of the chassis, the exact reverse of the customary arrangement in the seven passenger car. It is hardly to be doubted that decreased tire wear will be found to be a characteristic of the close coupled car, as the advantage of placing the load between the axles is important in this regard. As an intermediate type between the high powered runabout, with its somewhat precarious "dinky" seats, and the full seated touring car, the close coupled body, with its "real seats" for four or five, will doubtless find a legitimate sphere of usefulness.

The Good Roads Movement.

The good roads movement, which received its first impetus in this country during the bicycle era, is now assuming a truly national importance. The missionary work which has been done by good roads organizations and other bodies indirectly interested in the subject during the intervening period is bearing fruit, and now many of the States are making large appropriations for road construction. The present time seems particularly well adapted for taking up road building on an increased scale, for, owing to the industrial depression many laborers are out of work who would gladly accept employment at this work. The State is under certain moral obligations to provide work for its unemployed, and if it can do so with advantage to itself, as in the present instance, it has a double reason for doing so.

There can be no doubt that both labor and material could be had on more advantageous terms now than during a period of great industrial activity, and this should more than offset the fact that slightly higher rates must be paid for money. It will, perhaps, be remembered that during the depression of 1893 the suggestion was made that the national Government should relieve the situation by appropriating a large sum for road construction, though nothing ever came from this project.

Although much money has now been set aside for the purpose in many of the States and road building is actually carried on quite extensively, the time for missionary work is not yet past. The great problem involved is to secure the necessary funds. The expense of road building must, of course, be entirely borne by the taxpayers, and as they, through the power of franchise, control the disposition of the public moneys, the problem is to convince the taxpayers or the public that good roads will be a boon to them. The gospel of the blessings of good roads to every member of the community, directly or indirectly, is now being spread by good roads, automobile, road drivers and other organizations, and it is significant that the Republican party in its recently adopted platform declares itself in favor of the construction of improved highways more and more out of public funds and less at the expense of adjoining property holders.

With the object of discussing the good roads situation and automobile legislation, a three days' convention will be held in Buffalo, N. Y., next week. Many of the automobile clubs throughout the country will send delegates to this convention, and a number of speakers of national reputation through their connection with the movement will discuss the subject of modern road construction and maintenance. To emphasize the practical nature of the convention trips of inspection will be made to various sections of road now under construction, according to the various modern methods of road building, and there will also be a show of road building appliances held in connection with the convention.

It is to be expected that the meeting will be mainly of a social nature, but it is to be hoped that something practical will be accomplished which will tend to convert more people to the cause of good roads, so vitally important to the automobile trade.

Magnetic Spark Plugs.

From time to time low tension ignition systems have been brought out in which the contact spark is produced by means of make and break devices, operated magnetically instead of mechanically. The object is to secure whatever advantages the contact spark possesses, which many engineers seem to regard as important, and at the same time eliminate the numerous and somewhat vulnerable moving parts required to produce a properly timed mechanical make and break in each combustion space. The rather recent announcement of a magneto operated magnetic plug system by one of the leading magneto manufacturers has aroused new interest in this method of spark production.

One feature of the mechanically operated contact spark system, which is to a certain extent sacrificed in the magnetic plug arrangement, is the practically constant cyclical position of the spark independent of engine speed. With the mechanical make and break system, low tension or high tension, the break which determines the spark is as rigidly related to a given piston position as is that of the opening of the exhaust or inlet valve, assuming the position of the timing lever to be fixed. With the magnetic plug system a certain, though small, time interval elapses between the mechanical action which establishes the electrical conditions preparatory to the breakage of the circuit and the actual breakage of the current, with its accompanying spark. In this regard the magnetic plug system is like the high tension vibrator coil system. In kind, if not in degree, the time which elapses in the magnetic plug system between the production of the impulse which is to cause the break and the actual occurrence of the break and resulting spark is comparable to the time interval which elapses in the vibrator coil system between the closing of the circuit at the timer and the first break between the vibrator blade and its contact screw. Mechanical and "electrical inertia" enter into this time element, which is roughly a constant for any given piece of apparatus. Where such a time element exists the cyclical position of actual spark production becomes later and later, in proportion as the engine speed is increased, assuming the cyclical position of the mechanical act antecedent to spark production to be constant. The magnetic plug system thus possesses, theoretically at least, the same objection that is lately so frequently made to the vibrating coil system; namely, that of requiring a considerable change of the spark timing lever to correspond to differing engine speeds. In the mechanically operated contact spark system the spark lever needs very little, if any, shifting after the engine is once started, and the same thing is true to a considerable degree of the high tension magneto system. The use of the latter system has tended toward the disuse of the timing lever upon the part of the public. It is sought to reduce the time element in the operation of magnetic plugs by reducing the mechanical inertia of the moving part by reducing its weight, and it is further sought to make this part quick acting magnetically by correctly proportioning the magnetic mass. Through the expedient of magnetically energizing the plug to a certain extent a measurable period before the actual spark time, and producing the break by a sudden electrical and magnetic impulse superposed upon this magnetic state, the lag of the plug is very materially reduced.

In an arrangement like this, in which the break at the plug is caused by the sudden letting into circuit of a powerful current flowing in a short circuited portion of a magneto armature, the conditions are extremely favorable for a spark of enormous power representing a considerable store of energy.

A good deal of difficulty has been experienced in the mechanically operated contact spark system in regard to correctly synchronizing the spark periods of the several cylinders. Unequal wear in the make and break mechanisms of the several cylinders tends to cause asynchronism. Much of this trouble should be eliminated by the use of the magnetic plug system, although there may be slight differences between apparently identical plugs, causing slight differences in their time elements, just as there are between coil vibrators which are as near identical as they can be made.

Like everything else, the magnetic plug system, while eliminating certain serious evils, tends to introduce others of more or less importance

Book Reviews.

Die Kugellagerungen, Ihre Konstruktion und Ihre Anwendung fuer den Motorwagen und Maschinenbau (Ball Bearings: Their Construction and Their Application to Automobile and Machine Construction). By August Bauschlicher. Published by M. Krayn, Berlin, Germany.

This is Vol. IV of Krayn's Auto-Technical Library, the first three volumes of which have already been reviewed in these pages. A German book on this subject is of the more interest for the reason that most of the recent work in the perfection of ball bearings seems to have been done in Germany. The first portion of the book contains a résumé of the work of Professor Stribeck, including a theoretical study of ball bearings and practical experiments. The next chapter enters into the construction of ball bearings, which are divided into several classes. This is followed by numerous tables of dimensions of German ball bearings. The third section relates to the mounting of ball bearings in automobile parts and in other machines, numerous examples being illustrated and discussed. The book is written on practical lines for the designer, and is illustrated by more than 150 line cuts.

Motoring Abroad, by Frank Presbrey. Published by the Outing Publishing Company, New York.

Mr. Presbrey, with his wife and a party of friends, last year made a two months' automobile trip through Normandy, Brittany, England, Scotland, Ireland and Wales, and the present book is an account of this trip, interestingly written. The text is accompanied by a considerable number of half-tone illustrations of scenes by the way or of sights visited. A chapter of useful hints to the intending European tourist completes the volume. The half tone illustrations are printed on separate sheets of heavy coated paper distributed through the volume.

English and Scottish Touring Car Trial—I.

By Roy Lindsay.

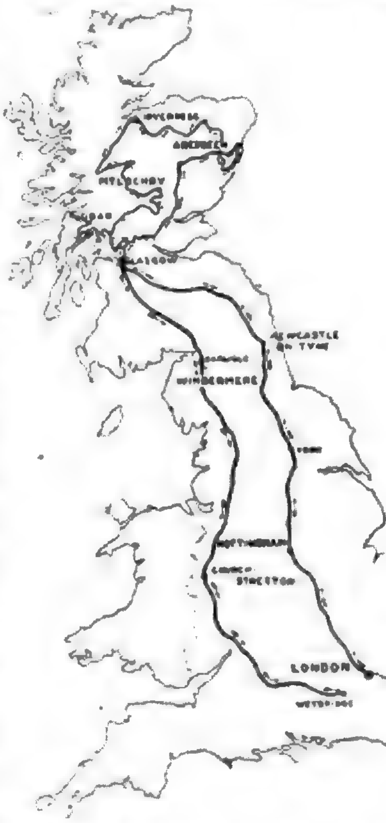
During the four years 1900-1903 the Royal A. C. promoted annual reliability trials for touring cars, and all other events of a similar nature held throughout the world have been practically based upon the well arranged rules and regulations that were gradually evolved for those early contests. Owing to the outcry that small vehicles were swamped out of publicity by the doings of the then big cars of 20 horse power, the club ran off a week's trial for light cars only, chassis price not exceeding $1,000, in 1904, but have organized no other big trials since that date. For the three years 1905-1907 the Scottish A. C. stepped into the breach, and by thoroughly attending to every detail secured the confidence of the trade and public for results that were absolutely beyond suspicion in respect to impartiality.

The Royal A. C. claims the right to be the governing body of automobilism in Great Britain, and while nobody gainsays that claim, the club's influence as the arbiter of the merits of machines was fast departing owing to the headway the Scottish Club was making, and when the latter announced its decision to run another long distance trial in 1908 the Royal Club felt that it ought to have a finger in the pie. Tentative rules were therefore issued, but considerable exception was taken to them by the Society of Motor Manufacturers, who threatened to boycott any English event of the kind unless their membership took a hand in drawing up the rules. This threat was not an empty one, and in consequence a joint committee was formed of ten members from each of these two organizations, who have produced regulations that were scathingly criticised when finally issued, and despite so called finality, have been altered, revised and added to nearly every week, the very last of the alterations only being issued so recently as two weeks before the start of the event.

Meanwhile the Scottish club had definitely fixed their dates, and although requested to abandon their event for 1908, "in view of the greater importance of the Royal Club trial," refused to budge from the position they had adopted, and the Royal Club eventually had to invite the Scottish people to a conference. And the canny Northerners came out with flying colors, the only concessions they would make being to (1) permit entrants in the Royal event to enter the Scottish trial at a reduced fee; (2) to allow the Royal Club to include the Scottish route as a portion of the bigger trial, and (3) to allow the English observers to travel on the cars while in Scotland. The affair is considerably complicated owing to the fact that the English and Scottish events are each run under their own particular rules, which differ very materially one from the other. To an outsider who does not thoroughly understand the cross purposes that have been at work the situation is rendered still more chaotic by reason of there being three separate and distinct lots of vehicles running. These comprise (1) cars entered for the English event only; (2) cars entered for the Scottish event only, and (3) cars entered for both. In order to avoid confusion, the events will therefore be described by the writer, who is following them from end to end, as though they had no connection.

ROYAL A. C. 1908 TRIAL RULES FOR TOURING CARS.

The total distance to be covered is 2,000 miles (inclusive of a 200 miles speed test on the Brooklands track), starting on Thursday, June 11, and ending on either June 26 or 27, this giving fourteen or fifteen actual running days, the machines being locked up on Sundays. The basis of the competition is time lost under any of the following headings: one mark for each minute or portion of a minute being counted against each machine; in excess of maximum or advance of minimum running time on each stage; adjustments; repairs; replacements; filling oil and water tanks or any involuntary stop; in excess of three minutes for gasoline cars and ten minutes for steamers allowed for starting up each morning; in excess of one minute starting allowance after midday lunch stops; for every gallon of gasoline filled into the tank. For the timed hill climbs (there is one on nearly every day of the trial) the fastest car in each class is reckoned as maximum and cars going up more slowly lose one mark for each minute or part of a minute they are slower than the fastest car in that class. Five minutes are allowed each day for brake adjustments without penalty. All delays on the road due to tires are penalized one mark per minute, but detachable wheels and rims are permitted and new tires can be fitted as often as required at night time in garage without penalty. During the Brooklands 200 miles speed test tires can be changed with impunity without any penalty.



These rules as to the time basis need a little explanation. Supposing there are six cars in class 3 (which, as a fact, happens to be the number in that class), and that when the road runs are completed the cars are thus penalized for reliability, hill climbs, gasoline consumed, filling water and oil tanks, tire troubles, etc.: A, 500 marks; B, 550 marks; C, 575 marks; D, 600 marks; E, 600 marks; F, 650 marks. The machines would therefore be lined up at Brooklands track and started for the 200 miles speed run in the following order: A, first; then B 50 minutes after; C 75 minutes after A; D and E 100 minutes after A; F 150 minutes after A had started, and the first to complete the 200 miles takes the gold medal in its class as being the best all round performer.

Another considerable departure has been made in the classification of machines. Hitherto it has been the general practice to divide according to price of chassis with tires, but the present trial is based upon what is now known as the R. A. C. touring car standards, and the $\frac{D^2 N}{2.5}$ engine rating formula is used. Ten classes have been arrange, 1 up to 6.4 horse power, 2a up to 9.4 horse power, 2b up to 13 horse power, 3 up to 16 horse power, 4 up to 20.8 horse power, 5 up to 25.6 horse power, 6 up to 32.4 horse power, 7 up to 40 horse power, 8 up to 46.4 horse power, 9 up to 2.8 horse power, and 10 up to 60 horse power. In addition, each machine has to carry two persons for classes 1 and 2 and four persons in all other classes. Each class has a fixed minimum weight for the complete vehicle; and each class must have a fixed wind resistance area of the body and mud guards. The whole object of these minimum dimensions and weights is aimed at preventing the introduction of freak bodies and big engines on cars with apologies for seats, and there is no doubt the object has been attained. It is freely rumored that one well known maker, who had paid the entry fees for two machines in different classes, but who did not start his cars, withdrew them because the special bodies that had been built to comply with the measurements, while strictly conforming thereto in respect to size and weight, would never have passed the scrutiny of the judges, because sundry fittings were of so flimsy a character that they would not have stood the strain of two weeks' hard touring.

Criticism has been passed upon the rules by all but one of the technical journals, the exception having on its staff one of the men who helped to construct the rules as they now stand. The general objections have been directed against the excessive number of very steep hills up which the timed ascents will be made as telling against the light cars up to about 12 horse power, and the weird 200 miles speed test at Brooklands, which everybody agrees is quite unnecessary in the touring car event. This is proved by the fact that the three first classes 1, 2a, 2b) have only received one entry each, exclusive of the 10 horse power Cadillac in class 2b, which is the identical machine that came through the recent Cadillac standardization test. The entry fees were also placed at such a high figure, varying from $255 per machine in the small horse power classes up to $300 for the big cars. When it was definitely decided to run English and Scottish trials this year it was feared one would clash with the other, and this has unfortunately proved to be the case, the Scottish only receiving some 65 as against nearly 100 in 1907, and the English trial securing support only from 25 manufacturers, with a total of 51 machines, a very poor showing indeed, considering the variety of cars that are now on the British market.

THE ENGLISH TRIAL DESCRIBED.

All the machines had to be at the White Steam Car Company's big new garage in Camden Town, London, by 12 noon on June 8, when weighing commenced, bodies were measured, and the cars were examined by the judges to see that compliance was made with the specification that had to be sent with each entry. The start of the competition took place at 9:30 a. m. on Thursday, June 11, when it was announced that 5 machines had been withdrawn, the number of starters being therefore 46, as follows: Class 1, 1 car; class 2a, 1 car; class 2b, 2 cars, including the 10 horse power Cadillac; class 3, 6 cars; class 4, 10 cars; class 5, 8 cars; class 6, 5 cars, including the nominal 10 horse power White steamer, which has been rated by the technical committee at 28 horse power; class 7, 5 cars, including the nominal 18 horse power White steamer, rated at 37 horse power; class 8, 1 car; class 9, 4 cars; class 10, 1 car. The first day's run was from London to Nottingham, 131½ miles over almost level roads, one machine, a 15 horse power Zedel, failing to arrive at the destination inside maximum time. The route on the second day was to Newcastle, third day to Glasgow, where the Scottish trials would commence on Monday (fifth day), and continuing on sixth, seventh, eighth and ninth days, when the English portion would be resumed from Glasgow and the machines will travel down south toward London. The crux of the English trial will come during three days of the last week, when the headquarters will remain at Windermere, right in the heart of the far famed English lake district, and where some terribly severe hills will have to be surmounted.

After seven days on the road it can be said that the event is to all intents and purposes a race from start to finish, but with the remarkable difference that the performers' speeds are limited to 20 miles per hour, the racing in each class being as to who shall lose least marks each day. Not only are marks lost for repairs or adjustments, both mechanical and for tires, but also every gallon of gasoline consumed becomes a one mark penalty, and one mark penalty is incurred for each minute spent in filling oil tanks, or for putting a few drops of oil onto a magneto bearing. Every night the various penalties incurred that day are posted up at the official stopping place, and as the days go on the interest is vastly increased, the changing of positions keeping everybody on the qui vive.

It was noted above that a Zedel had dropped out the first day, but this turned up on the morning of the second day only some twenty minutes within the time qualifying the car to continue; a feather had stripped from the differential gear and the driver and mechanic had pluckily set to work, taken down the axle made a new key out of a file, rebuilt the axle and were running again in eleven and one-half hours, the machine being thereby penalized 660 marks and put hopelessly out of the contest unless the four other machines in its class have unlikely troubles in the next twelve days. The Zedel driver believes in the proverb that while there's life there's hope. Minor incidents were the accidental stopping of the Ariel engine after a "coast" down a long hill to save gasoline; a six minutes' stop on the 14 horse power Belsize to clean a spark plug, a two minutes' stop on the 12 horse power De Dion to release a jammed throttle lever, two stops of four minutes each to clear a choked carburetor on the 10 horse power Zedel, a twenty-three minutes' stop on the 12 horse power Humber for a choked carburetor, fourteen minutes' stop to release a jammed gear lever on the 15 horse power Hillman-Coatalen, two stops of five minutes each on the 18 horse power Benz, five minutes' stop on the 18 horse power Panhard to tighten a sprocket nut, a two mark penalty against the 16 horse power Star for inadvertently stopping the engine, a one minute stop on the 25 horse power Deasy for lost pressure in the gasoline tank, and a seven minutes' stop on the 25 horse power Hillman-Coatalen for a choked oil pipe. These penalties are typical of what always happens in the early stages of every reliability trial, mainly because sufficient time has not been given in the factories to proper overhauling and adjustments, and is proof of the contention of some of the older hands at the game that more efficient results can be obtained from a machine that has been on the road for some months than from one fresh out of the workshops.

One of the most extraordinary mishaps on the second day happened to the 12 horse power Shamrock in class 3. This machine is fitted with quickly detachable Rudge-Whitworth wire wheels, and while the car was bowling merrily along through a village at 15 miles per hour the off side front wheel detached itself and ran forward straight into the door of a blacksmith shop, about the best possible place the wheel could have selected. Although the machine dropped on the end of the stub axle apparently no harm resulted, as the wheel

Standard No.	Engine Rating.	Brooklands Rating.	Seating Capacity.	Weight Loaded.	Dash to Rear Axle.	Wind Resistance Area.		
						Body.	Fenders.	Total.
1.	> 0 ≯ 6·4	> 0 ≯ 16	2 only	≮ 10½	≮ 4·0	≮ 9¼	≮ 3	≮ 12¼
2.	> 6·4 ≯ 13·0	> 16 ≯ 32·5	≮ 2.	≮ 14½	≮ 4·0	≮ 9¾	≮ 3	≮ 12¾
3.	> 13·0. ≯ 16·0	> 32·5 ≯ 40	≮ 4.	≮ 16	≮ 5·3	≮ 13.	≮ 3	≮ 16.
4.	> 16·0 ≯ 20·8	> 40 ≯ 52.	≮ 4.	≮ 20	≮ 5·9	≮ 13.	≮ 4.	≮ 17.
5.	> 20·8 ≯ 25·6	> 52 ≯ 64	≮ 4.	≮ 22½	≮ 6·0.	≮ 14¼	≮ 4.	≮ 18¼
6.	> 25·6 ≯ 32·4	> 64 ≯ 81	≮ 4.	≮ 25	≮ 6·0	≮ 14¾	≮ 4	≮ 18¾
7.	> 32·4 ≯ 40·0	> 81 ≯ 100	≮ 4.	≮ 27½	≮ 6·0	≮ 14¾	≮ 4¼	≮ 19.
8.	> 40·0 ≯ 46·4	> 100 ≯ 116	≮ 4.	≮ 30	≮ 6·3	≮ 15.	≮ 4½	≮ 19½
9.	> 46·4 ≯ 52·8	> 116. ≯ 132.	≮ 4.	≮ 32½	≮ 6·5	≮ 15	≮ 4¾	≮ 19¾
10.	> 52·8 ≯ 60·0	> 132 ≯ 150	≮ 4.	≮ 35	≮ 6·6	≮ 15.	≮ 5.	≮ 20

> = is greater than. ≯ = is not greater than. ≮ = is not less than.

TABLE OF DIMENSIONS FOR CLASSES IN BRITISH TRIALS.

CAUTION
CAUTION

SIXTY HORSE POWER LORRAINE-DIETRICH. HOW THE REAR OF BODY HAS BEEN HEIGHTENED TO COMPLY WITH THE R. A. C. RULES FOR AREA.

was attached within ten minutes and the car has traveled very well ever since.

On the third day the trip led from Newcastle over the Scottish border to Glasgow, a distance of 151½ miles, and the whole of the forty-six starters arrived within maximum time. The weather was truly awful, rain pouring down without intermission all day, rendering everyone concerned miserable in the extreme and destroying any opportunity of even a glimpse of the splendid scenery among the Cheviot hills. On arrival at Glasgow certain of the machines came under the control of the Scottish Automobile Club for what is known as the Scottish trial.

The writer of these notes had intended to describe the English and Scottish trials as separate events, but the two are so inextricably mixed up that hopeless confusion would result if this had been done. The principal regulations of the Scottish trials are that the machines are classed according to chassis price, that five minutes is allowed each day for brake adjustments, thirty minutes is allowed each morning for filling up gasoline, water and lubricating oil tanks and lubricating generally; that machines are penalized one mark per minute for repairs and adjustments, that there is a timed hill climb every day and that the final awards depend upon marks *gained* for reliability plus marks gained for lowest gasoline consumption per ton mile plus best times for hill climbs in each class. For the Scottish trial only forty-four cars were entered as follows: Class A, up to $1,000, 5 cars; class B, up to $1,250, 5 cars; class C, up to $1,725, 11 cars; class D, up to $2,125, 17 cars; class E, up to $2,625, 13 cars; class F, up to $3,250, 13 cars; class G, up to $4,000, 5 cars. This made exactly ninety machines to travel through Scotland. Separate observers had to be carried to represent the Scottish club, additional to the observers for the English trial on those machines taking part in both events; but only the Scottish observers were permitted to give any instructions to the drivers. On the two seated runabouts in class A the English observers were left behind in Glasgow, these various arrangements more than emphasizing the intention of the S. A. C. to retain entire control of the trial they have always organized so well and resenting interference from the Royal Club. On the surface there is the fullest amity between the two bodies, but, as events have shown in the first three days of the English trial, the officials controlling that portion have yet much to learn. Complaints were rife concerning the wretched arrangements for lunch on the second day and the vile garage that was selected for the storage of the machines during the first night at Nottingham, where an enormous amount of time went to waste by the tired competitors manœuvring within the confined space.

The first day of the Scottish trial was from Glasgow via Perth, Blairgowrie, Braemar, to Aberdeen, a distance of 172¼ miles, and included a climb up the dreaded Cairnwell Hill. This hill is 1 mile 960 yards long, with a total rise of 742 feet, average gradient 9 per cent, with many corners and long stretches of 18 per cent. The climb took place in the afternoon, and the surface, already soddened with rain during the preceding days, was made worse by the torrential downpour that started midday and continued while the climb was in progress. Even on a very dry day the climbing of this hill is reckoned a feat, the worst grade being right at the commencement, and taxing the power of the engines to the utmost to get away from the standing start invariable for timed hill climbs in British events. Midway occurs a true hairpin corner known as the Devil's Elbow, and this proved a terror to many cars, particularly some of big power that were geared far too high for tackling the awful hills that literally abound in Scotland. The small cars did comparatively much better, one of the star performances of the day being the manner in which the 10 horse power Cadillac went up with never a falter despite the inches of mud and loose stones, and although it was almost the last to make the ascent, the big cars taking precedence. Owing to the long delays at the hill that was quite unavoidable, many of the vehicles did not reach Aberdeen until midnight. Quite a number of cars were penalized for mechanical troubles, and there were two withdrawals, viz., the 16 horse power Belsize, with a cracked cylinder, and the 10 horse power White steamer with a damaged back axle, the latter said to be due to the breakage of a differential pinion concerning which no confirmation could be obtained from the officials.

The second day of the Scottish trial (the fifth day of the English) was from Aber-

THE SHAMROCK TWO THOUSAND MILES TRIAL CAR.

deen to Inverness, 168¼ miles, including a timed climb up another so called hill that was really a mountain pass. Cairn o' Mount, 2 miles 35 yards in length, rising 1,070 feet in the distance, with an average grade of 10 per cent. and a fearsome stretch of 20 per cent. right at the top. So bad was this grade that the 16 horse power Star altogether failed to surmount it, as did the 32 horse power Porthos. Several of the small machines, after coming to a stop, had to shed their passengers before progress could be made. Two machines were disqualified from taking any further part in the trial for being pushed by the passengers up an ascent steeper if anything than the timed climb. There were again numerous minor mechanical troubles, most of these being connected with choked carburetors. The 60 horse power Lorraine-Dietrich was penalized 67 marks for remaking a joint between exhaust pipe and muffler, the trial regulations very properly requiring vehicles to be fitted with proper mufflers, and prohibiting anything in the nature of a cutout or exhaust joints that are not absolutely gas tight. This day's withdrawals were the 8 horse power Clyde (sheared pin in differential gear), and the 28 horse power Belsize. A leaking rubber pipe on the water circulation had been repaired on the middle of the hill by the driver of the Belsize, and when he attempted to restart the engine his right arm was so injured by a back fire that he could not handle the steering wheel, and no other driver being available, withdrawal was inevitable.

The third hill climb on the Wednesday was up Trinafour, 1,686 yards long, total rise 390 feet, average gradient 8 per cent., and the worst grade 14 per cent., a promenade for the competitors after the terrors that had been "tackled" on the two preceding days. All the machines went up without trouble, and covered the distance of 147 miles to Pitlochry. The seventy-three cars still left in were taken over mere apoligies for roads, across mountain tracks rough in surface and containing so many tortuous bends that it was difficult for some of the long wheel base cars to negotiate the sharp corners. This part of the route was purposely selected as providing a splendid test for the springs and transmissions, and although some of the most magnificent scenery in the Scottish Highlands was traversed, the drivers were too busy dodging stones and ruts to have an eye for anything else but the front wheels, and the passengers had all their work cut out to prevent being bounced out of their seats. So bad were the roads that it says much for the vast improvements made in the modern automobile that all the vehicles survived the ordeal with credit.

The officials of the Scottish club certainly know their own country very well, for on Thursday the route from Pitlochry to Oban, 153¼ miles, was a succession of long and terribly steep hills, with descents of so precipitous a character that on some of them the more careful drivers went down in a series of dead stops every few yards. This day's run was mapped out with the object of fully testing the holding power of the brakes, and nobody could doubt the efficiency of the test who was privileged to accompany the machines as passenger or observer. One of the drivers declared he would not go through the experience again for $1,000, for in one place a descent of 25 per cent. actual (not estimated) had to be taken around a "wicked" corner along a narrow ledge with a rocky wall on one side and an unguarded drop into the valley below of many hundred feet.

The fourth of the Scottish climbs took place in the afternoon up the Pass of Glencoe, popularly known as "Rest and Be Thankful" because of a stone at the top inscribed with that sentence. The distance was 1,706 yards, total rise 461 feet, average grade 9 per cent. and worst grade 14 per cent. Although not so steep as some of the other timed climbs, it presented more difficulties, as the road is little more than wide enough to permit the passage of one vehicle only, has a very rough surface and is all awkward turns and acutely angled corners, and there is a "hairpin" nearly at the top of the worst grade. It was woeful to watch the number of fine cars that came to an absolute standstill at this spot solely because ridiculously high gears had been fitted. The total of cars arriving at the end of the day was reduced to seventy-one by the withdrawal of a 48 horse power, six cylinder Rolls-Royce, with a seized piston, and the 25 horse power Ariel, with split live axle casing.

(To be continued.)

THE CARS AT COMSTOCK. STOP FOR TEA.

British Imports and Exports for May, 1908.

The automobile imports into Great Britain during May, 1908, consisted of 299 cars complete with bodies, valued at $535,787; 277 chasses, valued at $509,369, and parts valued at $730,389; motorcycles to the value of $17,789, and parts therefor to the value of $9,379 were imported, making a grand total of $1,802,693. After the necessary deductions for re-exports, the total of net imports was $1,778,210, a decrease of $66,552 compared with May, 1907.

The British automobile exports consisted of 144 cars, valued at $271,528; 15 chasses, valued at $25,014, and parts of a value of $123,978. Motorcycles to the value of $11,644 were exported, and parts for motor cycles valued at $7,134. The total exports of motor goods of all kinds in May, 1908, was $439,298, a decrease of $30,696 as compared with the corresponding period in 1907.

Consul Skinner writes from Marseilles that owing to tariff discrimination almost no American tires are sold in France. The duty on American tires is 90 francs per 100 kg., and on tires from other countries 70 francs. One American solid tire firm has given a concession to a French firm, and American type solid rubber tires find a good sale in France, but they are completely manufactured there. He does not seem to think that there is a possible market for American tires in France.

The following passage on the good roads question appears in the platform adopted by the Republican party at Chicago recently:

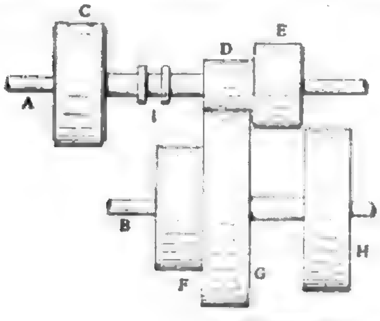
"We recognize the social and economic advantages of good country roads, maintained more and more largely at public expense, and less and less at the expense of the abutting owners. In this work we commend the growing factors of State aid, and we approve the efforts of the National Agricultural Department, by experiment and otherwise, to make clear to the public the best methods of road construction."

Frictional Change Speed and Transmission Gears—IV.

By Albert L. Clough.

(Concluded.)

Another class of frictional change speed devices consists of cylindrical wheels on parallel shafts, the faces of which are forced into contact. On the engine shaft is keyed a pulley for each speed ratio which it is desired to secure, and on the driven shaft a corresponding number, the ratios of the diameter of the different pairs of pulleys being appropriately proportioned. Fig. 12 shows a proposed arrangement of this kind, which is the frictional analogue of a Panhard sliding gear change speed combination. A is the motor shaft, with the paper faced pulleys C D E slidably splined thereon, and B is the driven shaft which drives the car through the usual universal joints and bevel gear arrangement. On this shaft are keyed the fixed metal faced pulleys F, G and H, and the shaft itself is supported so it can be moved toward shaft A to give the requisite frictional contact between the pulleys. When the pulleys on A are slid so that C and F are opposite one another, and the shaft B is moved so as to cause engagement, the high gear is produced; when E and H are engaged the intermediate speed is secured, and when D and G are in contact the lowest speed is produced. The frictional principle may also be similarly applied by combining the elements so as to resemble the accepted type of sliding gear, which produces the lower speeds through a lay shaft, and furnishes a direct driven high gear. In this case the friction pulleys would be idle at the high speed, and a jaw clutch utilized.



THE HORSELESS AGE

FIG. 12.

GREAT BEARING PRESSURES.

In arrangements of this type the diameters of the friction pulley are rather small, on account of space considerations, and the pressure between the shafts must needs be rather high. For instance, in the combination shown in the figure, the pulley D could not well be more than 4 inches in diameter. Figuring the speed of shaft A as 1,000 revolutions per minute, and assuming 20 horse power to be transmitted, the torque at the face of D would be 634 pounds. Assuming the coefficient of friction to be 0.6, the pressure between shafts A and B would have to be 1,056 pounds in order to secure a non-slipping drive. On the high gear with two 10 inch pulleys in contact, the torque under the above named conditions would be 253 pounds, and the pressure between the pulleys would be 421 pounds. The pressure between the friction members in an arrangement of this type, under the same load conditions, is higher than that required in the single disc and wheel arrangement, and much higher than that required in the double disc and wheel on account of the smaller pulley diameters permissible, as compared with those allowable in the disc arrangement. The pulley diameters given in the above example are about as large as can conveniently be used, as they would require a casing about 25 inches wide. The face friction of cylindrical pulleys is, however, without side travel, and the wear and tear of such an arrangement as above described ought to be slight as compared with a disc and wheel combination, working under anywhere near the same conditions. Furthermore, the widths of the pulley faces can be made about as large as desired, and the specific pressure kept within bounds, there being no cross travel involved by the use of liberal contact faces as in the case of the disc and wheel arrangement. It also has the advantage that it lends itself better to enclosure than the disc and wheel type, water, oil and grit, all of which tend to to make the frictional coefficient vary through wide limits, being thus more readily excluded.

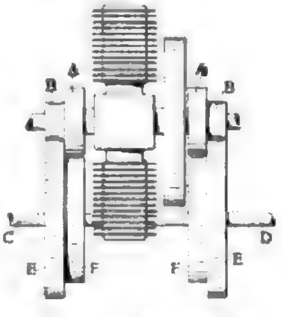
THE REEVES GEAR.

If the above described arrangement is mounted when its shafts are transverse to the car the motor which drives shaft A is mounted slightly to one side of the axis of the car length, and the opposite end of shaft B carries a driving sprocket which turns the rear live axle. With this mounting the pulley diameters can be made rather larger, and the pressures of engagement thus reduced. An arrangement of this kind is made use of in some motor buggies. Fig. 13 shows such a device giving two forward speeds. The transverse crank shaft of the longitudinally mounted opposed motor carries splined to each end two paper faced friction pulleys A and B, A being of the larger diameter. On two separate horizontal cross shafts C and D in the same straight line, and parallel with the motor shaft are keyed the pairs of aluminum faced pulleys E F, E F, E being larger than F. Means are provided for causing the shafts C and D simultaneously to approach or recede from the motor shaft. When the shafts are brought together the two sets of pulleys E B are brought into engagement, and their diameters are such that a low gear is produced, the shafts C and D being independently driven, each by its respective pair of pulleys. Sprockets on the outboard ends of C and D drive the rear wheels, and it is sometimes proposed to do away with a differential gear, but if this is not thought judicious, the driving sprockets may have ratchet action or a balance gear may be carried by either C or D.

The diameters of pulley A F and B E must of course be so chosen that both sets cannot make simultaneous engagement when shafts C and D are moved forward, and thus pulleys B and E come into contact before pulleys A and F touch one another. In order to allow the contact of A and F, pulleys B B are slidably splined on the crank shaft, and means are provided for telescoping them within pulleys A A. This allows contact between A and F when shafts C and D are moved sufficiently far forward, and as A is nearly as large in diameter as F, the high gear is produced. For use upon light cars this arrangement seems to possess merit, as pulleys of good diameter may be employed, they may have sufficient width of face to reduce the pressure per inch of face to a safe working value, and the frictional action is purely a rolling one.

GROOVED FRICTION PULLEYS.

Instead of using flat faced cylindrical friction pulleys with faces of aluminum and paper respectively, as in the above described arrangement, frictional engagement may be made in a similar manner between metal pulleys or wheels, the abutting faces of which have turned or cast in them V grooves of slightly rounded contour. A pair of such pulleys is diagrammatically represented in Fig. 14. The driving action may be considered as due to side contact between portions near their peripheries of a multiplicity of discs. Each side of each corrugation may be considered as the side of such a disc which is in contact with the corresponding part of another disc. The contact point of one pulley is always performing an arc externally tangential to the corresponding contact point of its mate, and there is more or less slippage. If correct angles and conformation of the corrugations are adopted, and the right metals employed, excessive wear may be obviated, and by making the smaller pulley readily replaceable, and of the more rapidly abraided material, the maintenance cost of such a drive may be kept within reasonable limits. It has been adopted as the drive for a high wheel car designed by one of the oldest and best known of American automobile engineers, who uses in a two stepped form, giving a high and low forward speed vith a reverse attachment. The pressure between shafts required in order to produce a given normal pressure between the contact surfaces is less than that required in most frictional combinations on



THE HORSELESS AGE

FIG. 13.

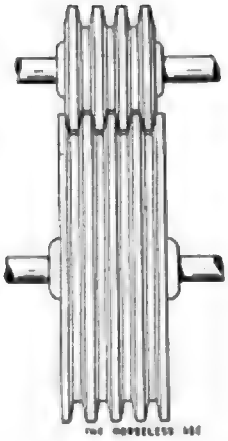


FIG. 14.

account of the wedging action of the corrugations in the V slots, the force with which the shafts must be forced together to give a certain normal pressure being that normal pressure times the sine of one-half the angle of the V. For sharp Vs the pressure between the shafts may be quite light, but experiment is the only way to determine the most practical angle for the Vs. The surfaces being metallic, the coefficient of friction is low, perhaps about 0.2, and thus the absolute values of the normal contact pressures must be large, especially if small pulley diameters are employed. No end thrusts are produced. As large diameters as are admissible are advantageous in this form of frictional device, as in most others, and liberal width of face with a considerable number of corrugations is also to be desired.

TWO DISC FRICTION GEARS.

A form of two disc variable speed frictional device is shown in Fig. 15, which employs, as does the just described arrangement, friction between the circumferential portions of the faces of discs. In the figure, A is the motor shaft which carries the metal disc C, which is provided with means for being slightly moved along the shaft. B is another shaft capable of swinging about the universal and slip joint E. The end of the shaft carries the disc D, which in the figure is shown as of the same diameter as disc C. As here illustrated, the edge of the face of D is in contact with the face of C at a point rather near the centre of the latter. A rather low gear is thus produced, the ratio of engine speed to driven shaft speed being equal to the radius of D divided by the radius of its point of contact on C. As disc D is moved so that it makes contact nearer the edge of C, this ratio is reduced, and vice versa, and when the edges of the disc are in contact the highest gear is produced. Theoretically the contact between the two discs is a single point, and the drive is thus effected without slippage. Practically, however, there is quite an arc of contact or rather a segment of contact, which increases in area as the two shafts come into the same straight line at the high gear position, when the two discs act as the two plates of a clutch, and the drive is without rolling or sliding friction. In this particular form of this device, the area of frictional contact is least for the lowest gears and heaviest torques, which is an objection, in that it renders the specific pressures higher.

In this arrangement the action is nearer a purely rolling one than is common in many frictional devices. The paths of contact of the two discs are on internally tangential arcs, and the difference between these two arcs is not large, except when the edge of the driven disc is close to the centre of the driver. As in most frictional change speed devices the departure from a pure rolling action is greater at low than at high speeds, and the efficiency less under the latter than under the former conditions. Instead of perfectly flat surfaces on the abutting faces of the discs they are sometimes made slightly curved, in order to regulate the extent of the surfaces in contact.

A device which in principle very much resembles that above described has been designed for use on a well known runabout. It is known as a multiple speed clutch. By an ingenious arrangement the pressure between the frictional elements is made self contained, and the clutch is self tightening, so that driving slip is automatically avoided.

INTERNAL ROLLING FRICTION PULLEYS.

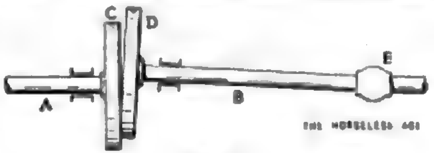


FIG. 15.

In Fig. 14 is represented a form of three speed frictional change gear, which makes use of contact between internally tangential cylinders. The engine shaft A carries keyed upon it the cylindrical pulley B, while the stepped pulley D is carried upon the driven shaft and connected, through a universal and slip joint, to the drive shaft of the car. The driven shaft and pulley D are capable of a motion or translation (up and down in the cut), and also of motion in the axis of shaft A. Means are provided for clamping the back of pulley B against the web of pulley D when these two elements are in the position shown in the figure. B and D then act as a two plate clutch, and the driven shaft runs at engine speed in the same straight line with the engine shaft. If, however, the driven shaft is given a motion of translation, by suitable mechanism, so that the surface E of D is brought into frictional contact with the surface of pulley B, the two will roll together and B will be driven at a fraction of the engine speed measured by the ratio of its diameter to that of the diameter of E. An intermediate speed is the result. If, by suitable linkage, D is moved away from the engine so as to bring surface F of D opposite to the surface of B and surface F is then pressed against B, the two cylinders will roll in internal contact, and as F is of very much larger diameter than B a low gear will result. If D is moved so that the idler C is pinched between surface E and B, the direction of motion of the driven shaft will be reversed and a backing speed will be produced equal to the intermediate forward speed. A reverse of the same ratio as the low forward speed is secured by moving D so that the idler C is pinched between B and F.

In this arrangement the frictional pressures act radially to the shafts, are not transmitted to the engine, and can be rendered self contained in the device itself. The whole mechanism can be enclosed and pulleys of good diameter and liberal width can be used (the greatest single desideratum in all frictional gears). The contact being between internally tangent surfaces, there is quite an area of engagement; there is no tendency toward cross travel, but practically only a pure rolling action. Cork inserts can be employed in the frictional surfaces to increase the coefficient of friction and to minimize the effect of any oil which may enter. Best of all, the high speed is a direct drive. On the low and intermediate speeds considerable work is, of course, given the universal joints, but, on the whole, the arrangement is one of the most promising yet proposed. No mention need be made in this article of the use of stepped or cone pulleys upon which run a number of belts, one of which is tightened upon its pulleys, to obtain any desired speed ratio. These devices are too well known to require comment.

It is realized that by no means all the methods of speed changing embodying the frictional principle have been described, but it is believed that some idea may have been conveyed of the wide variety of principles which are available for this purpose.

CONCLUSIONS.

A few general conclusions may be drawn as to the qualifications necessary for a successful frictional change speed device. The

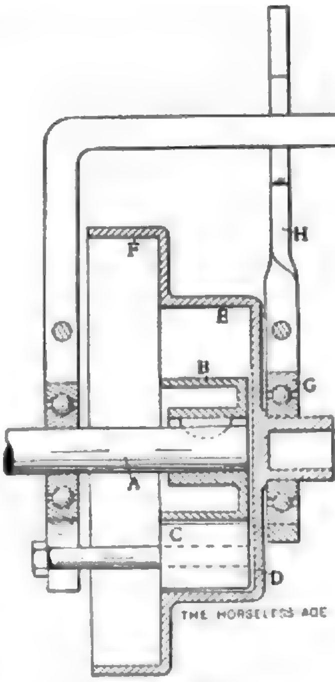


FIG. 16.

action of the frictional surfaces must be as free as possible from other than rolling action. The coefficient of friction between them must be as high as possible in order to reduce the pressure of engagement required. The engaging pressures should be as far as possible self contained in the apparatus and not transmitted to the motor. Large bending moments on overhanging shafts should be avoided as far as possible. High peripheral speeds rather than high torques are to be desired, and the frictional elements should in general have large diameters. As large surfaces of contact should be used as can be employed without involving wasteful slip in order to reduce specific pressures and distribute wear. Complete housing of the apparatus is highly desirable, and the frictional change speed system which allows of a direct, non-frictional drive on the high gear is the best, other things being equal. The parts subject to rapid wear should be easily and cheaply replaceable.

In the opinion of the writer the frictional system of speed changing is likely to find very wide application in low priced cars designed for business and pleasure, but no one can tell just what form of device will be found to offer the best solution of the problem.

Maintenance and Repairs.

Replacing Carburetors—An Air Strainer.

At times it is necessary to replace the manufacturer's carburetor by another, usually not of the same type, for reasons of economy or because of inability to procure a carburetor of the model designed for the car. The new carburetor will in the large majority of cases have a different thread in the manifold connection or there may be female connections on both the manifold and the carburetor. In such a case the work is simple, requiring only a nipple or a short section of tubing threaded to fit the manifold and the carburetor at different ends. But after the fitting is done it sometimes happens that the linkage to the throttle will have to be entirely reversed in its action, or even replaced. An example of this was seen recently in the case of a popular two cylinder runabout, in which the stock carburetor was replaced by another of entirely different design.

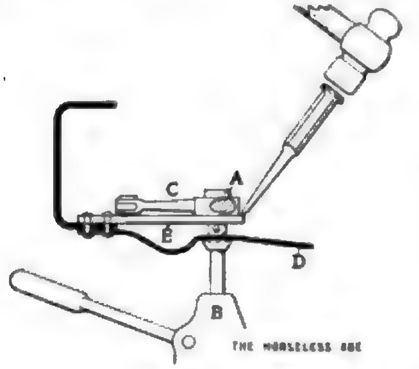


FIG. 2.

In Fig. 1 the old carburetor is shown in dash and dot lines, E being the carburetor, F the throttle lever, and B the link connecting to the arm N of clevis C. B rides above J, the gear wheel bearing, the parts moving in the direction of the arrows. When the new carburetor D was placed, and connected by means of a nipple, it was only capable of being put in the position shown by the full lines. The throttle lever G worked in an opposite direction from that of F, and owing to the proximity of the pump gear K it was impossible to use the old link B. Consequently the clevis C was reversed and placed in the position shown in the full lines. A bell cranked piece, P, was fastened to the lever by means of two screws, as shown in the small sketch, and C and G were connected by means of the old link bent to clear the gear K, as at A. In this manner the throttle was operated, the changes being made at slight cost. The work done consisted in filing and cutting out P from an old mud guard, reversing C and bending link B to fit the new position. L in the figure is the link to the throttle connection on the steering pillar.

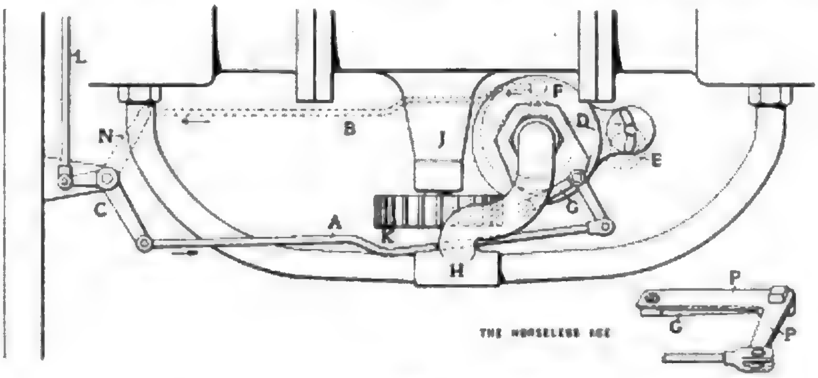


FIG. 1.

The removal of the pin of bell crank C was a matter of a few minutes, despite the fact that it was slightly rusted into the bracket. Fig. 2 shows the means employed for removing it. A is the pin, C the bell crank, and E the bracket. After removing the cotter pin and trying to lift C and A clear of the bracket, a jack, B, was placed upon the floor and elevated until its head forced up the apron D and slightly lifted the bracket E, pin A, etc. A chisel was placed, as in the cut, and the chisel struck a few blows with a hammer. The bracket was driven downward at each blow, and finally the pin was loosened and readily withdrawn. This arrangement was adopted because the apron D was fastened permanently to the chassis, and cutting the apron was the only choice for a quick job.

A quick replacement of a carburetor by another without pipe cutting or welding was recently made in an uptown garage in New York, the time taken being 25 minutes. The nut of the inlet manifold was removed, as well as the flange on the end. A threaded plug to fit the carburetor connection was drilled out to fit the manifold, which was inserted in the plug, and the end flanged over, as shown in Fig. 3. The plug was then screwed into the carburetor and a leather washer, shown in position at D, was put in to prevent possible leakage. A is the plug drilled to receive the manifold C, and B the carburetor. The device has been in use for three months and has showed no signs of leakage as yet. The carburetor was, of course, fixed to the motor by means of a bracket, as it was not intended to have the inlet manifold support the carburetor, to which strain it would be unequal.

A STRAINER COVER.

The majority of air intake pipes have no protective screen or covering to prevent the sucking in of dirt, etc. That they do inhaust dirt can readily be proven by examination of the interior of a carburetor and by the analysis of the deposit in a motor cylinder. To avoid this a strainer should be fitted to the end of the intake pipe. Fig. 4 shows such a strainer, made from the strainer cup of an oiling system for power-house service. This strainer, T, is made of 60x60 mesh brass gauze, and was fastened to the intake P by means of a brass strip, R, and screws. As this strainer is indirectly in the path of the air current induced by the radiator fan, provision is made for a "filter," consisting of the foot of a child's woolen sock placed over the strainer and tied.

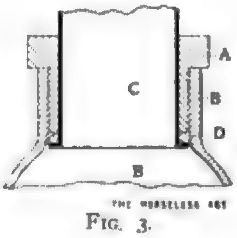


FIG. 3.

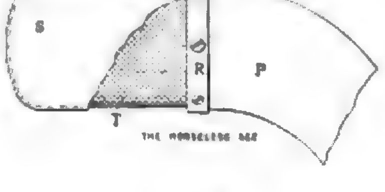


FIG. 4.

Some Recent Developments in Magneto Ignition, with Special Reference to the Bosch Systems.

(From a paper read by Otto Heins before the Society of Automobile Engineers at its Detroit meeting.)

Mr. Heins' paper contained a description of various new ignition apparatus recently brought out by the Bosch Magneto Company. After giving a description of the firm's magnetic spark plug, which has already appeared in these columns, Mr. Heins passes to a description of the magneto used with this plug: This magneto (Fig. 2) generates an ordinary low tension current, and is provided with low tension distributor distributing the current to the individual plugs, according to the number of cylinders, so that only one low tension wire for each plug is employed. The distributor disc is shown separately, as well as the interrupter, which latter is provided for the purpose of timing the ignition.

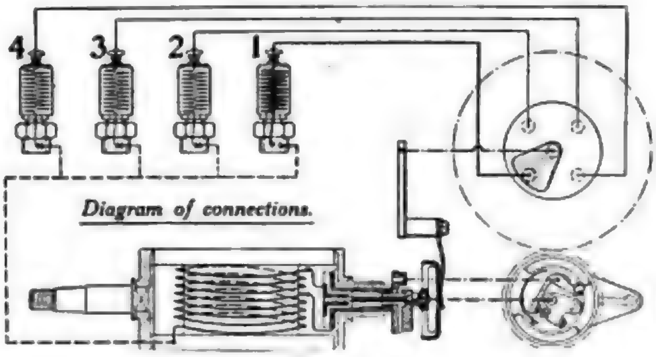


FIG. 1.

Fig. 1 is a diagram of the electrical arrangements, which will be seen to be similar to those of the Bosch high tension magneto. A portion of the wiring of the armature is short circuited by the platinum points of the interrupter, and when the circuit is interrupted the resulting armature reaction has the effect of raising the voltage of the armature sufficiently to operate the magnetic plugs. The rotating distributor bar is adjusted in such a way that it is always in connection with one of the spark plugs at the moment when the contact breaker of the magneto interrupts the circuit, so that the circuit to the plugs is closed and these are magnetized for operation.

The spark is advanced or retarded by rotating the timing lever, in the same manner as with a high-tension magneto, and the timing range corresponds to an angle of 50 degrees on the armature shaft. The magneto is switched off in the same manner as a high tension magneto, by making a ground connection. This is done by small plug switches with either a single plug or with a number of plugs equal to the number of cylinders, to enable each cylinder to be switched out separately for testing purposes from the seat while the car is in motion. As compared with mechanically operated igniters, electro-magnetic plugs are far simpler, and they are also far more convenient, because they require no separate adjustment, as they are operated by the magneto itself.

HIGH TENSION SYSTEMS.

During the past season dual systems of ignition have met with great favor among designers, especially among those who adhere to the high tension principle. The Bosch firm has developed a synchronized dual ignition system which comprises one of its various types of high tension mag-

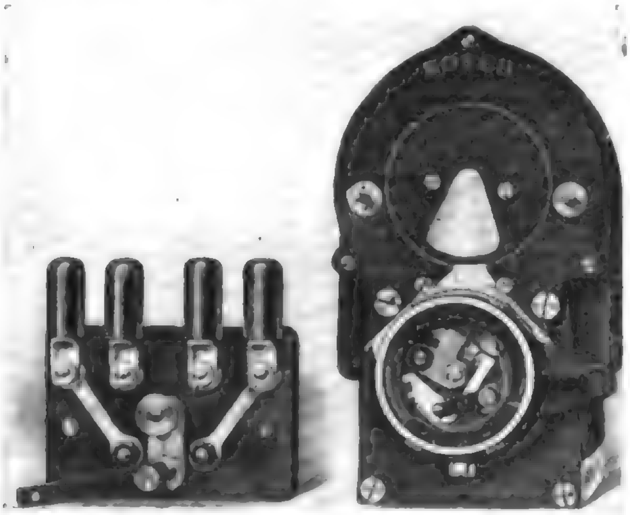


FIG. 2.

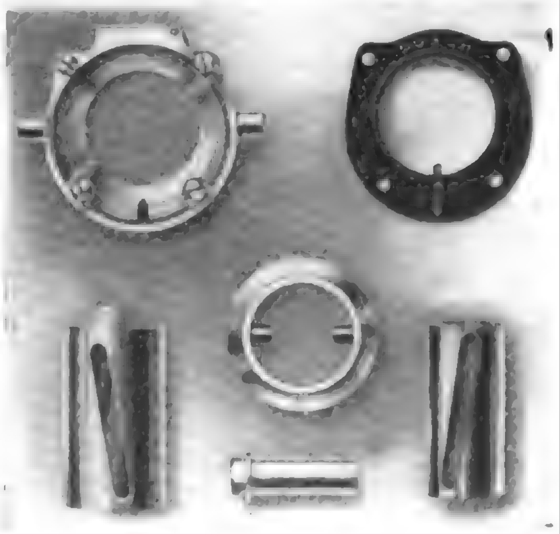


FIG. 4.

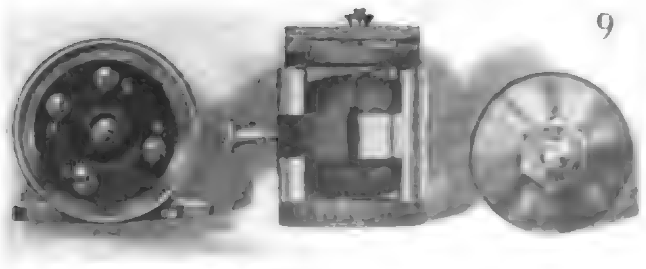


FIG. 3.

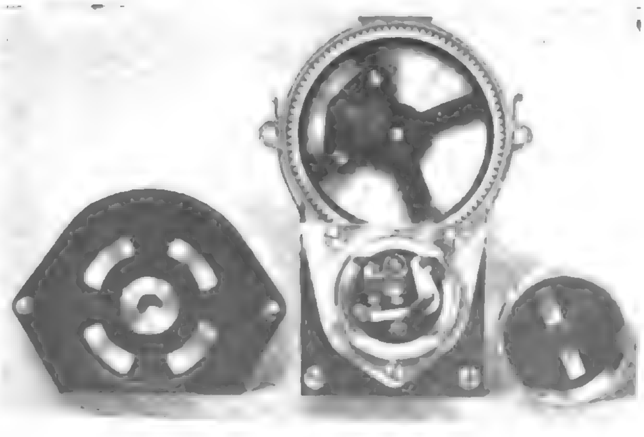


FIG. 5.

netos and combines the advantages of a true high tension magneto and the coil dual system.

The high tension magneto or the generator itself differs from the standard rotary armature type in two respects only. In the first place, the high tension connections are slightly altered; and secondly, an additional contact breaker for the battery is provided, so that the magneto will serve also the function of a timer for the battery, while the one high tension distributer of the magneto is used with both the magneto and the battery current. All other details of the magneto are similar to those of the ordinary machines, and it is therefore not necessary to describe them here.

For the battery ignition a special coil is provided, with a self-contained switch and a button for bringing a magnetic vibrator into circuit when desired. These various parts are all contained in a relatively small brass case, designed to be fitted to the dashboard, as illustrated in Fig. 4. Contrary to usual practice in vibrator coil ignition, the vibrator in this new dual Bosch ignition system is only brought into operation for the purpose of starting the motor from the seat. As soon as the motor is working the vibrator is cut out and the interruption of the current is effected by mechanical means. Consequently there is no lag in the operation of the circuit interrupter, as in the ordinary vibrator coil system, thus making a synchronized system. If there is any gas in the cylinder, the motor can be started from the driver's seat by simply pressing the button. The coil is of the general form of an H armature, as shown in Fig. 3, and not of the usual cylindrical form with concentric windings. It possesses the same amount of self-induction as the magneto armature, and while running the engine the two systems are absolutely synchronized, and no difference is apparent in the speed of the engine, whether the magneto or the battery is used.

The trembler is only used at the moment of starting. The button switch for bringing it into circuit is fitted in the lid of the case in such a manner as to render it quite waterproof. In order to eliminate all long connections between the switch and the coil the switch is directly combined with the brass housing of the coil, the short contact studs being well insulated from each other in the base of the housing. The connections are made by small segments in the bottom plate of the coil frame, the entire coil being moved toward the left or the right to effect the change-over. The switch handle projects through a circular slot in the housing and locks in three positions by a spring, the positions being designated, respectively, as "Magneto," "Off" and "Battery." The combination is very compact and can easily be inspected by unscrewing the switch handle and removing the lid, when the coil can be taken out without disconnecting any wire, exposing the components of the switch.

The casing or housing being watertight and made of metal prevents the coil being affected by atmospheric conditions. No wood is used in the construction. The connections between the dashboard and magneto, as shown in Fig. 6, are made by one quadruple cable, which contains the two high tension wires and the two low tension wires. Standard magnetos can be adapted to this dual system by only small alterations.

A NEW SMALL HIGH TENSION MAGNETO.

The great popularity of various light runabouts and the growing use of the four cylinder motor for such light vehicles, has of late created a demand for a small high tension magneto outfit. Such a machine, suitable for four cylinder motors up to 15 horse power, is shown in Fig. 5. The chief *raison d'être* of this type of vehicle being its low cost of construction, its accessories must necessarily be of low cost, and this point has been kept in view in the design of this magneto, though the electrical principles involved and the quality of workmanship are the same as found in the other high tension magnetos of the Bosch Company.

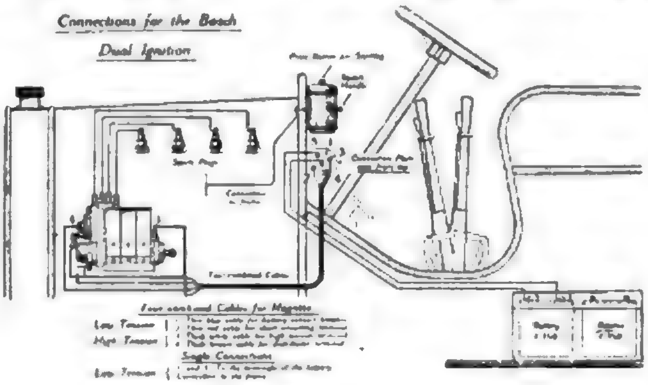


FIG. 6.

This magneto is of the rotary armature type, and must, therefore, be geared for four cylinder, four cycle engines to run at engine speed. The device is especially constructed with a view to enabling the layman to understand and use it, and the main parts can be removed without the use of tools. The interrupter is similar to the standard interrupter, but the distributor disc is of novel design and can be taken off with a jerk by pressing the springs on both sides. To simplify the ignition device, the magneto is generally furnished without any timing device. As these magnetos will generally be used on small cars driven by persons with no special technical skill, the absence of a timing device has the advantage that the engine cannot be abued by incorrect timing. The magneto, however, can be readily supplied with a timing device.

A NOVEL COUPLING DEVICE.

On certain engines, particularly two cycle and racing engines, an unusually large timing range is required. This necessitates the shifting of the magneto armature with respect to the driving shaft, which can be accomplished by a novel coupling device brought out by the Bosch Company. This coupling device, shown in Fig. 4, can be attached to practically any type of Bosch magnetos. It consists principally of two rotary sleeves, one fitting into the other, both provided with helical slots running in opposite directions, so that by moving the collar, which carries pins which extend into the above mentioned slots, an angular movement of these sleeves relative to each other up to 60 degrees is obtainable.

Foreign Business Opportunities.

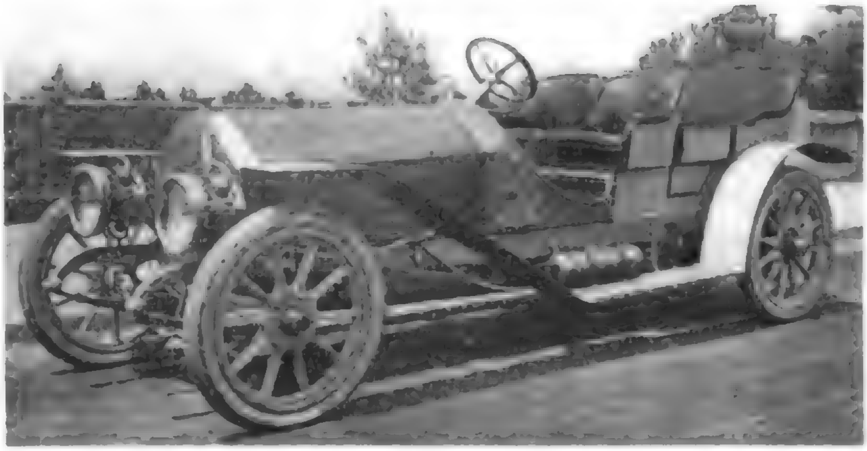
Consul Clarence A. Miller, of Matamoras, Mexico, reports that two gentlemen of this district (names obtainable from the Bureau of Manufactures) are now contemplating the purchase of machines. In addition to this another party is contemplating running automobiles from that city to the seashore, a distance of about 25 miles. This will at first be in the nature of an experiment, and machines will be rented in Brownsville, Tex., for that purpose. This should succeed, as there is no railroad transportation from the city to the coast on this side of the river, and it is necessary to make this trip by carriage. If machines are thus introduced it is probable that a number will soon be purchased.

An American consular officer in an Asiatic country reports that several automobile routes in that region have been officially recommended both for passenger and freight service. A concession for one motor line has been granted and inquiries are now being made into the matter of cars. The name of the concessionaire, with whom it is suggested that American firms communicate, is forwarded with the report, and can be obtained from the Bureau of Manufactures, Washington, D. C., by referring to No. 2,371.

The German Automobile Manufacturers' Association has recently induced the Government to remove the tax from automobiles which are taken into Germany temporarily for touring purposes, and it is hoped that this will lead to a considerable increase in the automobile tourist traffic of the country. The association is now endeavoring to upset the very objectionable automobile tax law, and in this it is assisted by the Union of German Tourist Associations in Leipsig. The secretary of the Automobile Manufacturers' Association will attend the coming meeting of the Tourists' associations and deliver an address.

NEW VEHICLES AND PARTS

The Palmer & Singer Six Cylinder Car.



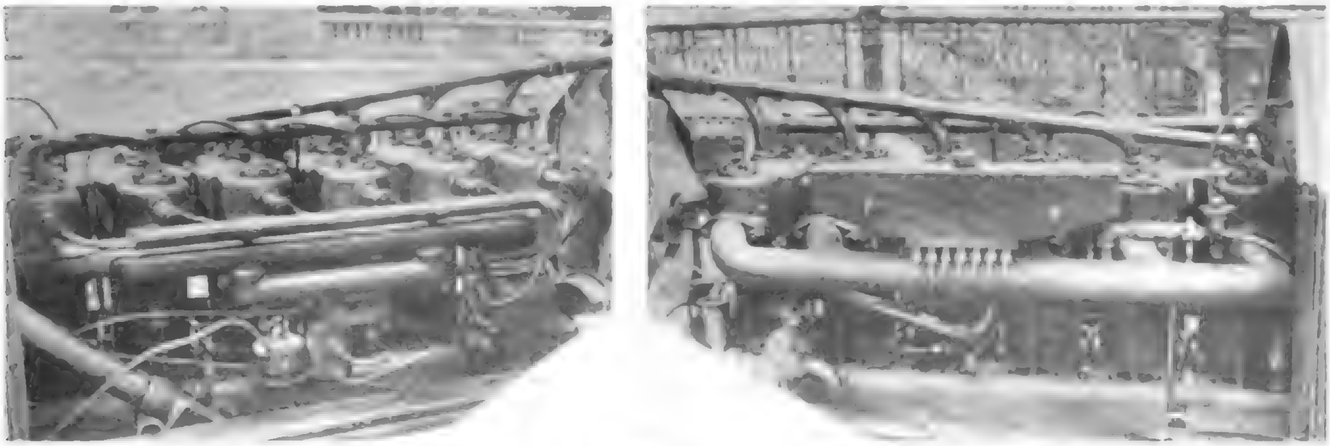
The Palmer-Singer Six-Sixty, Six Cylinder Sixty Horse Power.

The P. & S. "Six-Sixty," as it is called, is made in one model, but is fitted with three styles of body, viz., runabout with single rumble and double rumble seats, and light touring with baby tonneau. The wheel base is 125 inches, with a tread of 56 inches. The frame is of channel section chrome nickel steel and trussed to insure rigidity. It is mounted in long semi-elliptic springs both in front and rear, giving easy riding qualities. The front wheels have ten spokes and the rear wheels twelve spokes, and both are fitted with 34x4 inch Diamond tires mounted on Marsh detachable rims, although any make of tire will be furnished at the option of the purchaser. The motor has six cylinders of 4½ inch bore by 5 inch stroke, cast separately with integral water jackets, and is rated at 60 horse power. The exhaust and inlet valves are on opposite sides of the combustion chamber, and their cam shafts are located within the crank case. The crank case is divided horizontally into two sections, the upper half holding the bearings for the crank shaft and cam shafts, and the lower half forming an oil reservoir from which the oil is drawn and distributed to the main bearings. The crank shaft runs on seven plain bearings, bushed with a special bronze. The engine is positively lubricated by a pump that drains oil from the sump in the crank case and delivers it to an auxiliary tank shown just above the exhaust pipe in the illustration. From this tank the oil is distributed to the seven main bearings, from which it is led through the hollow crank shaft to the crank pin, and thence up the connecting rods to the wrist pins. The oil thrown off by the crank shaft lubricates the piston and cylinder walls, and the surplus drains into the sump. A compensating carburetor of the company's own manufacture is used which is water jacketed, the water connections being plainly shown in the cut of the inlet side of the engine. The cooling water for the motor is drawn from the radiator by a gear pump situated on the exhaust side of the motor. Power is transmitted from the engine through a multiple disc clutch with forty-nine steel to steel discs. The clutch is located in the same housing with the change speed gears. Four speeds and a reverse, operated selectively, are provided, with the direct drive on the third speed. The gear ratio on the third speed is 3 to 1 and on the fourth 2 1-10 to 1. The clutch and gears are lubricated by a non-fluid oil, and it may be a surprise to many to know that the clutch operates satisfactorily even when packed in heavy grease. The change speed gears run on imported F. & S. bearings. These bearings are used throughout the car, with the exception of the crank shaft. The final drive is by a cardan shaft, fitted with two universal joints, to the live rear axle. The universal joints are packed in grease and rendered oil tight by leather caps. The rear axle is fitted with two radius rods and a torsion rod, which insures alignment.

Two separate and distinct systems of ignition are used, viz., a Bosch high tension magneto, which is shown on the inlet side of motor, and a dry battery system with single coil and secondary distributor. Two sets of equalizing brakes are fitted, both operating on the rear wheels. Steering is irreversible, through worm and sector gearing with universal joints at all steering connections. Spark and throttle levers are on a quadrant on the steering wheel convenient to the right hand, and a foot accelerator is provided. A 28 gallon fuel tank is suspended from the rear of the frame from which the fuel is forced to the carburetor by exhaust pressure. Grease cups are liberally used on all steering and spring connections.

The Rogers Fireproof Automobile House.

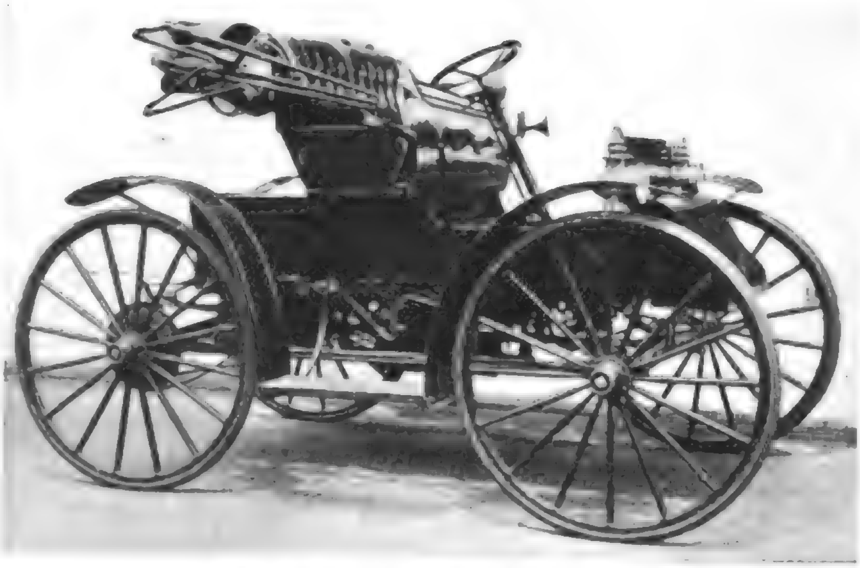
J. S. Rogers & Co., of Moorestown, N. J., are making a "knock-down" structural steel house for automobiles or motor boats. The house is 20 feet long, 13 feet high and 12 feet wide, giving ample room for a touring car and work bench within and sufficient space to move around the car in washing, etc. An 8x8½ foot door is fitted, as are also twin sliding windows on each side and at the end opposite the door. The framing is entirely of structural steel angles, and comprises four roof trusses, with the necessary purlins and girts, and eight angle posts. The sides are sheathed with either corrugated steel or with a steel clapboard. The roof is either of corrugated steel or a crimped steel roofing, as desired. The doors are also of steel sheet



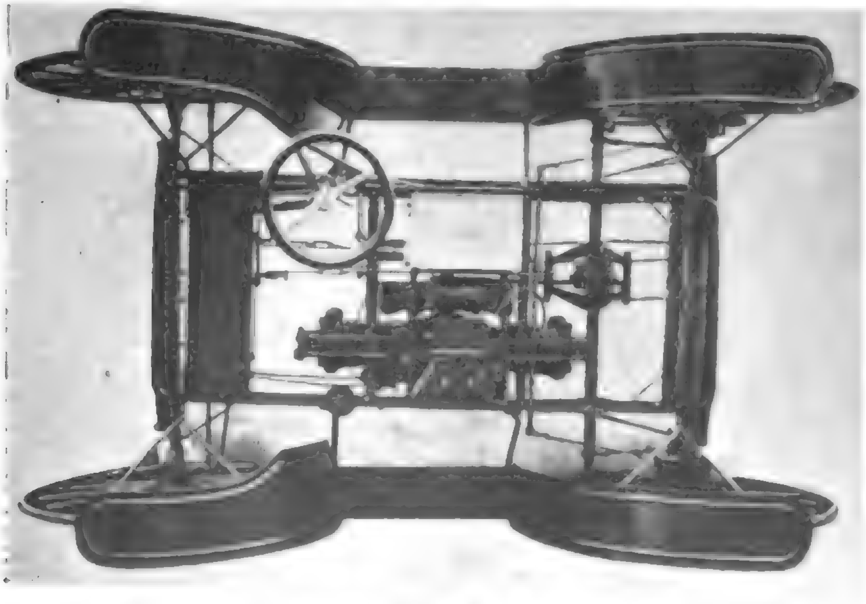
Inlet Side. P. & S. Six-Sixty Motor. Exhaust Side.

The P. M. C. Runabout.

We illustrate herewith the P. M. C. solid tire runabout, manufactured by the C. S. Peets Manufacturing Company, 60 West Forty-third street, New York city. The car has a wheel base of 70 inches, tread of 56 inches, and is fitted with 38 inch wheels front and rear mounted on plain bearings and equipped with 1¼ inch solid rubber tires. Roller bearings are furnished, however, at a small extra cost. The frame is heavy angle steel and is mounted on two full elliptic springs set crosswise to the frame. The motor is a two cylinder opposed, air cooled, 4⅛x3¾, rated at 12 horse power. Ignition is by jump spark with dry batteries, and lubrication by a six lead automatic force feed oiler. The transmission is through a two speed forward and reverse planetary change speed gear, by chain to a countershaft and by side chains from the countershaft to rear wheels. Two constricting band brakes are used, operating on the rear wheels. Steering is by wheel through bevel gears, and the throttle and spark levers are mounted on the steering column convenient to the right hand. The car weighs complete without top 900 pounds. Either a Cape or limousine top and lamps and horn are supplied extra.



THE P. M. C. SOLID TIRE RUNABOUT.



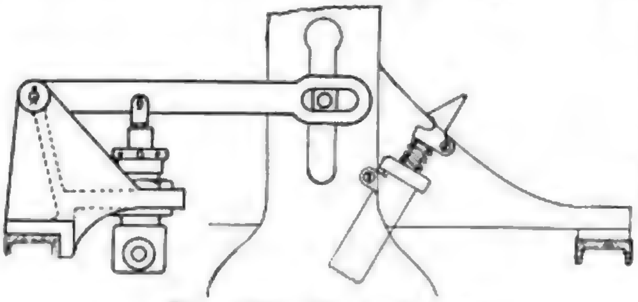
CHASSIS OF P. M. C. RUNABOUT.

The Rock Island Automobile Vise.

The Rock Island Tool Company, Rock Island, Ill., have brought out an automatic swivel vise specially designed for use on automobiles. The base of the vise is fastened to the running board or step of the car and always remains in position, while the vise itself is ordinarily kept in the tool box. When it is to be used all that is necessary is to slip it over the base and to insert the piece to be worked on between the jaws, then by tightening the jaws in the ordinary manner the vise is automatically locked in position on the base. The vise has a width of jaw of 2 inches, opens 2½ inches and weighs 4½ pounds. It is either nickel plated or finished in the regular black finish.

The Clark Hill Climbing Pump.

Edward S. Clark, 242 Freeport street, Dorchester, Mass., has brought out a hill climbing pump for attachment to 1903 and 1904 model White steam cars. The pump is of the ordinary plunger type and carried by a bracket designed to be bolted with two bolts to the frame, to which the engine lugs are bolted. The pump lever at its outer end is slotted, and carries a hardened sliding block, which is made to fit the pin on the engine crosshead that ordinarily drives the air pump. The lever sets close to the engine and does not interfere with the regular pump connection. The line cut shows the pump with its bracket and lever and the method of connection to the engine. A by-pass valve furnished with this pump is fastened to the dashboard.



DARK HILL CLIMBING PUMP.

The Northway Engines.

Realizing that the trend of the times is toward specialization, the Northway Motor and Manufacturing Company, of Detroit, will hereafter devote the entire capacity of their plant to the manufacture of the engines described below. They will build these motors by thousands, and by so doing are enabled to offer thoroughly good motors made of first class material, with all parts interchangeable and machined to a close limit of accuracy, at a very low price.

Two sizes are made, viz., a 25 horse power model, with 4 inch bore and 4½ inch stroke, and a 32 horse power model, which is 4½ inches "square." Both models are exactly alike, except as to the cylinder bore.

The cylinders are cast in pairs, with the valve chambers on one side. They have exceptionally large and free ports for inlet and exhaust gases. The water ports and pipes are made large enough for thermo-siphon circulation. The bores are finished by boring and reaming to close limits.

The pistons are turned and ground. They are fitted with three rings, which are tool finished on the face and ground on both edges. The piston pins are unusually large. They are made of open hearth steel, carbonized and ground. Held fast in the rod end by an ample screw, they turn in bronze bushings, which are fast in the piston bosses. The connecting rods are vanadium crucible stee lcastings, carefully tested in the rough.

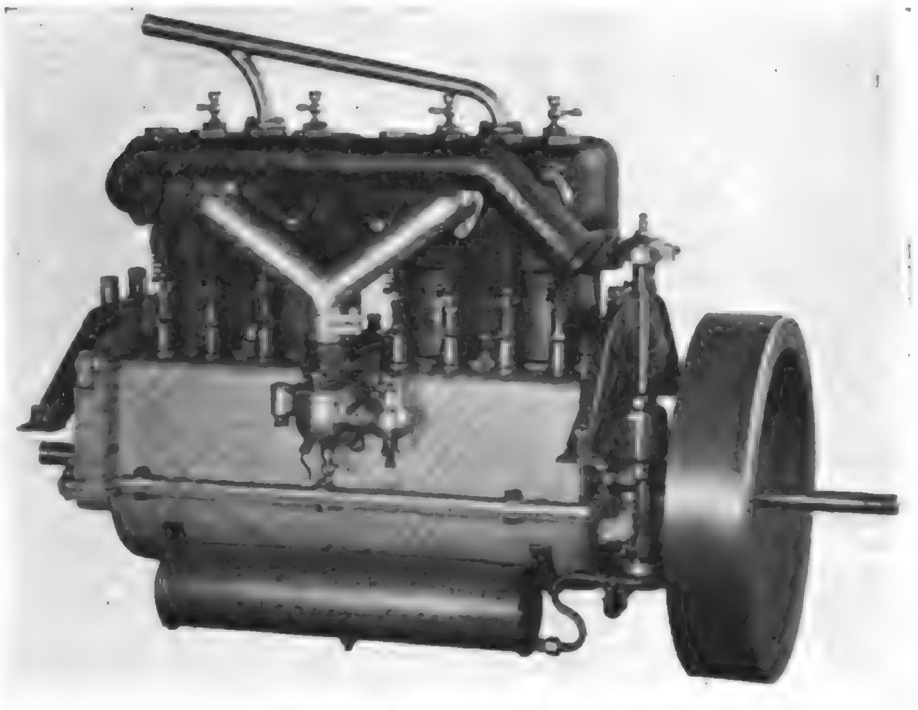
A drop forged crank shaft is used. The material is forty point carbon steel, triple heat treated. It is ground to within a limit of .001 inch, the finished diameter being $1\frac{11}{16}$ inches. Either Phœnix or Hoyt's nickel babbitt is used for bushing the shaft and crank pins.

Aluminum or gray iron crank cases are used at the purchasers' option. The upper part is of box section, and carries all the bearing caps. The lower part is simply an oil pan. A groove is provided in the joining faces, and is filled with a special packing to make the joint oil tight. The timing gears are fully enclosed.

The cam shaft is also of open hearth. It has the cams integral. Cams and bearing surfaces are hardened and ground, the cams being ground to form by a master cam grinding arrangement. The push rods are of the mushroom type, hardened and ground. The cap and lock nuts are fitted to their upper ends, for valve adjustment. The eight valves are all alike, and have nickel steel heads welded to carbon steel stems. A 17 inch flywheel is furnished, machined to fit a standard cone clutch.

At the rear end of the cam shaft is a housing for the bevel gears, which drive the vertical shaft for the timer. Splash lubrication is used for the standard equipment, with an oil gauge in each crank case compartment. Provisions are made to attach an integral oiling system operated by a sliding vane pump with ample reservoir capacity. The motors are arranged so that a water pump fan and magneto may be attached if desired.

Being built especially for sale in large quantities to manufacturers, these motors are furnished with separate supporting arms bolted to the crank case. In this manner any width of frame may be fitted.



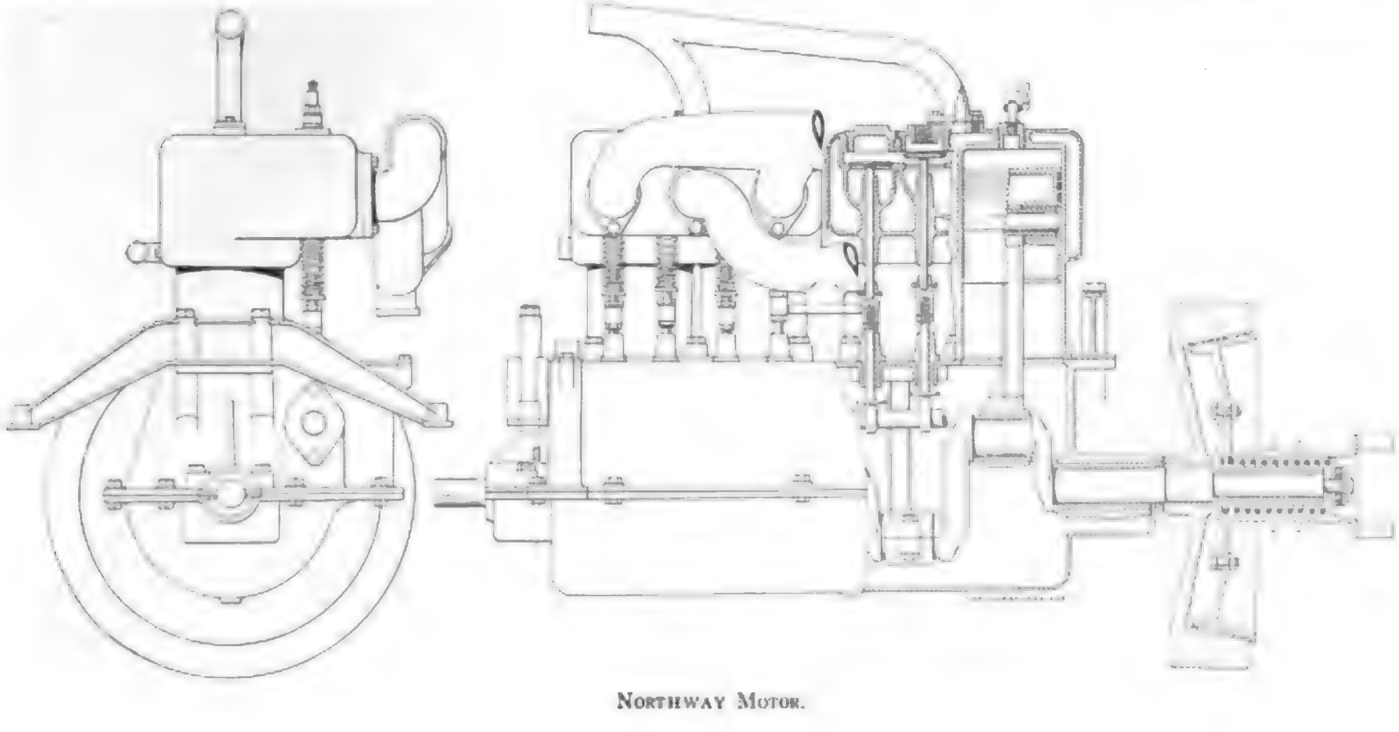
NORTHWAY MOTOR, WITH INTEGRAL OILING SYSTEM.

The Auto Creeper.

The Brown Company, 523 East Water street, Syracuse, N. Y., have placed upon the market a device that should prove a convenience to those automobilists who are now and then obliged to get at some part underneath their car, but do not have a pit. It consists of a light wooden truck mounted on casters, with a cushion at one end, on which the person who is to do the repair can rest his head, and a chain by which the truck can be drawn into place and out from under the car by a second person. No doubt the operator himself can also move the truck underneath the car to get it into the correct position.

The Clark Internal Expanding Brake.

Edward S. Clark, 242 Freeport street, Dorchester, Mass., has placed upon the market an internal expanding brake which can be fitted to any runabout or small touring cars that use artillery wheels, and also a brake specially designed to fit the Stanley small touring car and runabout. The brakes are fitted with a bronze shoe and are con-

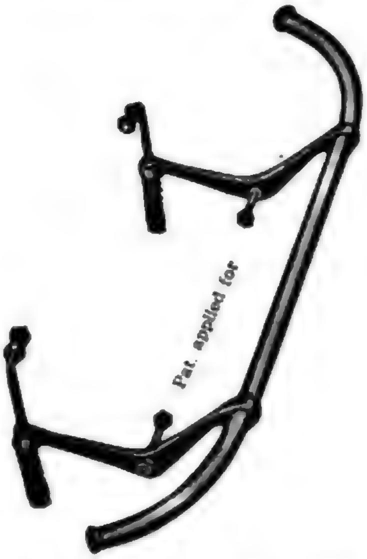


NORTHWAY MOTOR.

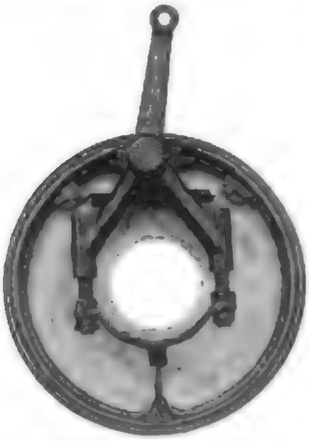
nected with a locking hand lever with latch on the quadrant. The handle of the operating lever and the latch are plated in either nickel or brass, while the rest of the lever and the parts are left unfinished for painting.

The Sager Protection Bumper.

J. H. Sager Company, Rochester, N. Y., have recently placed on the market a protection bumper, which is claimed to absorb the shock of a collision and to avoid injury to the car and the object struck. The tubing is placed 6 inches above the spring hanger eye, so as to give greater protection to the lamps, radiator, etc. Besides, a confused pedestrian may grasp it at the critical moment and thus avoid being run over. The upper part of the L stud bolt is bolted to the frame and is practically universal. The bolts in the centre of the arm pass through the eyes of the spring hanger. When a collision occurs the arms pivot around these bolts and compress the coiled springs at the end of the stud bolt.



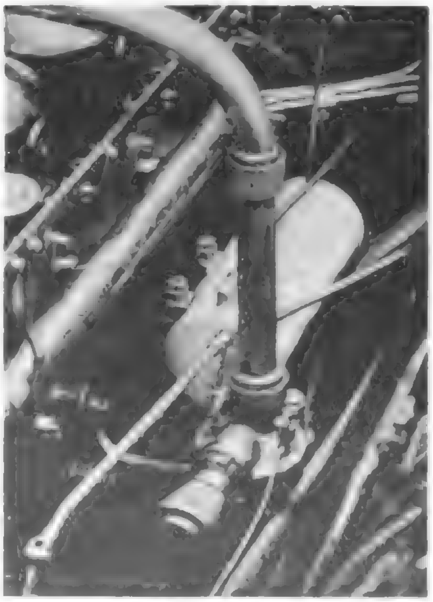
The Sager Protection Bumper.



Clark Internal Brake.

The "Recometer"

The Recometer Company of America, at Seventy-fourth street and Broadway, New York city, is putting on the market a combination recording speedometer and odometer. As illustrated herewith, there is a regulation dial which shows the speed, the trip mileage and the total mileage. Above this dial is a tape, upon which are recorded the time of starting on a trip, number, time and length of stops, distance traveled and speed. The month, day of the month and hour are also shown at any time. The tape, which is long enough for one week's use, is printed with the year, month and day of the month. It is further subdivided into vertical divisions, each division being equivalent to one minute, and at intervals of 15 minutes or divisions the hour is printed. The tape is wound on two spools, and is drawn past the recording pen at the rate of one division per minute. The pen is free to move vertically, one up or down movement corresponding to one-half mile. It is mounted on the end of a lever, which is moved up or down by a cam driven by the flexible shaft, the necessary speed reduction being accomplished by worm gears. When the car is standing the pen is stationary and draws a straight line, the length of which is the length of time the car is standing. When the car is running the pen draws a zigzag line, the number of divisions one up or down movement covers being the time for one-half mile. The tape requires replacement once a week, and the clock requires winding once a week. The ink reservoir holds enough of thin non-evaporating and non-freezing ink to last about two months. The top of the instrument is fitted with a hinged cover whereby access is had to the tape. This cover can be locked to prevent tampering with. Further precautions are taken against tampering by either riveting or locking by a special lock the flexible shaft to the wheel. The instrument is 5x5x5 inches and weighs about 5 pounds.



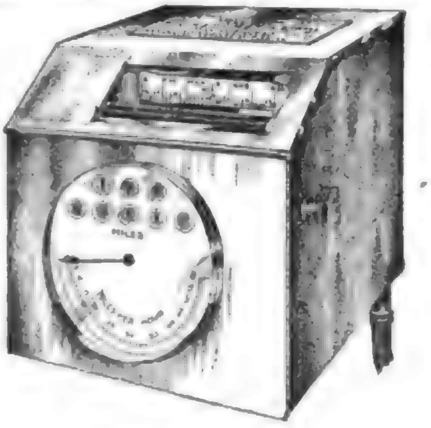
New Rambler Supplementary Gasoline Tank.

The Rambler Supplementary Gasoline Tank.

We show herewith a photographic view of the supplementary fuel tank which is now being fitted to Rambler four cylinder cars, and to which we referred in a recent issue. It will be seen that the supplementary tank is located above and behind the carburetor, but considerably below the main gasoline tank. This supplementary tank will carry sufficient gasoline to run a car several miles up grade, and is so arranged that the gasoline will flow into the tank on the level or on a slight up grade, but that it will not, under any condition, run back into the principal supply tank. The measurements of the tank are 4 inches in diameter and 10 inches long.

A. C. A. Bureau of Tours Year Book.

The A. C. A. Bureau of Tours has just issued its 1908 year book. The chief features of this year book are the A. C. A. official route cards, prepared with special signs copyrighted by the club. These signs are here used for the first time in print. The book also contains a full list of the ferries within a circumference of 150 miles from New York, giving sailing hours and charges on motor cars; also the steamship connections to all the coast points; a full synopsis of the various State motor laws; also a full list of hotels, garages, attorneys and physicians in every part of the United States holding the A. C. A. official appointment. Next follows a synopsis of all requirements in foreign countries and the necessary formalities on this side before embarking on a trip abroad. At the end of the book is a résumé of road conditions in the various States of the Union, compiled by the United States Office of Public Roads especially for this book.



The "Recometer."

The scheme of a combine of the older manufacturers with the object of "freezing out" the numerous small manufacturers of voiturettes is being broached in France. The plan is that each of the manufacturers shall confine himself to a single type of car and produce that in large numbers and sell it at a price which cannot be approached by the small makers.

COMMUNICATIONS

Puzzling Engine Troubles—Low Pressure of Inflation.

Editor Horseless Age:

"Owner's" letter in the last issue suggests the need of a puzzle expert—someone who would take up a hard problem like this and follow it to a finish; and it would well pay the maker of the car to pay such a man whatever it cost to remedy such a trouble. The remedy can be found, and if it is not found the car will go from one buyer to the next, disgusting all who get it, till it is fixed by someone. But before this time it may do the makers more damage than several cars are worth, besides disgusting a lot of would-be buyers who learn of the troubles and expenses of "Owner," or who hear of the unsatisfactory operation. I have often wondered if it would not be a good business proposition for some reputable but neutral authority like your own good selves to open a trouble bureau and provide unbiased experts to buy cars for innocent, unexperienced would-be users who are tempted to enter the ranks via the second-hand purchase, and to fix troubles beyond the ability of the local expert. The second-hand car problem is a rapidly growing one, and much of the dissatisfaction arising is due to the fact that a green man gets a rig that is not in perfect order but that has been "painted up and sold." A good disinterested report would show him that the fault was in the condition of the particular car and not in autos generally. It would indicate both the probable amount of the repairs and, what is of more importance, that the car could not be expected to please him till it was put right. A novice needs the best of tools, and this buying a second-hand "to see how I like it" is a very foolish move unless one knows that the second-hand is in order and running sweetly, as it readily can be.

In the same issue you bring out a number of facts regarding inflation pressures, to which I would like to add a few more. Air is the most perfectly elastic part of the tire, and we should make use of it to the fullest. This means that we should carry the load on the air and not on the fabric and rubber. Most users think more of the puncture bogey than of other things, and so demand thicker and stiffer tires. But a stiff, thick wall of anything, be it fabric and rubber, or any other substance, will not bend so many times as a thin flexible wall; so the stiff tire quickly breaks and a certain rapid deterioration is substituted for the may-or-may-not-happen puncture. Truly, this is not the thing wanted, and users should be led the right way. The stiff tire needs less air pressure, for the fabric is stiff enough to do more work; but since it cannot do it without wearing itself out, this work should be thrown on the air, which does work without wearing out. Another thought is that a wide tire rolls over more surface and so comes in contact with more of the tacks which cause the punctures. This would indicate that large wheels with small section tires will carry the load just as well and not meet so many punctures in a given distance. Further, the thickness of the wall is directly related to the cross diameter of the tire, in order to resist bursting strains, and with the large wheels and small section tires there may be a higher pressure of air under any given auto with consequent easier riding and easier propulsion. The nature of the fabric has much to do with the effect which the tires give. The object of the tire is to swallow the small obstacles and avoid throwing the wheel into the air. That this may be done most perfectly, a fabric that is extensible in a direction lengthwise the tire must be used. Experiments with a resiliometer in the cycle days showed differences as great as 25 per cent. in tires then on the market, and the most resilient tires were the ones selected for track use. They are the ones which give comfort and save gasoline.

Chas. E. Duryea.

Query.

Editor Horseless Age:

Will you please tell me how the number 900 is obtained in the formula

$$F = \frac{W \pi^2 N^2 r}{g\ 900}\left[\cos\theta + \left(\frac{v}{l}\right)\cos 2\theta\right]$$

which appears on page 736 of your issue of June 5, 1907, and on page 511 of the issue of May 6, 1908?

Russell T. Kirby.

[The author of the articles referred to, L. E. French, sends us the following derivation of the formula: "The expression $\frac{w}{g}\frac{\pi^2 N^2 r}{900}$ is the centrifugal force of the weight W, revolving N revolutions per minute at a radius R feet:

$F = \frac{M V^2}{r}$. $V = \frac{2 \pi r N}{60}$. $V^2 = \frac{4 \pi^2 r^2 N^2}{3600}$.

$M = \frac{w}{g}$. Substituting, $F = \frac{w}{g}\frac{4 \pi^2 r^2 N^2}{r\ 3600}$

$= \frac{w}{g}\frac{\pi^2 r N^2}{900}$ since N = revolutions per minute and v is expressed in feet per second."—Ed.]

Agricultural Tractors in Demand.

Editor Horseless Age:

Why is it no American manufacturer of autos wants to bring out something that can be used by the farmer? We want a motor we can plow, harrow and pull wagons with. It is the one thing needed that will settle the farm problem. With it farming will be a pleasant and profitable business. We have everything else in the way of farm machinery, but lack this one thing. I have written many manufacturers who are making automobiles. Several say it cannot be done. Now, these motors are and have been in use for two or three years in Germany, England and, I believe, France; but farms there are small and the demand is inconsiderable. Here we have immense farms and can use and profit by them—in fact, capitalists will soon be buying them all up for investment, as they have done in England.

Henry Hendrix.

[The recent inquiry in our columns for an agricultural tractor brought forth replies from a number of manufacturers of such machines, including the International Harvester Company, of Chicago, Ill., and the Columbus Machine Company, Columbus, Ohio.—Ed.]

"Remedy for a Fierce Clutch."

Editor Horseless Age:

Referring to the communication on page 662, "Remedy for a Fierce Clutch," will say that I had exactly the same trouble as your correspondent. All the oiling did not remedy the fault, and so finally I concluded to reline the clutch with new leather, and after this was done the trouble disappeared.

After taking off the old leather I found no oil would extrude when bending it one way, but when bending it the other it would. So I came to the conclusion that the face of the leather from continued friction was burned, or made so hard it would not absorb oil. The clutch of my machine has the spring plunger, and I am satisfied if the clutch is relined the trouble will disappear.

J. G. S.

Brake Lining Not Affected by Oil.

Editor Horseless Age:

The running brake on my car is immediately back of the change gear box, and I cannot get it to hold on account of the oil being continually thrown on it around the shaft. I have tried two or three different schemes to trap the oil—in fact nearly everything except putting in a perfect stuffing box, for which there is no room. Do you know of any brake lining which is not affected by the presence of oil? It occurred to me that there might be some such substance, and that might be the simplest solution.

F. E. Hoffman.

[The only brake material that is claimed not to be materially affected in its frictional qualities by oil is cork. The cork is applied in the form of inserts, and you would probably need a new cast iron brake band. —Ed.]

Wants Users' Experience With Leather Tires.

Editor Horseless Age:

Can you give me any definite information as to the practicability of the King leather tire, manufactured by the King Leather Tire Company, of Racine, Wis.? Have you had experience with them, or do you know of any reliable parties who have used them, and if so, with what success? Do you consider them superior to a good rubber tire?

J. W. Haggart.

[We have had no experience with these tires.—Ed.]

Mud Wallowing Experience.

Editor HORSELESS AGE:

It may be interesting to you to know that during the past spring I have on several occasions driven through "puddingey" mud that was 20 inches deep in a Pullman limousine steamer that weighed about 5,000 pounds. CORTLANDT DE P. FIELD.

Glidden Tour Developments.

Entries for the A. A. A. Tour continue to come in very sparingly, though the official announcements sent out by the press agent are still held in a very hopeful tone. According to these announcements, it is all due to the fact that the entrants all want to wait till the last minute before filing the paper in order not to have to change their nominations of drivers and observers. To the entries already printed in these columns only six can be added this week, all entered for the Glidden contest. They are: No. 15, Andrew Cuneo, Rainier; No. 16, J. F. Duryea, Stevens-Duryea; No. 17, I. H. Page, Stevens-Duryea; No. 18, C. H. Foster; No. 19, Frank N. Nutt, Haynes; No. 20, Loring Wagoner, Haynes.

Chairman F. B. Hower, of the A. A. A. touring board, announces the following officials as his assistants in the conduct of the tour:

Dai H. Lewis, secretary of the A. A. A. touring board, in charge of the confetti and pilot car; E. L. Ferguson, starter; Mortimer Reeves, checker at the finish and in charge of night controls; F. D. Stidham, chief of observers; H. D. Herr, hotel arrangements; David E. Hoag, M. D., official surgeon; Arthur Jervis, press representative; W. L. Conklin and W. A. Carroll, watchers.

The Skippack Hill Climb.

The series of events conducted in Monroe County, Pa., last week by the Norristown A. C. ended with a hill climb up the Skippack Hill on Saturday. The road surface was oiled for the occasion and was in fine condition, and telephone wires for the use of the timers had been strung along the course in advance. The hill is located on what is known as the Norristown-Reading pike, four miles above Norristown, and begins in the valley of the Skippack Creek, extending east directly over a bridge at Eagleville. It is 6,270 feet in length, with a total rise of 352 feet, the grade varying from 3 to 9 per cent. The event was attended by a large crowd, and the State constabulary assigned to duty on the hill had difficulty in keeping the course clear until after the fourth event, which was postponed until all the people had been cleared off the road, to which end it was necessary to open the grand stand and paddock to the public free. There was a total of sixty-six entries. The best time of the day was made by Willie Haupt, driving a 50 horse power six cylinder Chadwick, viz., 57 2-5 seconds. Following is the summary:

Event No. 1.—Gasoline stock cars at $850 and under. Won by C. W. Mann, 18 H. P. Buick, in 2:18.

Event No. 2.—Gasoline stock cars at $851 to $1,250. Won by Brockway, 24 H. P. Overland, in 2:11.

Event No. 3.—Gasoline stock cars at $1,251 to $2,000. Won by W. J. Hayes, Jr., 35 H. P. Jackson, in 1:53.

Event No. 4.—Gasoline stock cars at $2,001 to $3,000. Won by L. Zengle, 50 H. P. Pennsylvania, in 1:30.

Event No. 6.—Gasoline stock cars at $3,001 to $4,000. Won by L. Zengle, 50 H. P. Pennsylvania, in 1:36 2-5.

Event No. 8.—Gasoline stock cars at $4,001 and over. Won by William Bourque, 30 H. P. Knox, in 1:33.

Event No. 9.—Free for all. Won by Willie Haupt, 50 H. P. Chadwick, in 57 2-5.

Arrowhead Hill Climb to Be Held July 11.

The Riverside Motor Club, of New York, have changed the date of the climb up Arrowhead Hill from July 8 to July 11, in view of the Good Roads Convention of the A. A. A. being held during the former period. Arrowhead Hill is located at 177th street and French boulevard, and continues upward with varying grades to Fort Washington Heights. There will be ten events, as follows:

A.—Gasoline cars, $850 or less.
B.—Gasoline cars, $851 to $1,250.
C.—Gasoline cars, $1,251 to $2,000.
D.—Gasoline cars, $2,001 to $3,000.
E.—Gasoline cars, $3,001 to $4,000.
F.—Gasoline cars, $4,000 and over.
H.—Taxicabs, carrying four, including driver.
I.—Free for all, any type or motive power.
J.—Electric cars.

With the exception of events H and I, only stock cars will be allowed to enter. Unless three entries are received for any of the events that event will be called off.

Cleveland Hill Climb Dispute.

The protest of H. S. Moore against the winning Knox car in the piston displacement handicap event in the Cleveland hill climb, held on June 13, has led to a bad tangle and much bitter feeling. It will be remembered that originally the prize was thought to have been won by the Stoddard-Dayton car entered by Mr. Moore, but after carefully figuring out the results the officials on the night of the contest date declared the Knox, driven by Bourque, and entered by the Metropolitan Motor Car Company, to be the winner. Against this decision H. S. Moore entered a protest, claiming that the Knox had not gone all the way up on the high gear, as it should have done in this event. The referee, Will Wherry, decided that Moore's protest was justified, and as a result gave the event to the Stoddard-Dayton. Mr. Moore expressed his willingness to run the race over at any time; but the Metropolitan Company would not do so unless the timing apparatus were again installed, and unless all the officials were present. They, on the other hand, took exception to the ruling of the referee and the contest committee, and made an appeal to the racing board of the A. A. A., charging willful and knowing infractions of the racing rules, and are seeking to have the whole event held null and void, the promoters and officials disqualified and the records made set aside. The indictment of the officials in charge of the contest ranges from technical violations of various rules to the fact that the entire event was run without a sanction of any sort from the A. A. A., despite the fact that it was advertised as being so sanctioned. Not the least of the charges is that a woman was allowed to compete, this being directly against the A. A. A. ruling. The board of trustees of the Cleveland A. C. meanwhile upholds the referee and contest committee, by a decision reached on Friday last, and awaits the action of the A. A. A. racing board.

Proposed Californian Endurance Contest.

A 1,000 mile endurance and reliability run is planned by the automobile dealers' associations of Los Angeles and San Francisco, to take place early in September. It is proposed to start from San Francisco, travel south along the coast at the foot and over spurs of the Coast Range to Los Angeles and return to the Golden Gate by way of the San Joaquin Valley, crossing the southern spur of the Sierra Nevada, the Tehachapi Mountains, by way of Bakersfield and Tulare. The round trip would exceed 1,000 miles in length. According to the tentative plans the run will begin September 7 and end September 11. Should the project materialize the event will be made an annual affair, with the starting point alternating between the two cities. September is chosen because during that month, four months after the last rain, the roads in California are in excellent shape.

Toll Road in Lake County, Cal., to Be Opened to Automobiles.

One of the most mountainous and picturesque counties in the State of California is Lake County, the border of which is 100-120 miles from San Francisco. There are absolutely no railroad tracks in the county, the terminus of the railroad from San Francisco by way of Vallejo being at Calistoga in Napa County. From Calistoga the stage road climbs over a steep mountain ridge and descends to Middletown, whence other stage routes diverge. This road is known as the Lawlor toll road and is one of the best in Lake County. C. A. Eastman, the Pacific Coast manager of the White Company, has returned recently to San Francisco from a trip in Lake County, and reports that the Lawlor toll road has changed hands and will be opened to automobiles as soon as the supervisors decide on the rates to be paid for motor cars using the road. Another well known toll road in Lake County is the Great Western and Ida Clayton, which goes over Mount St. Helena. Part of this road is on clay soil, and where thick trees overhang it the mud is up to the hubs of a motor car.

Automobiling in Western Canada.

By D. J. Benham.

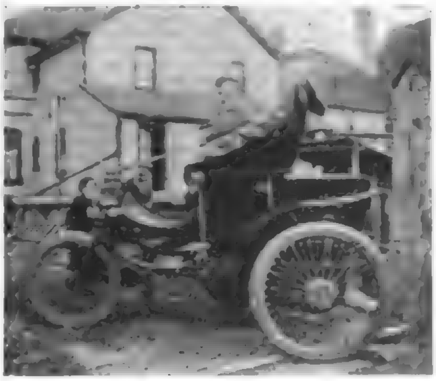
The automobile as a means of recreation or transport is peculiarly adapted to a prairie country like western Canada, where the vast plains stretching from Winnipeg to the Rocky Mountains, nearly 700 miles away, are threaded with a network of trails, so level and so well beaten that the big machines glide almost noiselessly along over them like a swallow over a mill pond. As a result the auto has rapidly developed a remarkable popularity, which promises to increase and expand with the progress and development of the country, as yet only emerging from its pioneer stages. Motoring has captivated the fashionable circles of every land, but there is something in the exhilarating dash and whirl of the auto, combined with comfort and utility, that harmonizes with the spirit of the West, and threatens to imperil the inherent love of the horse which heretofore has been one of the Westerner's ruling passions.

The first automobile made its appearance on the streets of Winnipeg in 1901, being the property of the late Professor Kenrick, of Manitoba University (whose contributions to our columns will be remembered by many of our readers.—Ed.), to whom thus belongs the honor of having introduced motoring into western Canada. This little machine is still in active commission, and may be seen any day upon the streets of Winnipeg, a sound tribute to the excellent workmanship and material used in the manufacture of the little car. It was a "dinky" looking little thing, compared with the big luxurious touring machines of the present day; indeed, as will be noted from the accompanying illustration, it resembled an invalid's chair more than a modern motor, having only three wheels, with a long steering tiller, which was the subject of more than one joke at the expense of the professor, the popular idea being that it was devised as a means of pulling the machine home when it became refractory on the trail.

From this humble beginning the auto leaped into popularity, until today there are in the little city of Winnipeg, with a population of about 115,000, considerably over 300 cars of all descriptions, from the small runabout to the luxurious $6,000 touring car. The trade throughout the three provinces of the west, namely, Manitoba, Saskatchewan and Alberta, has even outstripped Winnipeg in comparison with population, upward of 1,100 cars altogether now being in commission in the little towns and villages which dot the plains, while not a few of the farmers have added an auto to their equipment. It has been a decidedly profitable field for the various manufacturers catering to this trade, because of the comparative ease with which the purchasers can be reached.

After Professor Kenrick's innovation a Stanley steamer runabout was introduced by the firm of McCulloch & Boswell, who afterward became prominent in the trade as the owners of the largest garage in Canada. Within a year the Cadillac, the Oldsmobile and the Ford companies were represented by agencies here through which a considerable number of cars were disposed of in the spring and summer of 1903. One of the gentlemen who lent their patronage to the sport in those early years was ex-Mayor Arbuthnot, now the millionaire coal mine operator of the Pacific Coast.

The year 1904 saw the introduction of higher priced and much more powerful cars, such makes as the Cadillac, Oldsmobile, General, Rambler, Russell and Glide finding a popular demand. This was the real beginning of motoring in the Canadian west; and from that time on each year has seen the class of cars in demand steadily rise in price and style of construction in accord with the tastes and means of a wealthy and progressive people. During the season of 1907 some extremely handsome cars were introduced in Winnipeg, including several Royal tourists, a Winton and two Packards of the latest model, the property of R. J. Mackenzie, second vice president of the Canadian Northern Railway, and Hon. Robert Rogers, a member of the Provincial Government. All of these cars cost considerably over $5,000 each, and set a new standard for the type of machine for those whose bank account permitted them to choose according to their tastes. A large number of other cars, ranging in value from $1,800 to $2,800, were also sold to Winnipeggers, the total of machines placed in the city during the season being over 100. This year shows no decline in either the style or volume of the business.



The First Automobile Brought Into Western Canada.

CLUB LIFE.

The Winnipeg Automobile Club was called into existence in the spring of 1904. The club was a decidedly modest little organization, judged on a basis of numbers, as may be assumed from the illustration showing the first run held under its auspices. Major Webster, M. D., a most enthusiastic motorist, had the honor to be elected first president of the club, and Professor Kenrick served as secretary-treasurer.

The progress of the club during the initial year of its existence was not such as to bespeak for it the influential position it now commands. The membership did not show any material signs of increase until the opening of the season of 1905, but by 1906 the club was developed into a large and effective organization. J. C. Armytage occupied the position of president, and A. C. Emmett, who had been connected with motoring from its inception in the West, served as secretary, having been elected to the position on the death of Professor Kendrick the previous year. The new life infused into the organization by the policy instituted by the new executive was a material factor in popularizing motoring in the city. A series of very enjoyable club runs and social gatherings was successfully arranged, and several race meets, notably one in connection with the industrial fair, served to attract attention of the public to automobiling and were of sufficient interest to draw several entries from the East. By the conclusion of the season the membership had grown to 120.

The progressive spirit which pervaded the club in 1906 characterized it in the following year under the presidency of Judge Phippen, with C. W. Power as secretary. Many new members were added to the rolls, and a new feature was introduced into its programme of events in the shape of an endurance contest. Several little tours were also planned. The present season promises to eclipse all its forerunners. The first run of the season occurred during the first week in June, when the club journeyed out to Portage la Prairie, 55 miles west, where they were joined by the clubs from Brandon and Souris, who had each come upward of 150 miles or more to be present. The entire party spent a day inspecting the country surrounding the City of the Plains. Both Souris and Brandon have large and enterprising automobile clubs, with ever-increasing memberships. Another club is in prospect in Portage la Prairie, but organization has not been attempted in any of the other western cities or towns, not even in Edmonton or Calgary.

GOOD ROADS.

The Good Roads Association of Manitoba is an organization that owes its existence to the Winnipeg Automobile Club. The association was formed in 1907 with President Phippen and Secretary Emmett, of the Auto Club, occupying similar positions on the executive. The sympathies of the Country Club and the Amateur Driving Club were enlisted and the active assistance of those influential bodies obtained. A joint committee was appointed to do missionary work among the rural municipalities contingent to Winnipeg, where the land is exceptionally heavy, and in consequence the trials, unlike those on the lighter plains further west, are prone to be muddy after every rain. This is something that affects the business of Winnipeg, and when the subject was laid before the merchants by the representatives of the auto club there were none who gave the movement more cordial support and assurance of financial aid. The idea was to induce the councils of the municipalities to undertake the work and the association should assist in defraying the cost. Missionary work with this end in view was promptly begun and a committee attended numerous meetings of the taxpayers of the rural districts to discuss the project. The farmer element did not take kindly to the proposition at first, arguing that the roads were good enough for them and for their purposes, consequently if the auto club wished to have modern improvements made they should pay for it themselves. This short-sighted policy on the part of many of the farmers greatly embarrassed the association in its work and largely nullified its efforts for a time, until a realization of the fact that good roads meant something of a saving to horse flesh in teaming was forced upon the conservative rural dwellers.

First Run of the Winnipeg Automobile Club.

The movement, however, is now bringing forth good fruit, and the gentlemen responsible for the campaign have the satisfaction of seeing the agitation assume the importance of a provincial matter which is receiving the earnest support of the union of municipalities and the provisional government. Already an excellent paved highway from Winipeg to Winnipeg Beach, a charming summer resort on the shores of Lake Winnipeg, 52 miles away, is being constructed by the municipalities interested, aided by a substantial Government grant. When the road is completed, which will likely be some time this fall, the beach will afford a delightful headquarters for the auto club and the Motor Boat Club. There is excellent accommodation for all visitors at the beach, and besides many members of the auto club have their summer cottages and residences there. It will be one of the most enjoyable runs available to motorists in western Canada. On the other side of the city the Government, acting in conjunction with the civic authorities and rural councils, is having a magnificent driveway constructed from the city to the agricultural college, which lies to the westward of Winnipeg on the banks of the historic Assiniboine River. This driveway will follow the tortuous curves of the river through the choicest section of the residential portion of the city, beautiful Crescentwood, which is outrivaled by few similar thoroughfares on the continent, and when the work is completed it will be a spot of which Winnipeggers may be justly proud. The stately oak and elm trees which will line the drive from end to end in all their natural beauty will lend an additional charm to the prairie dwellers, who never see such trees away from the rivers.

These are but two examples of what has been accomplished by the movement inaugurated by the members of the auto club, though much more on a less pretentious scale is projected since the question of good roads has assumed the proportions of a provincial one. The association is now urging that the prisoners in the provincial institutions for correction should be employed on road construction, following the example of the United States, where convict labor is largely used for this class of work.

The city itself has nearly 50 miles of asphalted streets, which, with other well paved thoroughfares, afford fine opportunities for evening runs.

THE MANITOBA MOTOR LEAGUE.

The widespread use of the automobile and the opposition which has developed to its use on the trails amid the farming communities led the Legislature to introduce restrictive legislation at its session some months ago. The bill introduced by a representative of a farming constituency, and indorsed by his confrères, who compose a majority of the house, was so drastic in its provisions that it was considered inimical to the interests of every owner of an auto in the country. This legislation, as finally adopted in very much modified form, is reviewed hereunder, but for a time the bill threw consternation into the ranks of motorists. The Winnipeg Automobile Club vigorously opposed it when it was introduced, and when its representations were rejected by the house a meeting of all the owners of motor cars in the province was hurriedly summoned to meet in Winnipeg. Out of this meeting grew the Manitoba Motor League, with the avowed objects of promoting the interests of the sport in this province. Many of the most influential men in Manitoba were present or communicated their sympathies with the movement. Organization was finally effected with the following officers: Honorary president, Judge Phippen, Winnipeg; president, W. A. Scott, Brandon; first vice president, D. B. Sprague, Winnipeg; second vice president, Joseph Maw, Winnipeg; third vice president, H. Stevens, Portage la Prairie; secretary, W. R. Bawlf, Winnipeg; treasurer, L. R. Barrett, Winnipeg. An effective campaign was inaugurated against the bill and some of the most objectionable clauses were considerably modified.

The Motor League has also undertaken an important work in the interests of the sport in the production of route maps showing the various trunk highways throughout the province. In addition the league will provide and erect sign posts marking the different main and cross roads, showing the distance and name of the nearest town, and also the distance from Winnipeg. Any movement for road improvement by the various municipalities will also receive the hearty support of the league, and any influence possessed by it or any of its members with the Government will be employed to further such projects.

Anyone who owns an automobile in the province is eligible to membership, whether a member of any organized automobile club or not.

(To be continued.)

Coming Events.

July 4—Two Hundred and Fifty Mile Race, Lowell (Mass.) A. C.

July 6 to 8—National Convention of the A. A. A.

July 9 to 22—Glidden Tour, Buffalo, Pittsburg, Philadelphia, Albany, Boston, Poland Springs, Saratoga.

July 14 to 18 1908 Wisconsin Trophy Tour, Milwaukee (Wis.) A. C.

August 14—Algonquin, Ill., Hill Climb of the Chicago Motor Club.

Commercial Applications.

Motor Vehicles for Traveling Salesmen.

By D. R. H.

There are undoubtedly a number of advantages in the use of motor vehicles by salesmen in covering their territory, the most important of these being a great saving in time over railroad or horse buggy travel. Whether the vehicle employed is a motor car, motor buggy or motorcycle, the salesman who has some knowledge of his vehicle, and uses cars in its operation, is enabled not only to transact his business, but to bring his house into notice by reason of the up to date method of transportation and to cover a greater territory than his competitors not so equipped.

The runabout type of motor car is the most extensively used, its cost of upkeep being relatively low and its fuel bills equally so. A four or five seated car would give no better service, except, perhaps, to a liquor salesman for entertaining purposes, and would cost considerably more to maintain. The high power "runabout" is entirely out of the question. The salesman should be able at least to better the time taken by train, including waits, etc., but not to make train speeds. The seat alongside the driver is a potent factor in making sales, especially in territory removed from the larger cities. Samples would generally be carried in a box specially built behind, but this is not even necessary in the case of cloth, millinery and like goods salesmen, who can utilize the body as provided by the factory. In such cases the vehicle resembles a private rig, unless it carries the firm's advertisement upon its panels.

What has been said of the regular runabout applies also to the motor buggy. The seating capacity is the same, and the vehicle therefore, also offers opportunity for giving rides to customers, but owing to the motor and gearing being under the seats in most cases, a box for goods must be added, showing instantly the purpose of the vehicle. This box can be used for advertising purposes, and it is found that houses employing motor buggies generally desire this feature. The buggy, by reason of its higher wheels and narrow tires, can travel over roads on which the car would experience some difficulty. In this service the trips are generally not over very long distances, the territory covered not exceeding 250 miles in radius. The average salesman does not cover this much territory; in fact, he only occasionally gets more than 200 miles from headquarters, though the distance traveled usually exceeds this.

The motorcycle is particularly adapted to the use of advertising and other salesmen who do not have a great bulk of samples to carry. The amount of territory that can be covered with it in a day is limited only by the time during which it is possible to interview customers, or by the state of the roads in wet weather. The motorcycle can travel upon paths as well as roads and can attain as high an average speed as a car. At present it is generally used for trips of not more than a week's duration, and in the majority of cases for purely suburban work, say of less than 50 miles from headquarters.

EXPENSE.

As a sample of the relative cost of motor vehicle and ordinary service a trial run over a salesman's territory was recently made, and the results were noted. The car used was a 10 horse power, two cylinder, opposed runabout with sliding gear and shaft drive, having a wheel base of 80 inches. The boot contained the usual kit of tools and a sample case weighing 60 pounds. This territory is covered semi-monthly by the same man, by rail, to call on druggists. The towns covered are Trenton, Princeton, Monmouth, New Brunswick, Somerville, Plainfield, Rahway, Perth Amboy, Elizabeth, Newark, the Oranges, Morristown, Passaic, Paterson, Hackensack and Hoboken, N. J. Following are some data regarding the trip by automobile:

Mileage by odometer, 304.8.
Fuel consumed, 20½ gallons.
Time consumed, 3 days 8 hours.
Actual running time, 22½ hours.

It will thus be seen that the average mileage per gallon was 14.8, a good average for such a car. The average running time per day was a little over seven hours, which included both running between towns, making calls in the towns and a 10 mile "treat" at one place. The regular time for this route is four days, and sometimes more, owing to inconvenient train schedules.

The itemized expenses by the two methods of travel were:

Gasoline	$5.00
Storage	3.00
Ferries, miscellaneous	1.20
Repairs to tire	.75
	$9.95

Railroad fares	$7.38
Street car fares	.75
Hotel bus fares	2.25
	$10.38

The trip by railroad is thus only 43 cents more in this instance, but the item "repairs to tire," which were necessitated by a blowout, is something which need not occur on every trip. With filled tires it would not have occurred. Furthermore, the salesman traveling by railroad is one day longer on the road than when traveling by automobile. This means additional hotel expenses, which would turn the comparison still more in favor of the automobile. The salesman's time must, of course, also be figured. Thus the advantage appears to be entirely on the side of the motor vehicle. As the hotel bill, tips, etc., are the same in both cases, they are not included in the above.

No reliable data upon the use of the motor buggy are obtainable, but it is to be presumed that it is fully as economical as the regular car. The motorcycle is the most economical vehicle of the three. A motorcycle used in advertising selling covered a trip of 35 miles in and around New York city at a cost of 40 cents in five hours, the actual running time being estimated at three hours. A similar route was covered by trolley cars at a cost of 35 cents in six and one-half hours. The man traveling by trolley was at times obliged to wait at transfer points, and was once delayed twenty minutes by an open drawbridge. The motorcyclist was obliged to ride slowly in traffic, being sometimes forced to dismount and walk the machine. In this case the cost of traveling by motor is a trifle higher, but the time saved is considerable.

It is not intended here to go into the comparative cost of upkeep of motor vehicles per annum. Cars of the same type will not necessarily perform similarly under different conditions. The personal element of the driver enters as a factor, and so do the facilities at headquarters. It would be poor economy to place fine cars on the road and refuse to provide adequate facilities for keeping them in good order. It would be worse if a salesman were assigned to a schedule that necessitated his traveling between points at his best speed. The folly of this would soon show in the repair bills. The salesman need only have a good driving training, including training in making minor repairs.

EQUIPMENT.

Opinions vary as to the kind of top, etc., for use on a car selected for this and like purposes, some preferring a victoria or buggy top with wind shield and side curtains, while others prefer the buggy top with storm apron and side curtains, the apron coming to the level of the eyes and being set well back in the top. This latter arrangement is the cheaper one, and no injury can result to the operator from broken glass, although a wired glass wind screen would easily prevent such an occurrence. The motor buggy will probably not admit of the placing of a wind shield, so that the buggy apron or a like protection will be used. If a box or boot is fitted it should be made waterproof; this can be readily accomplished by lining the boot with some waterproofed material, if it is not already so fitted. The motorcyclist needs no other equipment than that which is provided by the manufacturer. Protection in his case must be secured by dressing appropriately, and not by the use of tops, etc.

The car salesman, in addition to his samples, carries his suit case or bag the same as in ordinary traveling. The motorcyclist salesman has to pack and pack closely, his outfit going into a kit bag or a roll fastened to the luggage rack or to the handlebars, as the case may be. This bag can hold the toilet articles, spare shirts and collars, etc. A motorcyclist who travels long distances, in the capacity of general representative, for example, would have his bag sent by rail to his destination, whereas the car salesman can carry a large supply in a "log cabin" or Gladstone bag. A cake of soap or a box of hand cleanser should be carried, as well as a towel, for use on the road.

DRESS.

A great point urged against the use of motor vehicles is that one is apt to become greasy or dirty through their use. This same thing may be said with some truth of all occupations, some individuals being more cleanly at their work than others. With a little care and the habit of washing after making adjustments or performing other necessarily dirty work, no driver need fear dirty hands. Gasoline may be drawn from the line at some point and used to cut any grease, etc. For the protection of the clothing a "duster" reaching half way below the knees should be worn in summer and an ulster with a deep collar in winter. Leggings of the putter type are also most comfortable in cold weather. High russet shoes with fairly thick soles should be worn, as russet leather makes a better appearance at all times than black leather. Gauntlet gloves and a light fabric or cloth cap in summer, and fur gloves and cap in winter complete the outfit. For motorcycle service a similar outfit should be worn, except that the duster should only reach the knees. Knickerbockers of good warm material replace the ordinary trousers, and a waterproof coat will be found of great service. A handy garment is a "duster" of cravenette or similar material, which has also the functions of a rain coat. Negligée or soft shirts are best for wear; they will pack easily in the kit bag and are more comfortable for riding than a stiff shirt.

BENEFICIAL EFFECTS.

Apart from the saving of time by the use of the motor vehicle, the health of the salesman is greatly benefited. He fills his lungs with fresh air and is not obliged to ride in poorly ventilated trains and crowded street cars. Instead of living by the time table he creates a schedule of his own. Where formerly it was necessary to get off at a station some distance away and walk to the destination when no vehicle was obtainable, the salesman now proceeds directly thereto at increased speed and without recourse to outside help. His personal baggage and samples are with him in the car; tips for porters and the trouble incidental to checking and guarding baggage on the train are eliminated. In a word, he is independent, and will be enabled to conduct business in a better manner by reason of being in better health.

The Motor Car as an Emergency Wagon in Public Service Work.

A motor emergency wagon has been placed in service by the Los Angeles Gas and Electric Company, of Los Angeles, Cal., and during the short time it has been in operation the results have been eminently satisfying. The machine, besides hurrying its crew to the scene of any leak in the gas pipes or breaks in the electric wiring of the company, hurries to every fire within the business district, and the promptness with which it arrives on the scene of the conflagration is of great value in shutting off the gas supply in the burning building and in locating live wires.

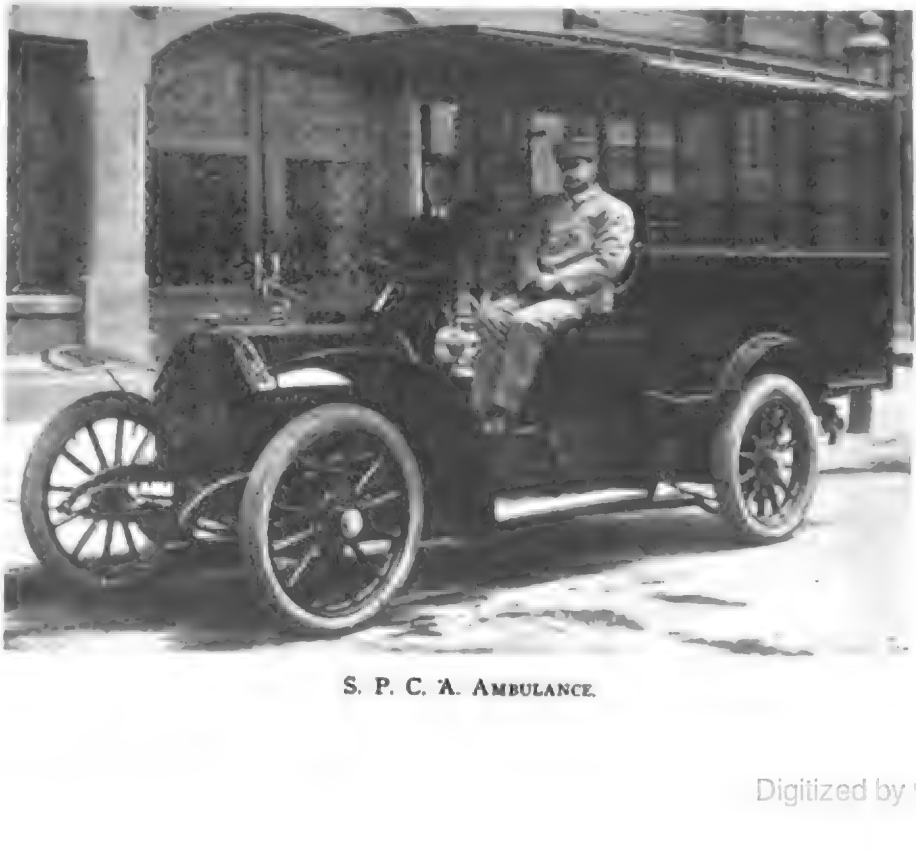
The emergency automobile is a 30 horse power touring car, with the tonneau removed and replaced by an oblong compartment, carrying every tool necessary for gas and electric work, besides an outfit of fire fighting apparatus. The front of the car resembles the seat of the ordinary touring automobile, and affords seats for the driver and one member of the crew of four, while the two others take their places on the footboards.

Eight men have been drilled for the use of the car, four for day and four for night duty. The second a trouble call comes in over the telephone the machine is cranked and ready to leave by the time the necessary details are received. The machine has a 10 inch fire gong, and has the right of way over all classes of traffic, exactly like a fire engine. The speed of the machine enables its crew to arrive on the scene of trouble in the shortest possible time, and the leak in the pipe or fixtures is repaired before serious complications arise. In the same manner trouble of the electric service is removed. If the break in the gas pipes is on the street, and requires tearing up of the pavement, additional help is summoned by the foreman of the emergency crew.

A novel part of the emergency car's equipment is a metal tank containing compressed oxygen for cases of asphyxiation. By means of this tank attempts at resuscitation can be made immediately upon the arrival of the car without waiting for a physician. A complete set of bandages and medicines is carried, and the members of the crew are instructed in the best methods of rendering first aid to the injured. Every possible tool for almost any kind of an emergency is carried on the car, while a fire extinguisher enables the crew to put out small blazes without calling upon the fire department. The operation of the emergency car promises to save money for the company, and the consumers are well pleased with the prompt removal of any trouble, the promptness being made possible by the use of the speedy machine with its wide radius of action. Conditions for the operation of the machine are specially favorable in Los Angeles on account of the mild climate and the absence of snow in winter, though the machine is called upon frequently to climb steep hills.

The S. P. C. A. Motor Ambulance.

The American Society for the Prevention of Cruelty to Animals, of New York city, have recently acquired a motor ambulance for dog catching service, etc., an illustration of which is here given. The specially built body, with latticed sides and double deck within, is mounted upon a Westinghouse chassis, fitted with a four cylinder, 35 horse power motor, four speed and reverse gear change and final drive by side chains. The roof of the ambulance projects forward to the dash, forming a top for the driver's seat which will comfortably accommodate the driver and two attendants. Side curtains are provided for protecting the animals in case of rain, etc. The "cage" is accessible through swinging doors at the back, the upper deck having a set of doors at the front in addition. The chassis is the gift of Mrs. Russell Sage to the society, and the body the gift of Lorillard Spencer, Jr. The Daimler ambulance, which the society placed in service some years ago, is now out of commission, but a Mitchell car is to be put on shortly.



S. P. C. A. AMBULANCE.

A Motor Freight and Passenger Service for Ashland, Mo.

The automobile bus and freight truck have just invaded the heart of the Missouri agricultural district and remodeled traditions of about forty years' standing in the little inland town of Ashland. Since its founding in the sixties Ashland has never had a railroad, a satisfactory mail service nor a convenient mode of travel to and from the surrounding towns and villages. But Ashland has for many years possessed one inalienable and indisputable advantage —good roads. Ashland and its neighbors, however, failed to appreciate the partiality of nature until a few months ago, when Captain Joseph Frazier, commandant of the college cadet corps of the Missouri State University, and his brother, W. L. Frazier, both of Columbia, Mo., the State's college town and a neighbor of Ashland, looked into the subject of a motor bus line between Ashland and Columbia, and Ashland and Hartsburg, which is the nearest railway station.

The initial trip of the passenger car has just been made. The mayors of the three places concerned, newspaper men and a few others were the passengers in the first car over the road. Between Hartsburg, at the western terminus of the line, Ashland in the centre, and Columbia on the east, a white gravel and macadam road stretches along at easy grades. The existence of the road is almost entirely due to the abundance of gravel in the vicinity. Over this road the car made better time than had been anticipated, and it is hoped that possibly three trips daily can be made with the single car. Whether others will be purchased in number sufficient to make hourly trips from the termini will depend entirely upon the volume of business. A freight carrying motor car, however, has already been ordered, and will begin its work as soon as delivered.

These two cars will perform the additional service of mail carriers for Ashland. For years the mail was taken from Columbia, 16 miles away, by wagon. Lately however, it has been delivered from Hartsburg, 2 miles nearer, by similar means. Being an incorporated town, the rural routes do not touch Ashland, and this has been as great a worry to the village as any, even more so in view of the fact that Hartsburg reads more newspapers and periodicals in proportion to its population than any town or city in Missouri.

The promoters of the enterprise, who will manage the line personally, are very confident of success. The capacity of the big passenger bus and the freighter will be sufficient to make the trips pay even at the reasonable fare between the towns of 25 cents, and a proportionately low rate for freight.

Commercial Notes.

According to a cable from London, the manager of the Knickerbocker Hotel, of New York, has arrived there on his way to Paris, where he expects to purchase fifty motor taxicabs, to be operated from a stand in front of the hotel.

The Minneapolis, Minn., fire department committee will purchase an automobile at a cost of $1,750.

It is reported that a farmer in East Hartford, Conn., recently harvested his hay with an electric truck.

The first taxicab in Los Angeles, Cal., made its appearance in the streets on June 16. It is a Thomas cab and is operated by the Western Motor Car Company.

The Milwaukee, Wis., Board of Public Works has purchased a runabout for the use of the electricians of the fire department in keeping patrol boxes in order.

Arthur F. Rockwell, of Bristol, Conn., who recently investigated the taxicab services in a number of European capitals, intends to introduce a service in Washington, D. C., next fall.

M. S. Fairbanks and R. Shermin will start an automobile line between Placerville and Lake Tahoe, Cal., about July 1. Two machines will be used, one leaving the lake and the other leaving Placerville daily.

A Salina, Kan., promoter has been conferring with the mayor and city council of Beatrice, Neb., with regard to the establishment of a motor service between that town and surrounding points in Gage County.

B. S. Bennett, proprietor of the Fresno Hot Springs, Cal., has established an automobile stage service between the springs and Coalinga, the stage leaving Coalinga every morning at 5 o'clock and returning there about 10 o'clock.

Two automobiles have been placed in service on the Escondido stage line from San Diego to Escondido, Cal., replacing the horse stages formerly used. The new vehicles carry six and seven passengers respectively, and a daily schedule is maintained.

The Indianapolis Water Company, a pioneer user of automobiles in that city, recently purchased two new runabouts for the use of its officials and inspectors. The company now owns four runabouts and two tourings cars which are used exclusively, the horse drawn equipment having been discarded some time ago.

The automobile stage line between Mojave, Mt. Whitney and Keller, Cal., has been opened for the season with four touring cars. The service is conducted by A. T. Hay and J. Henze, of Los Angeles, and E. F. Carter, of Mojave. The distance from Mojave to Lone Pine is 130 miles and is covered in about ten hours. Each of the cars carries six passengers.

Dr. Edgar F. Kiser, superintendent of the Indianapolis City Dispensary, has asked the Board of Health to purchase an automobile ambulance for the use of that institution. Dr. Kiser until now has been opposed to an automobile ambulance, but after seeing the work accomplished by the police automobiles has decided to ask for one. It will probably not be purchased before the first of next year, as there is no appropriation available.

The Burmah Transfer Company has been organized at Moulmein, Burmah, with a capital of 150,000 rupees to conduct a motor passenger and freight service.

It is proposed to establish a large motor car service in Mongolia to improve the communication facilities between the principal towns of the country, and it is suggested that a contract for carrying the mails throughout Mongolia should be given the proposed company.

David Gilpin, a rural mail carrier running out of Indianapolis, is making a test with an automobile for the benefit of the Indianapolis post office. He covered his route the first day in four hours and thirty minutes, as compared with the eight hours it usually takes to go over the 25 miles. He is the first carrier running out of Indianapolis to make use of an automobile.

Importing Firms Consolidate.

The consolidation movement has struck the importing branch of the trade. The Fiat Automobile Company, of New York city, last week absorbed the Palais de L'Automobile, importers of Delauney-Belleville cars and sub-agents for Panhard and Renault machines. The Fiat Company had already combined with the Auto Import Company, agents for Rochet-Schneider cars, and will now handle the following foreign makes in this country: Fiat, Rochet-Schneider and Delauney-Belleville exclusively, and Renault and Panhard as sub-agents. H. Neubauer, of the Palais de L'Automobile, has been elected second vice president of the Fiat Automobile Company, while E. Rand Hollender remains first vice president and general manager. The cause of the consolidation is the keen competition which has made itself felt in the importing branch of the trade recently.

"Jewel" Cars to Be Manufactured in Canada.

The Boyce Carriage Company, Winnipeg, Manitoba, have secured the Canadian rights for the Jewel automobile. The motor and chassis will be manufactured in the Massillon, Ohio, works, but will be assembled in Winnipeg, where the bodies, wheels, tires, etc., will also be fitted. The stanhope type of car will sell in Canada for $750 and the delivery wagon for $850. The Boyce Company owns a five story building, 120x75 feet, on Ross avenue, showrooms on Elgin avenue, and also a warehouse. The car will be known in Canada as the Boyce Jewel.

The automobile shops at Turin known as Fabbrica - Italiana - Automobili - Torino ("Fiat") are at present working about 800 men, reports Special Agent Captain Godfrey L. Carden. This is one of the most progressive shops in Italy. The head of the establishment is General Director Cav. Giovanni Agnelli. Inspection of the works disclosed a superb installation of up to date American machine tools. There are more than 500 machine tools.

LEGISLATIVE and LEGAL

Evidence of Speed.

By Xenophon P. Huddy, LL.B.

There are at present in vogue three methods of estimating the speed of automobiles, namely, by the use of a stop watch over a measured course, by the speedometer, and, lastly, by the opinion of eye-witnesses. The reliability of the evidence produced by the foregoing methods is in the order given. Magistrates and courts have, as a rule, arrived at the position of assuming that stop watch testimony is correct, unless circumstances prove it to be unworthy of credence in any particular case.

The use of a speedometer upon a motor cycle or automobile has probably been resorted to more this season than ever before. Only a few weeks ago a motor vehicle filled with plain clothes men was sent out by the Police Department of the city of New York, and almost 100 arrests were made. The defendants did not suspect that the car coming alongside, and apparently inviting a brush, was merely a decoy and out for the purpose of roping in all who violated the speed limits. The method employed was to compare the speed of the Police Department's machine with the machine of the arrested driver, at the same time making a note of the speed as registered on the former vehicle. This method of estimating the speed of automobiles is undoubtedly about as correct as any. Yet upon close scrutiny it will be seen that under some circumstances it may be little more reliable than opinion evidence.

Take, for example, a machine equipped with a speedometer and following the car ahead for the purpose of estimating its speed. We will say that the pursuing car is several feet behind; the speedometer registers 20 miles an hour; the speed limit is 15 miles. In order for the time to be correctly estimated the rear car must keep a certain distance behind the car ahead for a certain length of time. This distance is merely a matter of judgment and of opinion, almost as much so as the estimation of the speed of an automobile by an observer. A police officer will swear that he kept about 25 feet back of the automobile ahead, when the chances are that it was nearly 300 feet, and it is well nigh impossible to swear that the car was traveling at the same distance behind for any length of time. It is merely opinion evidence on the part of an officer.

In connection with the evaluation of automobile speed by the stop watch method, there is probably no element so important as an absolutely correct measurement of distance. Measurement with an ordinary tape measure is not sufficient for accurate evidence, especially where seconds count and are vital to the guilt or innocence of the defendant. Testimony that the distance was that of a block or two blocks is absolutely worthless. Measurement of the distance with a surveyor's steel tape measure is more accurate, yet a measurement by a layman is apt to be unreliable.

In the State of New York the testimony of police officials who time automobiles over measured courses and arrest drivers for violating the law over the courses measured by the officers themselves would seem to be inadmissible, for the reason that there is a provision in the general statutes of the State which prohibits the giving of evidence by any *surveyor* concerning the measurement of lands or distances, unless it is shown by proper legal authentication that the measure or instrument used for measuring the course complied with the State standards of measurement. This provision absolutely bars the testimony of officers who have measured speed traps on the public highways. It may be contended that a police officer is not a *surveyor* within the meaning of this law, but he is a surveyor if he measures, and the fact that he has measured a police trap course constitutes the policeman a surveyor at the time and for the purpose.

The term surveyor as used in this statute does not mean one who engages in surveying as a business for a lifetime. The Legislature used the word in its ordinary meaning, which is, according to Webster's International Dictionary, page 1453: "One who views and examines for the purpose of measuring the quantity of anything, as a surveyor of highways." "One who surveys or measures land." See also Fulton vs. Town of Dover, 6 At. Rep., 638; 6 Del. Ch. 1.

In order that a police officer may give evidence to the effect that an automobile traveled over a certain distance at a certain rate of speed, he himself must have measured the course. It will not do for him to give evidence based upon the fact that some other officer measured the course and told him the distance in feet or yards. This would constitute hearsay evidence, which is absolutely prohibited.

Legal Notes.

The Oklahoma police force has started a campaign against speeding motorists and automobiles that are being run without numbers.

The White Company, of New York, last week paid under protest a fine of $85 and $5.60 costs for an offense committed by one of its drivers at Montclair, N. J., on May 25, who after being arrested for speeding escaped while on his way to the police station.

A peculiar plea has been made by the attorney for Forrest G. Willcox, of the A. C. of Rhode Island, who is charged with having driven an automobile "faster than a common travelling pace," under Chapter 1157 of the Public Laws, passed April 13, 1904. The contention is made that this chapter was repealed by Chapter 1592, passed May 26, 1908, and that no law now exists under which the charge made will hold.

City Controller George T. Breunig, of Indianapolis, has placed warrants in the hands of the police of that city calling for the arrest of 234 automobile owners. The warrants are for the arrest of those who failed to take out a city license in 1907 and are dated November 30 of last year. Many Indianapolis owners have paid their 1908 fees, but have refused to pay the 1907 fees which were due while the license ordinance was being tested in the courts.

The boards of review in various Indiana counties are obtaining lists of automobile owners in their respective counties for the purpose of placing them on the tax duplicates. In many counties the assessors have made a uniform valuation of $50 for automobiles more than two years old, while comparatively new ones have been listed at from $100 to $150. The boards of review propose to find the original cost of the cars and make their valuations accordingly.

A defect in the new Ohio law has been discovered by a dealer in second hand cars. The law provides that a dealer must take out one license for each of the makes of cars handled by him. This dealer states that as many as one hundred different makes of cars pass through his storeroom in the course of a year, and he has addressed the Attorney General asking for advice as to what course to pursue to comply with the law. The Attorney General handed the letter over to the Secretary of State without an answer.

The Agnew-Hart anti-gambling laws recently passed in New York State are being enforced in connection with other contests besides horse races. On the occasion of the recent boat races on the Hudson River the mayor of Poughkeepsie, N. Y., issued instructions to the city police to prohibit the selling of pools and bookmaking. If the Vanderbilt cup race should be held on Long Island next fall it will therefore not be accompanied by public betting, as were the last several automobile races held in New York State.

A chauffeur in the employ of King Leopold of Belgium on June 19 was fined $110 for having knocked down and injured a bicyclist. King Leopold was cited to appear in the case, but he pleaded diplomatic immunity. The summons for him was subsequently withdrawn.

The petroleum reservoirs of the district of Constanza, Roumania, during 1907 took care of 460,900 tons of petroleum. The quantity exported by the tank steamships represented a value of $65,000. Important improvements are in progress at the petroleum station, and it is estimated that within a short time the port of Constanza will be able to export 1,000,000 tons of petroleum per annum.

MINOR MENTION

The J. L. Clark Carriage Company, Oshkosh, Wis., have started the manufacture of motor buggies.

The Rose Manufacturing Company, of Philadelphia, have brought out an "air cooled" acetylene generator for automobile lighting.

The Bonner Manufacturing Company, who are building automobiles at Christian, Ill., are using Rutenber motors and carburetors.

The Earl Motor Car Company, of Kenosha, Wis., will in future use the Hall engine, made in Waukegan, Ill., for its cars.

The Riter apartment house, which is now being erected at Salt Lake, Utah, will be provided with a garage and a roof garden.

The Speedwell Motor Car Company is erecting a shipping warehouse, 200x30 feet, on a spur of the Big Four Railroad at Dayton, Ohio.

The Pacific Motor and Automobile Company are seeking a location at Long Beach, Cal. They intend to manufacture a car called the Coyote Special.

The Milwaukee Board of Public Works, Milwaukee, Wis., has been experimenting with "Westrumite" as a dust layer. The experiment is said to have been successful.

Among the applications for chauffeurs' licenses made to the Secretary of State of California a considerable number are from Japanese residing in San Francisco.

Two Indiana inventors are reported to be experimenting with a motor buggy for country use at the shop of an Oshkosh, Wis., concern. If the experiments prove satisfactory a company will be organized in Oshkosh.

At the National and State encampment at Pine Camp, near Watertown, N. Y., two 30 horse power Studebaker cars are being put to severe tests in connection with military service. One is reserved for the exclusive use of Major General F. D. Grant and the other is held for the use of his staff.

Umapine, a Walla Walla Indian, belonging to the Umatilla tribe, is said to be the first member of his race to buy an automobile. His purchase was a $500 motor buggy, which is to be used on a tract of wheat land owned by him in the Indian Reservation at Pendleton, Ore.

President Roosevelt has named the following delegates to the International Roads Congress which is to be held in Paris October 11-18: Logan Waller Page, director of the office of public roads of the United States Department of Agriculture, chairman of the commission; Col. Charles S. Bromwell, of the United States corps of engineers, and Clifford Richardson, of New York, an authority on bituminous road building materials.

The name of the E. R. Thomas-Detroit Company has been changed to the Chalmers-Detroit Company in order to avoid confusion between the two Thomas companies which are operating on separate lines. E. R. Thomas, of Buffalo, still retains a stock interest in the Detroit company.

The Willex Manufacturing Company, recently organized at Rome, N. Y., has begun operations in the former plant of the Maxwell & Fitch Company, where it will manufacture timers and distributors after designs by D. B. Willex. The company will also operate a garage for thirty cars.

The protest made by William F. Smith, manager of the Philadelphia Rambler branch, that the 30 horse power Acme car which made best time in the $1,001-2,000 class in the Wilkes-Barre hill climb, was not a stock car, has been allowed, and the Rambler, which finished second, has been declared the winner.

The Chamber of Commerce of Napa, Cal., at a meeting on June 16 passed a resolution asking a number of other local associations to join in a movement to induce the Southern Pacific Company to carry automobiles and other vehicles on their ferryboats between Vallejo Junction and South Vallejo.

Efforts will be made to reorganize the Kansas City Motor Car Company, which became bankrupt some time ago, with the object of manufacturing a motor buggy. A. R. Walton, formerly with the Dorris Motor Car Company, of St. Louis, is the designer of this car, which is fitted with a four cylinder, 3⅝x4¼ inch motor.

Officials of Plainfield, a small town near Indianapolis, Ind., have all of the streets in the place oiled, this being the first town in Indiana to do so. The oil was placed on the streets at a cost of about $900, which was borne by business men and other citizens. However, the experiment has not proved entirely satisfactory, as housewives are complaining of ruined carpets.

We are informed that the Premier car which is being put through a 10,000 mile test by its manufacturers has completed 2,500 miles. On June 21 it made the trip from Chicago to South Bend by way of Michigan City, 114 miles, and the following day from South Bend to Indianapolis, by way of Rochester, Peru and Kokomo, 154 miles. The test is to be completed September 8.

The Hydro Carbon Engine Automatic Starter Company, Chicago, Ill., has brought out a starter for automobile gasoline engines. The device consists of a set of cylinders equal in number to the motor cylinders and has its own mixing valve or carburetor, which is supplied from the main fuel tank. The company is located at 184 La Salle street, and its officers are J. O. Hunt, president and general manager; Odillon Brisbois (the inventor of the device), vice president, and Julius N. Heldman, secretary and treasurer.

The Northern California branch of the Diamond Rubber Company, which has had its headquarters in Oakland since the great San Francisco fire, is now occupying new quarters on Second and Mission streets, San Francisco.

The Atwater Kent Manufacturing Works call attention to the fact that with their spark generator it is unnecessary to carry a reserve battery. When misfiring is noticed, as the batteries become weak, the user may increase the spark heat temporarily by screwing down the contact screw. This has the effect of prolonging contact and permitting the coil to "build up" to a higher degree of magnetism than with the very brief contact ordinarily used.

Club Notes.

W. H. Reed is organizing an automobile club in Corpus Christi, Tex.

The Milwaukee Motor Cycle Club will hold a 400 mile run during August.

The Marietta A. C. has joined the Ohio State A. A. and the American Automobile Association.

An automobile club has been formed in Anaconda, Mont., with the following officers: D. J. McDonald, president; A. C. MacCallum, vice president; Stockton Veazey, secretary; E. J. Bowman, treasurer.

The Motor League of Rhode Island is the official title of the organization formed at a recent meeting in the Alfredian Hall, Providence, R. I. A committee of five is to be appointed for the incorporation of the league.

The Salt Lake A. C. has been organized in Salt Lake City, Utah, with the following officers: President, Orson H. Hewlett; vice president, L. L. Terry; secretary, J. E. Jennings; treasurer, C. R. Pearsall. About thirty motorists were present at the organizing meeting, at which it was decided to incorporate the club and to place the par value of stock at $50.

The Chicago Motor Club has selected September 1 to 4 as tentative dates for its postponed four day endurance contest. It now develops that only seven entries were received for the contest in June. The club is also considering the organization of a removable rim "roadability" contest, in which the cars will be driven 100 miles or so and required to change rims at four or five designated points along the route.

The Chicago A. C., which already has an agreement with the A. C. A. regarding an interchange of membership privileges, was recently approached by Winthrop E. Scarritt on behalf of the A. C. A. with a project for joining the A. C. A., to seek national control of automobile racing, according to the Chicago version, or "to safeguard the interests of automobiling," according to the New York (A. C. A.) version. The proposal was rejected. Secretary Gorman, of the Chicago A. C., said: "We declined the invitation of the A. C. A. because we felt the interests of motoring would be best served by remaining loyal to the A. A. A."

The Long Island A. C. announces that women owners of cars may become members of the club by complying with Article IV, Sections 2 and 4, of the club constitution, but such membership shall carry with it only the privileges of the garage operated by the club, the country clubhouse and the right to display the club pennant upon their cars.

The Pennsylvania Motor Federation is arranging a three section tour to the Buffalo Good Roads Convention, one section starting from western Pennsylvania, another from the central portion of the State and the third from the eastern part. Secretary Paul C. Wolff will lead the western division; Senator Fred A. Godcharles, of Milton, the central section, and President Cooper, of the Federation, the eastern division. The start of the different sections will be so timed that they will arrive at Buffalo simultaneously, and they will enter the city in a body.

The Detroit Meeting of the S. A. E.

The third annual summer meeting of the Society of Automobile Engineers was held in Detroit June 25, 26, 27. Society headquarters were at the Hotel Tuller. On Thursday the Chalmers-Detroit and Ford plants were visited. In the evening papers on "Storage Batteries," by Bruce Ford; "Autogenous Welding," by E. S. Foljambe, and "Magneto Ignition," by Otto Heins, were read and discussed. Mr. Foljambe's paper was followed with a demonstration of the processes by an operator from the American Ferrofix Brazing Company, and excited a great deal of interest.

Friday morning the members attended the meeting of the A. S. M. E., and listened to the reading of the paper on "Clutches," by Henry Souther. Mr. Souther not being present, his paper was read by Secretary Hayward. Following the discussion of the paper, the members of the S. A. E. went for a tour of inspection of the Cadillac factory. Immediately on their return from this trip the members, with their wives and lady friends, accompanied the A. S. M. E. on a sail around Belle Isle and trip down the river to Bois Blanc Park. After a very enjoyable supper at the Park Casino the party returned to the city, reaching there at about 10 p. m.

Saturday the society were the guests of the Detroit Steel Products Company. They were taken for an inspection of the new Steel Products factories and then spent some time in looking through the Packard plant, where they were much interested in the methods employed in testing materials. Following their visit to the Packard factory they were taken for an auto ride through Belle Isle Park, ending at the Detroit Boat Club, where luncheon was served. Immediately after the lunch a short business meeting was held and a vote of thanks was extended to those companies and individuals who had been so generous in their hospitality. It was voted to hold the next meeting in Cleveland some time in September or October, the exact date to be fixed by the committee on meetings. A resolution requesting a report at the Cleveland meeting of the committee on foreign membership was adopted. The members then adjourned to the directors' room of the club, and the remaining papers on "The Unit System of Power Transmission," by Frank Beemer, and "The Increased Efficiency of Single Motor Drive," by A. L. Dixon, were taken up. The former was read in abstract by the secretary, and briefly discussed by Messrs. Alden, Coffin, Wall and Foljambe. Written discussions upon the points involved were promised by Messrs. Alden and Wall. Owing to lack of time the last mentioned paper was not read, and written discussion was requested.

The meeting was then adjourned about 4 p. m., so that members could take the afternoon trains and boats for their homes.

R. H. Smith Company Assigns.

The R. H. Smith Manufacturing Company, Springfield, Mass., on June 26 made an assignment to Robert A. Knight and Charles H. Beckwith. The senior member of the firm, R. H. Smith, recently committed suicide.

The liabilities of the company are estimated at $50,000. The cause to which the failure is ascribed is that the "motometer" which was added to the company's products about three years ago was produced on a larger scale than the market for it warranted, 3,000 of the instruments having been carried in stock. The instrument sold at $35, and the investment in this stock is much more than the total indebtedness of the firm. The trustees believe that if the company's assets can be disposed of at a fair value they will more than equal the liabilities. The company has been endeavoring to interest the new enterprise committee of the Springfield Board of Trade in a proposal to divide the company's business and place the manufacture of motometers on a separate basis. The Board of Trade committee made a favorable report on the business, and expressed the belief that it could be carried on profitably. It is not unlikely that this feature of the business will be disposed of. The manufacture of stamps has been carried on by the company for thirty years and is said to have always been profitable.

Business Troubles.

William H. Brown has been appointed receiver for the Hygrade Motor Car Company, automobile dealers at 9 Hill street, Newark, N. J. The insolvency proceedings were instituted by counsel for Harry Hardman, a creditor.

Schedules in bankruptcy of J. B. Brewster & Co., carriage manufacturers, 737 Seventh avenue and 213 East Forty-fourth street, New York, show liabilities of $46,011 and nominal assets of $34,494, consisting of stock, $16,195; machinery, etc., $2,500; office furniture, $150; books, $100; delivery horse and wagon, $50; cash in bank, $890, and accounts, $14,600. Among the creditors are the Fifth National Bank, $11,500; Michigan Buggy Company, $10,000; Frank Moss, $5,525, legal services; Brewster & Co., $4,950, on a judgment May 21 last, and Mary Duncan, $3,500.

A reader who intends to assemble a high grade touring car the coming winter desires catalogues of the following parts: Selective type change gear with differential for chain drive or separate differentials for chain drive, all on ball bearings; rear stationary axles with ball bearing hubs and brake drums; front axles with ball bearing hubs; steering gears mounted on ball bearings; frame to order; six cylinder motors mounted on ball bearings, with Bosch high tension magneto and spark plugs; clutches. Interested manufacturers are requested to address catalogues to J. H., care of THE HORSELESS AGE, and they will be forwarded.

Trade Personals.

O. W. Kern has taken charge of the repair department of the Glenwood garage, Riverside, Cal.

F. E. Shafer has been appointed sales manager of the Motor Car Agencies Company, San Francisco, agent for the Moon and Wayne cars.

William H. Noblitt, formerly of the firm of Noblitt & Fassett, Philadelphia, has associated himself with the Keystone Motor Car Company of the same city.

W. Wayne Davis has been appointed manager of the Matheson Motor Car Co.'s Philedalphia branch, which has just been opened at Broad and Green streets.

F. W. Lawrence, formerly connected with the Federal Manufacturing Company, has recently joined the sales organization of the Standard Roller Bearing Company of Philadelphia.

Louis P. Mooers, who recently resigned his position with the Moon Motor Car Company, is reported to be working in New York city on a new car of moderate power for the 1909 market.

Charles R. Greuter, the designer of the Matheson car, has resigned "on account of ill health." It is stated that he intends to take treatment in a New York hospital for an injury to his leg, sustained several months ago.

Charles M. Brown, who has been at the head of the Winton branch in San Francisco for some time, has been appointed manager of the New York branch. He will be succeeded by Harry Owesney, who has been his assistant.

It is reported that Lewis Strang, who was to drive the Thomas car in the French Grand Prix Race, has had a falling out with Harry S. Houpt, the manager of the Thomas representation in the race, and will not drive the car. His place will be taken by Montague Roberts.

A. L. Riker, engineer of the Locomobile Company, has resigned from the racing board of the A. A. A. and the contest committee of the A. C. A. Conditions in the world of automobile sports in this country have become such that men in the trade may find it very unpleasant to serve on national contest committees.

Garage Notes.

E. M. Lubeck, Kalamazoo, Mich., has established a new garage.

Bronson & Kaley, McPherson, Kan., have opened a garage and repair shop.

Rice & Sheets have opened a garage and machine shop in Tracy, Cal.

The A. P. Heil Auto Livery Co., Milwaukee, Wis., has opened a garage.

The West-Barnstable Motor Co., Sandwich, Mass., has gone out of business.

E. F. Tallman has opened a tire repair shop at 1212 South Main street, Los Angeles, Cal.

C. F. Sheppard has established a garage and a sales agency for Maxwell cars in St. John, Kan.

E. L. Kaplan has opened a garage and machine shop on East Clark street, Albert Lea, Minn.

Charley C. Cowles, Red Bluff, Cal., has purchased the garage business of Bonnard & Knauss.

Crawford Nelms has established an automobile repair shop in Jacksonville, Fla., on Virginia street.

W. J. Brayton, Spokane, Wash., will shortly open a garage in that city. He has the agency for the Oldsmobile.

The Charleston Motor Company, Charleston, S. C., are endeavoring to establish a garage and repair shop in Augusta, Ga.

Nicewonger & Helm, Tulare, Cal., will open a garage on North K street, where a building is being remodeled for them.

A new salesroom and garage for Cadillac cars has been established in Cleveland at 1839 Euclid avenue, on Automobile Row.

The Ashland Automobile Co., Ashland, Ky., have opened a garage on East Front street, between Sixteenth and Seventeenth streets.

The W. L. Huffman Automobile Co., agents for the Auburn car, have opened a garage at 216 South Nineteenth street, Omaha, Neb.

W. H. Shaw, Spokane, Wash., will be put in charge of the garage to be erected in Miles City, Mont., by the Miles City Automobile Co.

The firm of Davis & Gregg, Adrian, Mich., will hereafter be known as Davis & Treat. They conduct a garage and have recently taken the Ford agency.

Thomas G. Miller and Charles F. Holden have opened a garage at 1206 North Cascade avenue, Colorado Springs, Col., and will handle the Gearless car.

Mr. Bobst, of Turlack, Cal., has sold a one-half interest in his garage to Herbert Provost, of Riverside. The new firm intends to make a number of improvements.

J. A. Barger, Orange, Cal., will erect a garage on South Glassell street. The structure will be one story, 40x97 feet, and will be ready for occupancy about September 1.

R. C. Hawley, manager of the Hawley Co., Minneapolis, Minn., has taken over the Evans Motor Co.'s garage on Tenth street, and will represent the Locomobile Co.

D. E. Clough has associated himself with R. L. Forsyth to conduct the Auburn agency in Los Angeles, Cal. Mr. Clough will have charge of the mechanical end of the business.

C. A. Hawkins, San Francisco, Cal., has sold his interest in the White Garage in Los Angeles to F. C. Fenner. Mr. Fenner is now president of the company, and H. H. Ryus vice-president.

Clifford S. Phillips has become manager of the Iron City Auto Company, Inc., 609 Neville street, Pittsburg, Pa., who recently opened a new garage with facilities for repairing and for storing thirty cars.

The Ferry Garage Company, A. Olin president, have established a garage at 125 East street, San Francisco. They figure particularly on the patronage of motorists who cross the bay from San Francisco.

Herbert M. Gragg, Waltham, Mass., will erect a garage on Exchange street, in the rear of the Central House. The building will be of fireproof construction, 50x100 feet, and have a capacity for fifty machines.

The White Co., of San Francisco, have begun the erection of a new garage on Market street with a total of 80,000 square feet of floor space. The building will contain paint, upholstery and machine shops, salesrooms, a parts storage room, a second hand car room and a taximeter cab department.

Huxsaw & Dean, Corona, Cal., have made arrangements for the erection of a garage on Sixth street, between Washburn and Belle streets. The structure will be of brick with concrete floors, one story, 40x70 feet.

William Loos, Los Angeles, Cal., who for the past seven years has been manager for John T. Bill & Co., will open a garage in Oakland, Cal. He has the agency for the Reo and the Reading-Standard motorcycle.

A brick garage 40½x60 feet is being built by the First Bank of Highland, Cal. When completed the building will be occupied by A. A. True and E. A. Green, under the firm name of the Highland Auto Co.

P. A. Renton, Los Angeles, Cal., has purchased the interest of a former partner in his business, which is now to be conducted under the name of the Rentqn Motor Car Co. The firm has the agency for the Great Smith car.

The Auburn Garage Co., Butte, Mont., will erect a garage at 335 South Main street, at a cost of about $10,000. The building will be 70x115 feet and accommodate about sixty cars. R. G. La Fleur is manager of the company.

T. Browning Spence has purchased a controlling interest in the Pope Automobile Co., of Washington, D. C., and will be elected president of the company at the next directors' meeting. C. Royce Hough, who has been in charge of the establishment since 1899, will be retained in that position.

Browning Brothers, Ogden, Utah, are erecting a new garage, 50x150 feet and two stories high, adjacent to the depot building. It will be provided with a cement floor and a truss roof with large skylight. Pending completion of the new building they are occupying the building formerly used by the Ogden Automobile Co. on Twenty-fourth street.

New Agencies.

Globe, Ariz.—W. B. Lewis, Black.

Anaheim, Cal.—P. J. Weisel, Buick.

Fort Bragg, Cal.—C. A. Scott, Rambler.

Chicago, Ill.—Manhattan Motor Car Co., Mora.

Boston, Mass.—C. E. Whitten, Chalmers-Detroit.

New Canaan, Conn.—New Canaan auto station, Mitchell.

Chicago, Ill.—Levy & Fanning, Chalmers-Detroit.

Montgomery, Ala.—Capital City Garage, Chalmers-Detroit.

Kansas City, Mo.—E. P. Moriarty Co., Chalmers-Detroit.

Muskegon, Mich.—Charles J. Durheim, Chalmers-Detroit.

Minneapolis, Minn.—Barclay Auto Co., Chalmers-Detroit.

Fort Dodge, Ia.—Fort Dodge Automobile Co., Chalmers-Detroit.

Newark, N. J.—Newark Garage and Repair Co., Chalmers-Detroit.

Oakland, Cal.—W. L. Loos, Reo and Reading-Standard motor cycle.

Milwaukee, Wis.—W. L. Hibbard Motor Car Co., Chalmers-Detroit.

Pittsburg, Pa.—Kane Motor Supply Co., 539-543 Ellicott street, Cadillac.

New York.—A. L. Kull has secured the American selling rights for the Blomstrom gyroscope.

Trade Literature Received.

The Aerocar Motor Co., Detroit, Mich.—Catalogue of Aerocar 1908 models.

The Rock Island Tool Co., Rock Island, Ill.—Catalogue of vises.

Acheson Oildag Co., Niagara Falls, N. Y.—Booklet of testimonials regarding Oildag paste.

Ch. Dien, 45 West Thirty-fourth street, New York city.—Circular of the Henry Lepaute taximeter.

Edward S. Clark, 242 Freeport street, Boston, Mass.—Circular of Clark's internal expanding brakes.

Gibson Automobile Co., 238 Massachusetts avenue, Indianapolis, Ind.—Catalogue of Imperial magnetos and Ford commutator attachments.

The Logan Construction Co., Chillicothe, Ohio.—"Getting the Goods to the Customer"; a description of the Logan Model R motor delivery wagon.

New Incorporations.

Seattle Taxicab Co., Seattle, Wash.—Capital, $150,000.

Lauton-Lawson Co., Depere, Wis.—Capital, $25,000. To build automobile and marine engines.

North Automobile Co., Chicago, Ill.—Capital, $2,500. Incorporators, A. B. Pease, L. Pierson and George A. Miller.

Courtney Rubber Co., New York.—Capital, $100,000. Directors, W. J. Courtney, T. M. Johnson and John G. Phiel.

Automobile Reconstruction Co., Dover, Del.—Capital, $5,000. Incorporators, E. J. Forhan, H. M. Browne and F. W. Mills.

Electric Automobile Co., Los Angeles, Cal.—Capital, $10,000. Directors, C. D. Hendrickson, W. M. Varney and B. J. Martin.

Empire Garage, Middletown, N. Y.—Capital, $20,000. Directors, George N. Morrow, August Bretthauer and Bertha Bretthauer.

King-Bruns Auto Co., Cooperstown, N. D.—Capital, $20,000. Incorporators, Fred B. King, Otto H. Bruns and Elmer C. Mathison.

Albertson Power Transmitter Co., New York.—Capital, $250,000. Directors, William H. Buckhout, Charles E. Mallinson and Robert Oppenheim.

Swendeman Auto Co., Helena, Mont.—Capital, $6,000. Incorporators, W. L. Swendeman, M. C. Swendeman, S. T. H. Hill, G. H. Hill and J. P. Porter.

Automobile Co-operative Association of America, Half Moon, N. Y.—Capital, $40,000. Directors, Frank B. Rouss, William C. Dickerman and H. H. Williams.

Frontenac Garage Co., Niagara Falls, N. Y.—Capital, $10,000. Incorporators, Eugene Cary, Elmer H. Porter and Daniel Burtch. To deal in and repair automobiles.

National Ignition Co., Jersey City, N. J.—Capital, $15,000. Incorporators, F. C. Eberlin, A. Williams and G. W. Flaacke. To manufacture electric devices and appliances.

Malaysian Rubber Co., Jersey City, N. J.—Capital, $3,000,000. Incorporators, William Mason Smith, A. W. Riley and Clarence E. Starrett. To manufacture rubber goods.

Trenton Auto Garage and Supply Co., Trenton, N. J.—Capital, $5,000. Incorporators, N. P. Druck, J. Peoples and R. Summer. To maintain a garage and manufacture and repair automobiles.

Elkwood Park Automobile Association, Jersey City, N. J.—Capital, $10,000. Incorporators, B. S. Nantz, J. R. Turner and R. R. Thien. The company is to hold, manage, etc., automobile races, exhibitions, shows, etc.

The International Auto Supply Co., Phœnix, Ariz.—Capital, $250,000. The officers are: President, H. J. Egan; vice-president, George D. Walker; secretary and treasurer, L. M. Egan. To buy and sell automobiles and supplies.

Hydro-Carbon Converter Co., Dover, Del.—Capital, $100,000. Incorporators, William C. Eakins, Thomas J. Maloney and Edmund E. Eldredge. To manufacture, buy, sell and deal in patents for automobiles, engines and automatic machines.

Eureka Motor Buggy Manufacturing Co., St. Louis, Mo.—Capital, $50,000. Stockholders, Dr. J. H. Cadwallader, Mrs. J. H. Cadwallader, Mrs. J. M. Bull, Dr. B. A. Wilkes, C. C. Allen, Charles Zimmerman and John Woodburn.

The A. A. A. contest committee has refused the application of a tire manufacturer to be allowed to have compressed air tanks in controls during the Glidden tour and inflate the tires of competing cars there, but the officials recommend that all contestants carry air tanks on their cars.

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Change Gear Bearing Pressures.

By F. E. Watts.

In the design of a sliding change gear it is important that the bearings be properly proportioned for their work and not put in by guess, as is too often done. By inquiries which we receive from time to time it would seem that the principles involved are not generally understood. The following discussion has therefore been attempted with the idea of bringing out some of the practical and theoretical phases of the question.

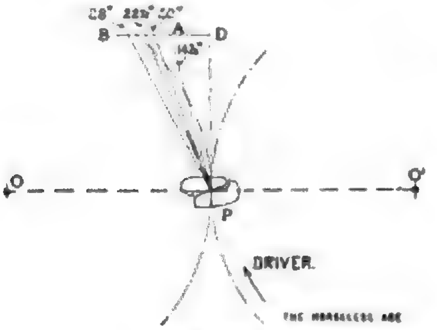


Fig. 1.—Angle of Pressure.

The writer has also been animated by the hope that some reader may know of experiments which may have been made for determining the pressure which gears exert on their bearings. He is very sure that experiments of this character have been made, but in a careful search through all the books and periodicals available he has failed to find any statements which appear to be based upon definite knowledge or backed up by experimental data. So the only remaining method of treating the subject is from a geometrical standpoint, noting as we go along some of the practical conditions, such as friction and interaction of the teeth, which may modify the results.

With the exception of the rear bearing on the through shaft, and possibly the front bearing in some constructions, all the pressures acting on change gear bearings are produced within the case by the radial pressure of the teeth of such gears as are in mesh. Since the weight of gears and shafts is seldom worth considering, the pressure between meshing teeth, neglecting friction, always acts perpendicular to their surfaces at the point of contact. In the systems of gear teeth usually employed on automobiles this line of pressure makes an angle with the tangent to the pitch circle at the point of contact. This is called the angle of pressure. In Fig. 1, D P A, D P B, etc., represent different angles of pressure. For some years an angle of 14½ degrees has been the standard for ordinary work, although a larger angle has been used where teeth require great strength; thus for rolling mill gears 20 and 22½ degrees have been used, and I understand that in the Carnegie mills 28 degrees is the standard. A short form of tooth known as the "Stub," with a 20 degree angle, has been very generally adopted for sliding change gears. This tooth was quite fully discussed in an article on page 438 of Volume 21.

Referring again to Fig. 1, it is easily seen that if P D represents the tangential pressure of the driver against the driven gear, P A will represent the actual pressure between the teeth, and A D that component which acts along the line O O', tending to force the shafts apart and causing pressure on their bearings. It will be seen that both the actual pressure on the teeth and the reaction on the bearings increase with the angle of pressure, and that the latter increases much the faster. The ratio between the torque and the radial pressure (that of P D to A D in the figure), is the tangent of the angle of pressure. For some of the more common angles it is given in the following table:

Radial Pressure on Gear Shafts from a Unit Pitch Line Torque.

Angle of Pressure. Degrees.	Radial Pressure.	Ratio to 14½ Degrees Angle Pressure.
14½	0.25862	1
20	0.36397	1.405
22½	0.41421	1.60
28	0.53171	2.06

The ordinary 14½ and 20 degree teeth have involute profiles, and only one pair of teeth are in mesh the greater part of the time. Any given part of meshing teeth make contact with each other just long enough so that the following pair are well in contact before those first mentioned part. With cyclodial tooth profiles, however, the outlines may be varied so that as many as three pairs of teeth are constantly in mesh. This variation of the number of teeth in mesh must affect the reaction on the gear shafts, but involute gears are all we need to consider at the present time.

If we took any pair of meshing teeth and plotted their successive points of contact from the time they met until they parted, the result would be a line passing through the pitch point, which is called the "line of action." This line is the same for all teeth in the gears. For involute teeth the line of action is a straight line, as A B, Fig. 2, and is the same as the line which defines the angle of pressure. On page 130 of his "Constructor," Reuleaux says: "The ray drawn from the pitch point through any point on the line of action gives the direction of pressure between the teeth at that point." So for involute teeth the angle of pressure is always constant whatever the position of the meshing teeth, and the pressure on the bearing varies as the torque transmitted. This statement does not take into account the friction between the teeth, which will now be considered.

On page 76 of the second volume of his "Machine Design," Jones says: "The pressure between a pair of teeth would be normal to their surfaces along the line of content, if there were no frictional resistance acting to prevent the combined motion of rolling and slipping of the one over the other. This frictional resistance always does exist, however, to an extent depending upon the material of the teeth, the finish of their working surfaces, and whether they are lubricated or dry, clean or covered with dirt and grit." The effect of this friction is to increase the pressure on the bearings when the teeth are coming together and to decrease it when they are parting. In Fig. 3, A P is the line of pressure when the teeth first meet. If A B represents the frictional component the resultant pressure will be A C, which gives far greater pressure on the bearings than that originally found. When the teeth are parting the line of pressure will be changed by the friction from D P to some such line as D F, and the pressure on the bearings may be little or nothing from this contact. What effect the summation of these frictions will have on the bearing pressure it is not possible to determine without experiment. Various authorities seem to hold differing opinions: Grant says, on page 21 of his "Gearing": "When the point of action between two teeth is approaching the pitch point—that is, when the action is

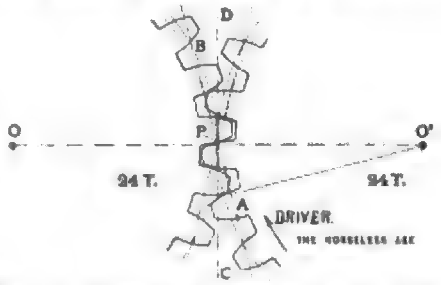


Fig. 2.—Contact Conditions with 14½ Degree Involute Teeth.

approaching—the friction between the two tooth surfaces is greater than when the action is receding." According to this view, the friction would tend to increase the pressure on the bearings. On the other hand, Jones is inclined to think that the bearing pressure is much less than would obtain if friction were neglected. This view is substantially the same as that advanced by Brown & Sharpe in their "Practical Treatise on Gearing," page 136, where they say: "Although the pressure works out by the diagram, as we have shown, yet in the actual gears it is not at all certain that they will follow the law as stated, because of the friction of the teeth among themselves. If the driver in a train of gears has no bearing upon its tooth flanks, we apprehend there will be but little tendency to press the shafts apart."

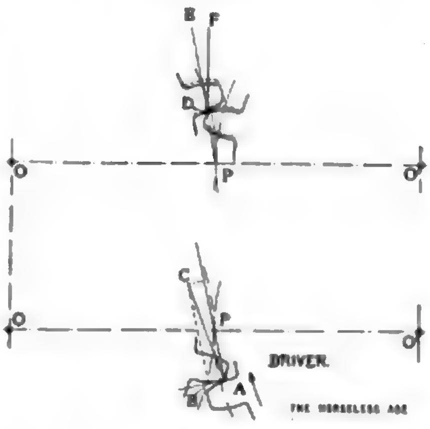


FIG. 3.

Under the heading of "Tooth Friction in Spur Gearing," on page 134 of "The Constructor" may be found the following: "The value of the coefficient of friction is in no case small, even when the teeth are well lubricated, on account of the usual high pressures. A usual value may be taken, $f = 0.15$, while for new and dry wheels it reaches 0.20 to 0.25, and even higher." It seems as though these figures must be intended to apply to cast gears, for they seem altogether too high for smoothly cut, well formed teeth running in an oil bath, which are the usual conditions in automobile practice. With such a high coefficient of friction, and the usual pressures, gear teeth would wear very fast under the constant sliding motion, while as a matter of fact they often run a long time before the tool marks are worn away..

It is the belief of the writer that tooth friction may be neglected in calculating the pressure upon automobile change gear bearings, and that the pressure may be calculated from the maximum torque of the motor. In doing this, however, it must be remembered that the instantaneous torque of the motor is considerably greater than the average for a whole revolution, particularly where there are fewer than four cylinders and if a light flywheel is used. Then, too, a heavy flywheel or a harsh clutch may cause a very high pressure for a short time, especially if the vehicle is heavily loaded. So the bearings should have a large factor of safety for the pressures obtained.

We will now calculate the bearing pressures on two typical sliding gears, one for a touring car and the other for a truck. These gears have been selected because they are among the best with which the writer is familiar.

Let us first consider the Marmon gear. As will be seen from an inspection of the figure, it gives three forward speeds and a reverse, selectively. The bearings are all annular ball, even the bearing in the divided shaft being of this type. The gears are stub tooth, 6-8 pitch, with a 20 degree angle of pressure. As the deflection of the shafts will be slight, it is probably fair to assume that the driving force of the gears is concentrated at their central planes. The resistance of the bearings of course acts in the

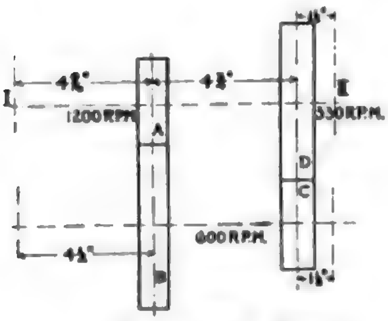


FIG. 4.—FIRST SPEED.

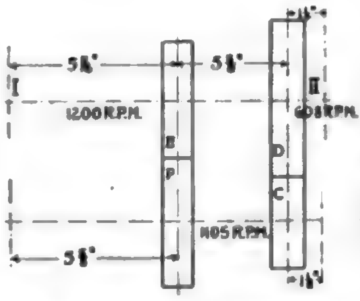


FIG. 5.—SECOND SPEED.

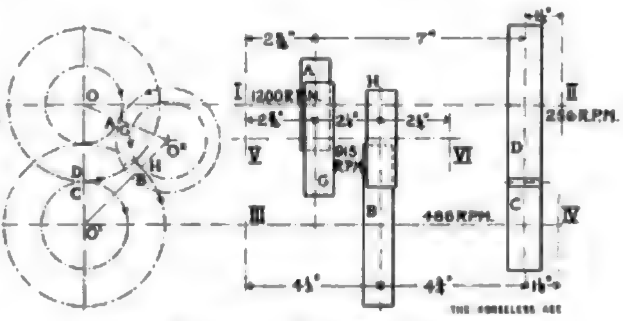
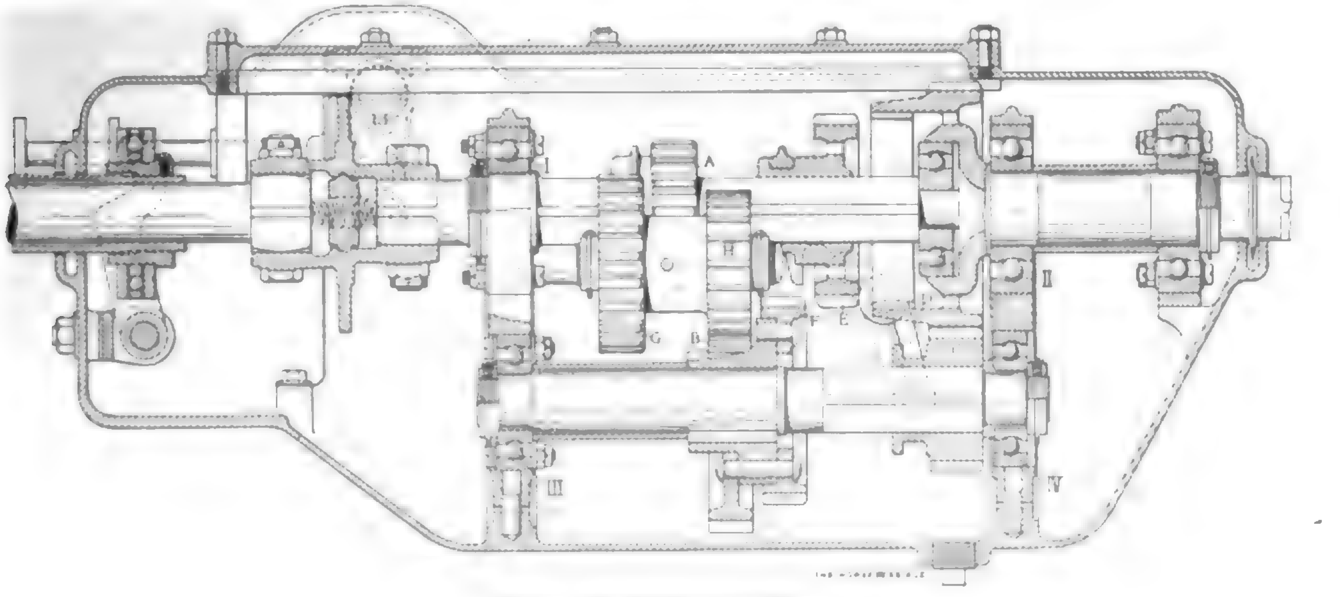
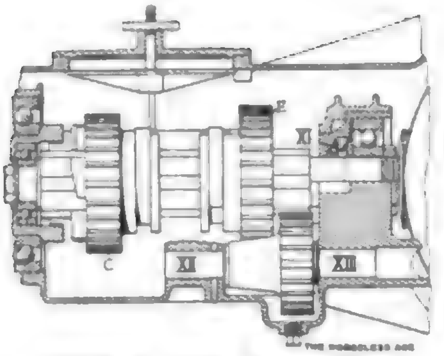


FIG. 6.—GEARS IN REVERSE POSITION.



CHANGE GEAR OF MARMON CAR.



COMMERCE TRUCK REVERSE GEAR.

plane of the ball centres. The gears are distinguished by letters, and have the following numbers of teeth:

MARMON CHANGE GEAR.

Letter of Gear.	Number of Teeth.
A	16
B	32
C	17
D	31
E	23
F	25
G	21
H	17

The bearings are designated by Roman numerals.

This gear is driven by a 5x5 inch, four cylinder motor. By the A. L. A. M. formula this should develop 40 horse power at about 1,200 r. p. m. As we have no torque curve of the motor we will use the torque given by this rating. It is 2.101 pounds at 1 inch radius.

Fig. 4 shows the gears in the first speed position. The torque at the pitch point of gears A and B is 2.101 ÷ .33 (pitch rad. of A) = 1,580 pounds. Similarly the torque on C D is found to be 2,975 pounds.

The radial pressure acting to force the gears apart is found by multiplying this torque by the tangent of 20 degrees.

Thus $1,580 \times .36397 = 568$ pounds radial pressure A B.

and $2,975 \times .36397 = 1,080$ pounds radial pressure C D.

These pressures on A and D act in the same direction, and may be considered as being carried by the bearings I and II. Of course, as the divided shaft has a ball bearing at its point of division it is flexible, and a part of the load which we consider as carried by II is really carried by the rear bearing; but it is safer to assume that II carries it all.

The shaft is thus in the condition of a beam supported at the ends and loaded with two forces, whose value and position are known; it is required to find the pressure upon the supports. The conditions for equilibrium are that the sum of the forces (exerted by the loads and supports) shall be zero, and that their moments shall be zero. This gives us the following equations:

$$I + II - 568 - 1080 = 0.$$

$$\text{and } I \times 10\ 9\text{-}16 - 568 \times 6 - 1080 \times 1\tfrac{1}{4} = 0;$$

from which I = 450 pounds.
and II = 1198 pounds.

The pressures on the bearings of the other shaft are practically the same.

Fig. 5 shows the gears in the second speed position. The conditions are the same as in the last case. The radial pressure at E F is 386 pounds; that at C D is 570 pounds. The pressure at I is 243 pounds, and that at II is 751 pounds.

The third speed is a direct drive with no gears in mesh, and the only pressure on the bearings is that due to the weight of the gears and shafts and to inaccuracies in machine work.

For the reverse, shown in Fig. 6, conditions are somewhat more complicated, as the forces are not parallel but lie in three planes—oo', oo" and o'o". Each bearing pressure will be the resultant of forces acting in two of these planes. The torque, radial pressure and bearing pressure are found for each plane, as in the previous examples. They are as follows:

Pounds.
Torque at A, G = 1580
H, B = 1950
C, D = 3675
Radial force at A, G = 575

Pounds.
Radial force at A, G = 575
H, B = 710
C, D = 1317

PARTIAL BEARING PRESSURES FOR REVERSE.
From contact A, G.

I 412

Bearing.	Pressure. Pounds.
I	412
II	163
V	395
VI	180

From contact H, B.

Bearing.	Pressure. Pounds.
III	447
IV	253
V	235
VI	475

From contact C, D.

Bearing.	Pressure. Pounds.
I	158
II	1159
III	1142
IV	1017

From these values the total pressures on the bearings are calculated graphically by the parallelogram of forces, as shown in Figs. 7, 8 and 9, with the following results:

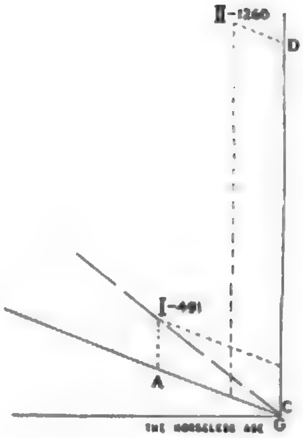


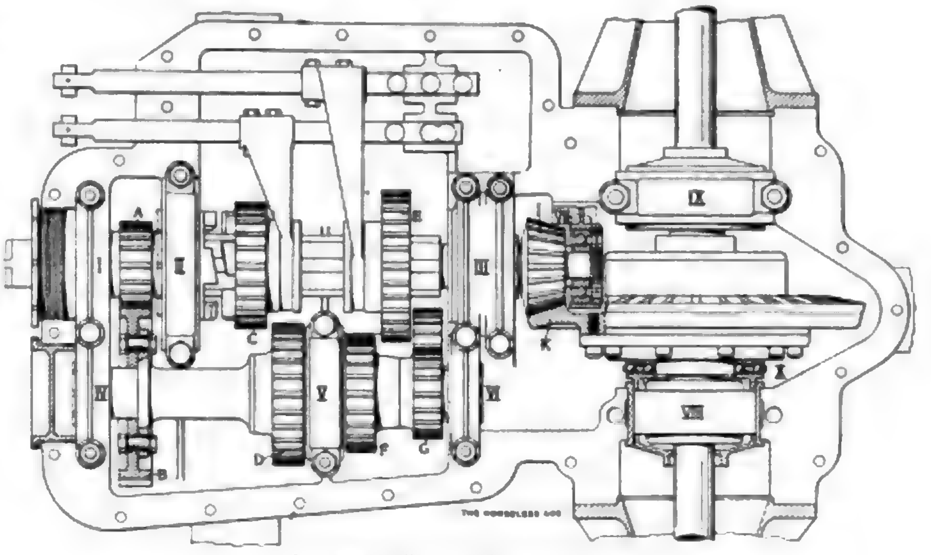
FIG. 7.

TOTAL BEARING PRESSURES FOR REVERSE.

Bearing.	Pressure. Pounds.
I	491
II	1265
III	560
IV	1390
V	567
VI	575

In the Commerce change gear an uncommon construction is used, since the work is very heavy. Owing to the unskilled class of drivers usually employed on trucks and to the heavy loads which must be started three bearings are used on each shaft. This gives short, stubby lengths of shaft between supports, so that serious bending is improbable.

The gears are 5-7 pitch, with 20 degree angles of pressure. Gears and bearings are designated as in the other change gear. The motor is a four cylinder, 5x6 inch, which should give 40 horse power at 1,000 r. p. m. This corresponds to a torque of 2,521 pounds at a 1 inch radius.



COMMERCE TRUCK CHANGE GEAR.

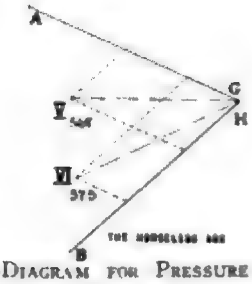


Fig. 8.—Diagram for Pressure of Marmon Reverse Gear.

By the methods employed in previous cases the following values were calculated:

Gear.	Pitch Line Pressure. Pounds.	Radial Pressure. Pounds.
A	1335	480
B	1335	480
C	1740	631
D	1740	631
E	2165 and 2790	750 and 1015
F	2165	750
G	2790	1015
H	2790	1015

The smaller value for E is obtained when it is used for the first speed, and the larger is for the reverse.

In this gear only one pair of gears are in action at a time between adjacent bearings. So it is easiest to find the load produced by each pair of gears separately and add the results. The first may most easily be done by the familiar graphical method of similar triangles. The results are given below:

First Speed, Gears A-B and E-F Meshed.

Bearing.	Pressure. Pounds.
I	240
II	240 + 324 = 564
III	306
IV	240 + 357 = 597
V	122 + 563 = 685
VI	186

Second Speed, Gears A-B and C-D Meshed.

Bearing.	Pressure. Pounds.
I	240
II	240 + 415 = 655
III	216
IV	597 + 105 = 702
V	122 + 525 = 647

Reverse, Gears A-B and G-H-E Meshed.

Bearing.	Pressure. Pounds.
I	240
II	240 + 186 = 426
III	796
IV	576
V	122 + 232 = 354
VI	734

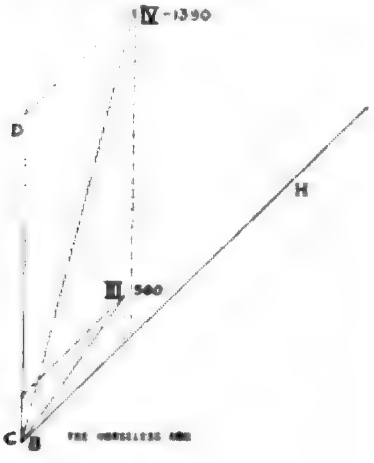


Fig. 9.

In this change gear a new factor is introduced, however, for the truck is side chain driven, and the bevel gears are in the case. They are shown diagrammatically in Fig. 10. The pitch line pressure may be taken as concentrated at A, the thrust may be represented by A P perpendicular to A O. It can be resolved into two components, A D and P D. A D acts at point B, and P D at point C. These gears are 4 pitch with 14½ degree teeth.

Pressures Produced by Bevel Gears.

Speed.	Pitch Line Pressure. Pounds.	A P. Pounds.	A D. Pounds.	D P. Pounds.
First	4020	1040	1015	254
Second	2700	690	680	170
Third	1345	346	338	85
Reverse	5060	1295	1270	320

The resulting bearing pressures are:

Speed.	Bevel Components of Pressures on III. Pounds.	—Pressures on— VII. Pounds.	VIII. Pounds.	IX. Pounds.
First	370	642	121	133
Second	247	432	83	90
Third	126	221	41	44
Reverse	466	808	152	168

Combining the pressures in the first column with those acting on III from the spur gears, we get:

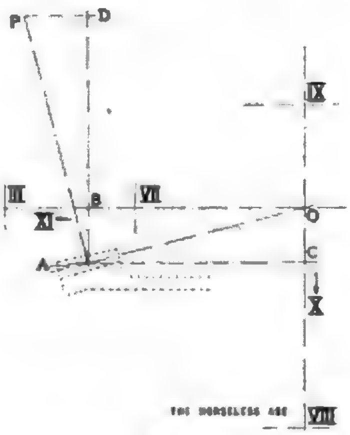


Fig. 10.

Total Pressure on Bearing III.

Speed.	Pressure. Pounds.
First	675
Second	403
Third	126
Reverse	972

The pressures on the thrust bearings are the same as the components of the bevel gear pressure. Probably bearings VIII and IX have an additional pressure from the chain pull, but this depends so much upon the deflection of parts that it cannot be computed. If it had been convenient to put the lay shaft on the opposite side of the main shaft from the bevel gear the pressures on bearing III would have become very small, except for the reverse speed.

In conclusion, I think that we may safely say that while the pressures in change gear bearings for ordinary service and powers are not large enough to present any great difficulty in handling, they should be given more attention than has been customary.

Are Pneumatic Tires Wrongly Condemned?

By George Croisier.

The writer's object is to rehabilitate the pneumatic tire and to show the public that it has been unjustly condemned. In order to effect this rehabilitation it must be shown what the tire has to withstand in practice. What follows has special reference to the Michelin tire, with the manufacture of which the writer is connected.

SURFACE TENSION.

As soon as the tire is put in position on its rim and inflated its envelope or outer cover is subjected to a force known among tire specialists as surface tension. Suppose, for instance, that an incision be made in the surface of an inflated tire, say about 1 inch long, when the surfaces of the cut will immediately draw apart. In order to keep them together it would be necessary to apply a certain force, and it is this force which is called the surface tension. This force is subject to calculation, but before giving the process of its determination we will explain another magnitude, viz., the curvature of a surface.

Consider a curved surface S and a point A in this surface. Through the normal A N to the curve at this point project a number of planes, cutting the surface along plane curves E_1, E_2 — E_n. Imagine a circle which meets one of these curves E at the point A (osculating circle) of a radius R. R is said to be the radius of curvature of the curve E at the point A. If we consider all of the curves E traced on the surface S through the point A, we will note that there is one with a larger radius and also one with a smaller radius of curvature than any of the others. The planes whose intersections with the surface describe these two curves are perpendicular to each other and are called the main planes. Consequently the main radii of curvature of a surface at a particular point are the radii of curvature of the intersection of the surface with the main planes. We will designate these radii of curvature by 1/R and 1/r. The difference in the pressures exerted on opposite sides of the surface may be desig-

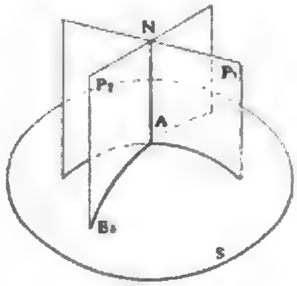


Fig. 1.

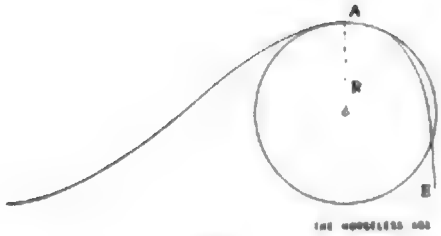


FIG. 2.

nated by p, and the surface tension at a particular point by A. Then

$$p = A\,(1/R + 1/r)$$

or

$$A = \frac{p}{1/R + 1/r}$$

Let us apply these equations to the case of our tires. Let R be the radius of the wheel equipped with an inflated tire, and r the radius of the tire section. These are the main radii of curvature of the tire at the point of contact. If we express the pressure of inflation p in pounds per square inch, we will get the surface tension A also in pounds per square inch. Suppose, for instance, a 36x5 inch tire inflated to a pressure of 85 pounds per square inch. This tire would be subjected to a surface tension,

$A = \frac{85}{1/18 + 1/2.5} = 187$ pounds per square inch.

In order to show clearly what this surface tension amounts to we will calculate the traction that must be applied to a tire in order to submit it to the same strain. The total area of the section is, $2 \times 3.1416 \times 2.5 = 15.7$ square inches, and it would, therefore, be necessary to exert a tension of $187 \times 15.7 \times 2 = 5{,}871$ pounds.[*]

This, however, is not the only strain to which the tires are subjected. The surface tension just calculated is effective while the tires are at rest, and it is considerably greater when the vehicle is running.

The jolting caused by road unevennesses has a tendency to flatten the tire, and consequently to lessen its volume. The amount of air in the tire being always the same, the pressure will increase momentarily in accordance with Mariotte's law. The increase in pressure is accompanied by a corresponding increase in surface tension. Everybody knows that a tire in use becomes heated, and that the air contained therein is expanded by the heat and its pressure increases. This increase in pressure may become quite considerable, as has been shown recently by the experiments of S. F. Edge on the Brooklands track in England. According to the law regarding the expansion of gases by heat, if the volume remains constant the pressure increases 1/491.2 for every degree Fahrenheit the temperature is raised. Therefore, if p_0 and t_0 represent the initial pressure and temperature, respectively, and p and t the final pressure and temperature, respectively, then

$$p = p_0\left[1 + (t - t_0)\,\frac{1}{491.2}\right]$$

If, for instance, the tire is inflated to 85 pounds per square inch at a temperature of 68° Fahr., and the temperature of the air within the tire is then raised to 158° Fahr., the pressure becomes

$P = 85\left[1 + (90 \times 1/491.2)\right] = 100.3$ pounds per square inch.

This is the pressure from which the surface tension must be calculated for conditions of continued use.

STARTING AND USE OF BRAKES.

Let us now examine the dynamic strains to which the tire is subjected as a driving member between the car and the ground. These strains are greatest when the car is being started and when the brakes are applied, but as the effects are similar in these two cases, we shall only consider the application of the brakes. Suppose that the driving wheel of a car is locked while the tire is moving. The adherence of the tire to the ground is about .6 × the weight carried by the wheel. This adherence F represents the retarding force of the locked wheel, and this force is transmitted from the point A of contact between tire and ground to the rim B of the wheel by the tire. In consequence the portions of the tire in the vicinity of the point A are subjected to tensions f, whose aggregate is equal to the adherence F.

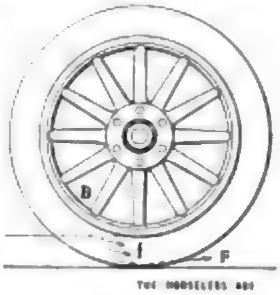


FIG. 3.

In order to obtain a clear idea of the magnitude of these forces f, suppose that they are equally distributed around the circumference of the tire section. If r be the radius of the tire section, the force f per unit of length of the tire's circumference will be

$$f = \frac{F}{2\pi r} \text{ or } \frac{w}{10\,r}$$

For a wheel fitted with a 36x5 inch tire, and carrying a weight of 1,350 pounds, the force $f = 1{,}350 \div 2.5 = 54$ pounds, which must be added to the surface tension of 187 pounds effective while the car is at rest. This figure of 54 pounds is, however, much too low for anti-skid covers, the adherence of which is much greater.

It might be pointed out that that fraction of the surface tension which is due to the brake action is inversely proportional to the width of the tire, for which reason a car cannot be equipped with too large tires, the factor of safety increasing with the size. In consequence of the increase in surface tension due to brake application the tread of the tire is quickly worn out, and tire bursts often result from this cause.

SKIDDING.

The surface tension in the tire due to the brake action extends in the direction of the rotation of the wheel. Skidding produces the same effect in a direction perpendicular to the plane of the wheel. The intensity of the forces due to skidding is the same as that due to brake action, but these forces are to be dreaded much more, for the reason that they attack the tire at its weak point, which is at the beads. The strain due to skidding has a tendency to separate the main portion of the tire casing from the bead. The bead is kept in place partly by the pressure within the tire and partly by the retaining bolts. But between two bolts only the air pressure and the stiffness of the fabric are available for keeping the tire on the rim. The force f transmitted to the point F pulls on the bead T. The bead is held in position by the air pressure against the surface D E. If the force f is sufficient to overcome the air pressure the bead will be pulled out of the rim and a burst will result. It is, therefore, very necessary to pump the tires up hard, especially in the case of heavy cars, and use a considerable number of retaining bolts.

It is also of interest to take into account the centrifugal force acting on the tires when revolving, which has a tendency to disrupt the tire in the same manner as cast iron flywheels will sometimes explode. In the design of engine flywheels care is taken that their circumferential speed shall never exceed 65 feet per second. We are far above this limit with the pneumatic tires of a car traveling at the rate of 70 miles per hour. Are there many metallic flywheels which would withstand a peripheral speed of 114 feet per second? The tires do resist, at least for a time.

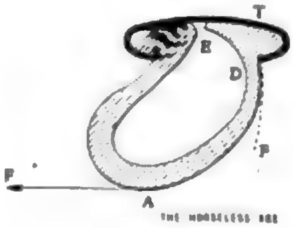


FIG. 4.

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[*] (This assumes that the section of the tire is solid and that two sections, at opposite ends of a diameter, are under equal tension. The former assumption is hardly calculated to give a correct idea of the actual strain on the tire, as the section of the air space within a pneumatic tire is more than one-half the total secion.—ED.)

Two Piston Rings.

By "Mechanicus."

It has been said that trifles make perfection, but perfection is no trifle. While the design of automobiles has not yet reached that stage of development that leaves only trifles to be perfected, some builders prefer to overlook many small details, and seem to consider "good enough" such devices as have been obviously improved on by their competitors.

The writer recently heard two groups of men, on different occasions and in different cities, discuss the design of automobile engine piston rings. One group was interested in and familiar with the design of a well known car, while the other group was in the editorial rooms of one of our representative trade journals. Recent discussions in the trade papers indicate that the theoretically correct shape and thickness of wall for a piston ring would not be practical to use in an engine even if that shape were known. Probably this shape is not known, but in any event it is certain that the piston rings in general use at the present time in automobile engines do not exert uniform pressure on all parts of the inner walls of the cylinders in which they travel.

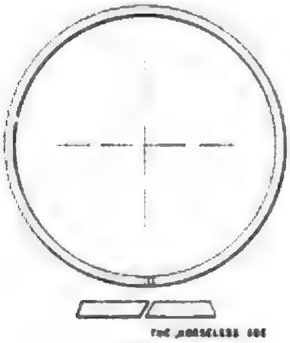

Fig. 1.

In common practice, therefore, two types are used, viz., those which are turned in so-called eccentric lathes, and which are presumed to be round when, after they are slotted, they are pressed into the cylinder; and those which are first slotted, and which are then held together in a fixture while the outside is turned.

One of the groups of men already mentioned was discussing the type of ring whose slot comprised simply a diagonal cut made with an ordinary rotary steel saw, as shown in Fig. 1. It seemed that the chief engineer in the plant where these men were acquainted had been considering the matter of the piston rings, and had arbitrarily settled all the points under discussion, except the proper width of this slot. His quandary was this: If he made the slot too wide he would lose compression, and also would correspondingly lose some of the force of the explosion; while if the slot were too narrow, the expansion of the ring under heat would make the two ends touch each other and probably cause undue friction in the cylinder. Finally an aggressive department head prevailed upon him to adopt his recommendation of a certain width as being "probably right." To this day no one knows the exact condition of that slot when the engine is running, but it is obvious that if the two ends of the split ring meet when the engine is hot they will not meet when it is cool. Therefore, that engine will not hold its compression when standing one minute after it has begun to cool.

The other group of men was discussing the exultant boast of an enthusiastic motorist that his engine would hold its compression for five or more hours when standing idle. The difference in this regard between the two engines lies entirely in the methods of slotting the piston rings. The second ring was slotted as is shown in Fig. 2. The difference in the cost of slotting these two rings was not large, yet when we consider the great advantage of the second type it seems strange that any designer should regard seriously, and much less adopt, the first.

Furthermore, as a talking point for salesmen that single detail affords a great advantage, for the general public has very little real engineering knowledge, and anything so practical appeals strongly to the purchaser.

It will ere long be in the improvement of the smaller details of the automobile that supremacy will lie. The maker who can convince the public that he gives to the minor parts of his machine the same care that he gives to the more prominent features will secure the same confidence that the builders of certain bicycles enjoyed a decade or more ago, although the superiority of their product over those of other makes was largely a matter of sentiment.

Unless basic patents close the way no builder should permit himself to be surpassed in any feature. The concerted effort of the trade can have but one result, which is in the continued improvement of the machines. This will hold the purchasing public, which offers a fair field and grants no favor.

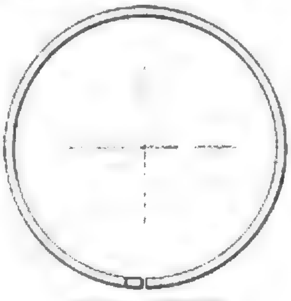

Fig. 2.

Discussion of Paper on Clutches.

At the Detroit meeting of the Society of Automobile Engineers a paper on clutches presented by Henry Souther to the Society of Mechanical Engineers was discussed.

F. Du P. Thompson discussed the type of induction clutch manufactured by the company he represents. The points made in its favor were that there is no friction, and hence no wear. The slippage and torque ratio may be varied by regulating the strength of the exciting current. This clutch is much the same as an induction motor, and the torque is created by eddy currents set up in a copper ring revolved in an annular slot in the iron frame. The ring is said to be cooled by the fan action of the radial coils. Its principal use at present is for driving machine tools, but it is sometimes used as a testing brake. It has been proposed to use this clutch for automobiles, for which purpose it would have the valuable property that it could be regulated so as not to stall the motor.

A very valuable discussion by C. W. Hunt was read by the secretary. He recommended from long practical experience that designers use coefficients of friction of .35 for cork, .25 for leather and .2 for wood, each acting against cast iron. These are for slightly oily surfaces, the coefficient varying widely with the amount of oil. Mr. Hunt favors a larger angle and increased spring pressure for cone clutches for automobiles, and says that with these changes springs under the leather are not necessary. He recommends chrome leather for facing.

As the discussion seemed to have resolved itself into a comparison of the merits of the multiple disc and cone clutch for automobile work, Mr. Fay briefly stated a few of the salient points of auto clutch design, ending with the assertion that either form was perfectly satisfactory if properly designed. He recommended metal to metal contact in an oil bath.

Protection of Gasoline and Water Pipes.

It is often necessary to run gasoline and water pipes through holes bored in the cross members of the frame in order to prevent sharp bends. In some cases the makers are content to protect these pipes from contact with the cross members by wrapping them with adhesive tape. It isn't long before this tape is worn through, and after that the pipe, thus permitting a loss of gasoline or water, as the case may be. Doubtless many of the fires are due to this wearing of the gasoline feed pipe. The entire piping system of the car should periodically be carefully examined, and if damage has been done the pipe should either be soldered or replaced. Wherever the piping comes in contact with the frame in such a manner that vibration will cause friction between the parts, with consequent wear, the pipe should be protected. A neat and easy protection to apply is to take a block of wood and bore a hole lengthwise through the centre the same size as the pipe, then split the block or saw it through the centre line of this hole, and trim the block to size. It can then be applied and fastened to the pipe by a few turns of wire at each end. Care should be taken that it is secured tight enough to the pipe that there is no movement between the two, otherwise it is liable to work out of place.

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Excuses for Speeding.

Many and various are the excuses that are offered by drivers accused of speeding, the following being a few of those most commonly given: There was a sick person in the car; a physician was speeding to the bedside of a patient; it was raining hard; the car was speeded up temporarily to get out of the dust of the car ahead. In some instances magistrates and judges have discharged motorists for one of the above reasons, while in other cases they have utterly refused to listen to excuses of this nature. May there not be circumstances under which the operation of an automobile at excessive speed is excusable morally and legally, and which is the proper course for a judge to pursue?

The various State automobile laws say that motor vehicles shall not be driven faster than certain rates of speed. There are no exceptions or provisos in these laws permitting the speed limits to be exceeded under any circumstances, consequently there exists no judicial discretion to discharge arrested automobilists on any of the grounds mentioned; however, since all laws must be enforced by means of human agency, "humanity" must necessarily enter into the execution of any particular statute. It should not be forgotten that "intention" has no place in violations of the speed law. Whether the arrested automobilist "knew" that he was exceeding the speed limit makes no difference in regard to his innocence or guilt. The law says that he who operates an automobile drives it at his peril if he exceeds the speed limit. But there is certainly an unfairness in "trapping" an automobilist who does not intentionally speed for the sake of creating a race or showing off. Just what to do to prevent oppression by officers of the law on the one hand and to curb reckless automobiling on the other is the great question.

Speed traps and the practice of convicting automobilists on mere "seconds" and "mathematics" should be abolished. Yet alertness on the part of the protectors of the public safety should not be discouraged. Where will we strike the happy medium? Connecticut is said to have solved the problem, but this may be doubted. In that State danger to the public is the test up to 25 miles an hour, and it is rather difficult to produce evidence establishing dangerous driving when it did occur.

First, and above all, a limited discretion should be given magistrates and judges to excuse those arrested for speeding who present plausible and bona fide reasons in mitigation of the offense and where the arrest is purely technical. Secondly, no automobile driver should be convicted on the uncorroborated evidence of one person using a stop watch or otherwise estimating the time. Secret evidence, wholly within the possession of one party, should not be permitted to convict a defendant. The opportunity to ascertain the correctness of this evidence upon cross-examination is slight.

As a general proposition of jurisprudence the rule should be that an excessive speed may be permitted where the object is to avoid a greater danger than involved in the speeding. Legislation based upon this theory and granting a limited discretion to magistrates and judges would be commendable.

The Status of the Chauffeur.

Hired drivers for a long time objected to being classed as servants, claiming that their calling required special knowledge and training, which entitled it to be recognized as a profession. So far as the legal aspect of the matter is concerned, it has now been definitely decided that a chauffeur in the employ of a private owner is a servant. It does not take special prophetic powers to predict that this will be the generally recognized status of the chauffeur in the future.

The driver of a private automobile holds the same relation to his employer as the driver of a private carriage, both performing personal services. It may, and it may not, require more special training to properly drive and care for a car than to drive and care for a carriage and pair—the point has by no means been definitely settled. The main difference at present is that the horse is in such common use that a great portion of the population acquire familiarity with its care in their early youth without any special effort on their part. They simply "pick up" this knowledge as they grow up. The opportunities for learning to drive and maintain automobiles in this manner have been very slight so far, and most of those who have qualified as drivers have had to take a special course either at a school or in a factory or garage. It hardly admits of argument that as the number of cars in use increases many boys and young men will have opportunity to become familiar with the operation of these machines by simple observation without any special instruction, and this distinction between the coachman and the chauffeur will then vanish.

In the past the owner of a car frequently did not know how to drive it, and this fact, coupled with his enthusiasm for the new mode of travel and the relative scarcity of skilled drivers, often prompted him to acquiesce in actions and demeanors of his chauffeur which would not have been tolerated in the case of a coachman. But these conditions are passing. The younger generation of wealthy owners, almost without exception, are themselves skillful drivers. The unbounded enthusiasm of the early days has subsided, and there is no longer any scarcity of skilled drivers. What most wealthy owners particularly miss in their chauffeurs is the gentlemanly manner and modest bearing which have been inculcated in the coachmen's class for generations. Some of them have missed it so much that after several unhappy experiences with mechanic chauffeurs they have engaged a coachman, and had him trained as an automobile driver under the impression that what he might lack in mechanical knowledge he would make up in reliability, honesty and devotion. One thing that should be borne in mind in this connection is that from now on the tendency in construction will probably be toward greater simplicity and dependability, so that there will be relatively less need of wide mechanical knowledge and skill on the part of the driver.

If the mechanic drivers wish to hold their own against the coachman drivers, who are now taking their places in some instances, let them study and seek to imitate the attitude of coachmen toward their employers; let them be faithful, steady, sober, modest and polite. There is nothing degrading in any of these qualities; in fact, they are all virtues. Their mechanical qualifications will always be valued, and they will be preferred to the coachman if they possess equally desirable personal habits.

Recent Practice in Inlet Valve Design.

In the early days of the industry it was a commonly accepted practice to make the exhaust valves of larger diameter than the inlet valves. Then, as now, the necessity of quickly and completely clearing the cylinder of burnt gases was fully recognized, and it was, perhaps, more generally realized than was the all important matter of fully filling the cylinder with its fresh charge. As very little if any lead was given the opening of the exhaust valves in those days, the necessity for the large valve area was perhaps greater then than now, when exhaust valves are opened 40 or even 50 per cent. before the lower dead centre is reached, thus allowing one and a quarter strokes for the clearing of the cylinder.

Some years ago the use of valves identical in diameter and other proportions for both inlets and exhausts became general, and this is almost universal practice today. It is convenient in that it requires but a single type of valve to be carried as a spare, and is the natural arrangement where valves are located side by side, or even on opposite sides of the cylinder, and similarly operated, as it leads to a symmetrically formed cylinder.

In a recently designed four cylinder vehicle motor, which is to be manufactured in large numbers, the inlet valves have about two and one-quarter times the area of the exhausts and about one-third the area of the cylinder bore. The inlets, it is perhaps unnecessary to state, are located in the centres of the cylinder heads and the exhausts at one side. The use of larger inlets than exhausts, although not entirely novel, is still rather uncommon practice.

For some time past it has been becoming increasingly evident that the admission to the cylinder of the fullest possible charge is one of the most important conditions to be sought for in a motor of high weight and fuel efficiency. The gradual recognition of the desirability of a large lag in closing the inlet valve, after the lowest point of the suction stroke is reached, has come about through a realization of this desideratum. It is a fact that full admission is harder to attain than a free exhaust, especially in engines of high piston speed. Gas movement during exhaust is under very considerable pressure, while the movement of the fresh charge toward the engine is always under a pressure amounting to but a fraction of an atmosphere. The first portion of the intake stroke is of comparatively little value as far as admission is concerned, while the portion of the exhaust period preceding the beginning of the exhaust stroke proper ought to reduce the cylinder pressure to nearly atmospheric.

In so far as extremely large inlet valves opening directly into the combustion space tend to a full charging of the cylinder, they are highly desirable, and such advantage should greatly outweigh the disadvantage of non-interchangeability in valves. The use of mufflers with practically no back pressure, and the employment of large exhaust valve leads, have solved the problem of a free exhaust, and attention is now concentrated on the even more important matter of securing the unobstructed admission of the fresh charge.

The Applications of Autogenous Welding.

While the process of welding with the acetylene-oxygen blowpipe is comparatively new in this country, quite a number of prominent companies are already experimenting with it. The frame makers were the first to take it up, and most of them are doing some work of this kind. There is little reason to doubt that we will see quite a variety of welded frames at the next shows. Indeed, it is reported that one Eastern maker of pressed steel frames is now using this process for fastening the gusset plates, and finds it cheaper than riveting them.

There is little doubt that this process or a similar one will be used very extensively in the construction of the future automobile, but those who take it up should be careful not to become too enthusiastic. While its possibilities are admittedly great, there are certain practical difficulties in its use which must first be overcome, and it may take several years before we have a class of operatives skillful enough to secure reliable results on difficult jobs. So far we have not been able to learn of any tests made to determine the strength of an autogenous weld when subjected to repeated stresses. It will be necessary to make these tests upon specimens made in commercial quantities before we can determine how extensive an application of this process can safely be made to automobile construction at the present time.

The Vibration Factor.

Those who have had any experience in the design of machinery are familiar with the term "factor of safety." As first used, this factor represented the ratio between the tensile strength of the material and the allowable working stress under a given set of conditions. Later it was found that a more logical factor of safety was the ratio between the elastic limit of the material and the safe working stress. During the past two or three years it has become generally known that the tensile strength and elastic limit of a material are of secondary importance in determining its value for constructions subject to constant vibration, such as automobile parts. Hence a new element has become the rational basis of the selection of a material for an automobile part—namely, its resistance to a succession of shocks. It has been found by tests upon machines which subject the test specimens to repeated bendings that if the stress produced by each of these distortions is kept below a certain amount, which differs widely with the material in question, the bending may be repeated a very large number of times before rupture occurs—so large a number, in fact, that it may be considered as infinite for all practical purposes.

In all future discussions regarding materials for automobiles it would be well to recognize this stress, for it represents the limit for safe working under continuous vibration. It would perhaps be well to give it an expressive name, such as "vibration limit," and there might be some advantage in connecting it with the elastic limit of the material, calling the ratio the "vibration factor." After more extensive experiments we may be able to closely determine the "vibration limit" of a material from its elastic limit and chemical composition.

The Prince Henry Endurance Contest.

By Max A. R. Brunner.

During the three years, 1905, '06 and '07, the annual Herkomer endurance contests were the chief events in the German automobile world. After the last of these trials had been concluded it looked for a while as though no big event would be held in Germany this year, and as there also will be no automobile show, things promised to be extremely quiet in German automobile circles. Then Prince Henry donated a trophy bearing his name, which led to the organization of a contest drawing far more than 100 entries, and which has just been carried to a very successful conclusion.

The Prince Henry Tour is the only great automobile event in Germany this year. Although primarily an endurance contest, it included two speed trials over short distances, one a so-called level race, near Rendsburg, and the other a hill climb, near Bacharach on the Rhine. These short stretches could, of course, easily be guarded, and as there was very little chance of one vehicle overtaking another on these stretches practically all risks were eliminated. The distances of the daily stages were such that they could readily be covered at moderate speed, and excessive speeding offered no advantages, but the disadvantage of an increase in fuel consumption and tire wear. These conditions also obtained in the Herkomer contests of former years, but they were not sufficient to prevent occasional undue speeding on the part of some of the competitors, and for this reason this year a new rule was introduced which entirely prohibited the overtaking of a vehicle ahead, except if that vehicle got out of order. Only when the official observer of the car ahead showed a white flag the following vehicle was allowed to pass, and then only outside of built up localities. Another arrangement designed to obviate speeding was that committee vehicles were started at intervals between the competing vehicles, which it was strictly forbidden to overtake. In addition, the rules called for a strict observation of all police regulations, in the open country as well as in villages, and any violation of this rule might have entailed disqualification. Prince Henry, the originator of the contest, is known to be very much opposed to senseless speeding, which undoubtedly in some measure accounts for the sensible driving which characterized this year's contest.

The German capital was selected as the starting point of a large international automobile event for the first time. Two days before the start all of the competing cars were weighed in the presence of the contest committee and representatives of the leading firms and clubs. Although there were no typical racing cars among the entries some strange forms of body work were to be seen. The Horch cars especially were of very peculiar construction. The seats were no more than of cushion height, and the entire weight was carried very low to the ground in order to lower the centre of gravity and to lessen the air resistance. The Mercedes bodies were of similar shape, and in addition their rear ends resembled the stern of a torpedo boat. A peculiar feature of the Adler cars was the mud guards, which were straight and horizontal and carried on hinges, so they could be raised when the side doors were to be opened. Another new feature of design brought out by this contest was an extreme ratio of stroke to bore (180 mm. stroke by 115 mm. bore). Such a large ratio of stroke to bore has never been employed before, the maximum former stroke for a bore of 115 mm. being 160 mm. The result of this contest should therefore permit of making some interesting comparisons between short stroke and long stroke motors.

The start took place from the large military training ground known as the Tempelhof Field, near Berlin, where a lively scene was witnessed on Tuesday morning, June 9. Of the 144 cars entered, 130 presented themselves at the starting line, 98 vehicles being German, 2 Belgian, 9 French, 5 Italian, 4 Austrian, 1 Swiss and 1 English. Early at 5 o'clock the starting place was crowded with spectators, who had come by street car, taxicabs and private automobiles. The first car was dispatched at exactly 6 o'clock. The two leading cars were committee cars, and served as pacemakers. Altogether about 140 vehicles crossed the line, carrying about 460 people, including sixteen women and forty-four army officers, which latter acted as official observers.

The destination of the first day's run was Stettin, an important seaport on the Baltic, a distance of 308 km. The route led through Zossen, which has become known through-

A Group of Competing Cars in Front of the German National Monument in the Teutoburg Forest.

out the world by the high speed electric road trials carried out there in 1903; Frankfort-on-the-Oder, Kustrin, etc. The first car arrived at Stettin at 12:40 p. m., and by 5 o'clock all of the starters except one had reported at the control, the one missing vehicle having collided with a tree at a curve and broken a front axle. The following morning the journey was continued from Stettin, 129 cars being started at one-half minute intervals. This day the destination of the vehicles was Kiel, Germany's largest war harbor, a distance of 392 km. Prince Henry of Prussia, his wife and two sons, and a number of other members of German reigning houses, appeared at the end control five minutes before the first car arrived, and stayed for nearly half an hour, seeing many of the cars come in. Later the Prince went to the garage where the cars were stored during the night. A number of accidents occurred during this stage, but none particularly serious. One car caught fire about 25 miles from the finish on account of a leaky carburetor. A protecting cloth hung underneath the mechanism was gutted, but the fire was extinguished by the passengers without doing any further damage, and the trip was continued. On another car the rear wheel brakes seized and the differential and frame were damaged.

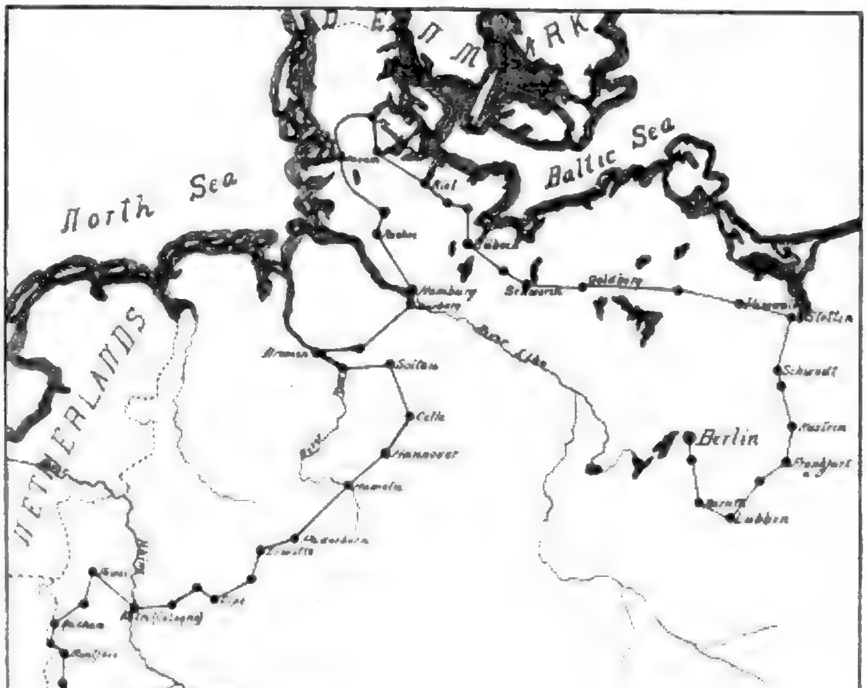
At 6 p. m. 126 cars had passed through the control at Kiel, the three damaged cars having discontinued the journey. This stage was the longest of all, and the results can certainly be called satisfactory. The organization was excellent, and that no more accidents occurred is probably largely due to the fact that the public had been thoroughly instructed regarding the contest through the authorities and the schools. Owing to the fact that many of the contestants had not been able to fill their fuel tanks at the start of this stage, a supply of 3,000 litres of gasoline was ordered by telegraph to be kept ready at Schwerin, about half the distance of this day's running.

The next day, June 11, was a day of rest for the competitors, who enjoyed a visit to the numerous warships anchored in the harbor. One of the cars which suffered delay owing to some mechanical defect reached the city late at night on the 11th, having lost its way and made a detour of about 100 km. Several protests were considered by the committee, but these were of minor importance. A number of concerts in honor of the contestants were given in the evening, but most of the latter retired early so as to be ready for an early start in the morning.

With one exception all the cars which had started from Berlin three days previously came to the starting line in Kiel, several running along as non-competitors. One of the incentives to continue in the contest after disqualification was that all wanted to take part in or observe the level race, which occurred in the third stage. The race took place over a stretch of 9½ km. The first to pass the finishing line was Edgar Ladenburg, last year's winner of the Herkomer contest. It was announced by telephone that his time was 3 minutes 4 seconds, but later this was found to be a mistake, and the correct time was given as 4 minutes 35 seconds. The weather was fine in the morning, but in the afternoon a thunder storm came up which disabled the telephone service and made the road dangerously muddy. The best showing in the race was made by Von Lengerke, who drove a Benz car, but the results could only be announced on the day following the trial, as the calculation of the plus or minus points obtained by each competitor required a great deal of work. The absolutely best time was made by W. Poege, driving a Mercedes—viz., 4 minutes 24 seconds. No electric timing apparatus was used, but it will probably be introduced next year. A number of cars were disqualified. Hamburg, the destination of this day's run, was reached at an early hour, and in the afternoon the competitors enjoyed a trip through the harbor of Hamburg on a steamer placed at their disposal by the Hamburg-American Line. The committee were the guests of the Hamburg Senate at a banquet in the city hall.

The stage Kiel-Hamburg was 335 km. in length, and the next stage, from Hamburg to Hannover, by way of Bremen, was 313 km. The trip from Bremen to Hannover was covered in five hours without mishap. On June 15 the route led from Hannover to Cologne, a distance of 330 km. The intervening country is rather mountainous and many sharp S turns were encountered, which required careful driving. Of the 120 cars which started from Hannover in the morning 119 finished in Cologne, which is certainly a very good showing after a distance of 1,400 km. had been covered by all the cars. In the way of entertainment there was a concert in the Opera Garden in the evening and a reception by the local automobile club. The next stage was from Cologne to Trier, 253 km. During the latter half of this day's journey the Eiffel Mountains were passed through, where it is proposed to build an automobile track. The last day's stage led from Trier to Frankfort-on-the-Main, and included the hill climb at Bacharach on the Rhine. The course for the hill climb began about 1 kilometre from Bacharach, was 6 kilometres in length, and comprised five turns. A large crowd had assembled to witness the hill climbing, some morbid curiosity having been aroused by a fatal accident to a driver practicing on the hill the previous day. The strictest order prevailed, the course being excellently guarded by police and soldiers. The cars were sent off at regular intervals, in the order of speed, so that one car would not be likely to overtake another on the hill, and as soon as a vehicle got stalled, flag signals were given to warn the following competitors to slacken their speed. At each of the dangerous turns visitors congregated in great numbers, and at one point where a specially good view of the course could be had a tent had been erected for Prince Henry and other royal personages.

With the exception of five, all of the competitors climbed the grade without difficulty. One car went over the edge of the road and landed in a ditch, one had trouble with its ignition, a third broke its crank shaft and a fourth went down a slope 10 metres deep. Fortunately, nobody was seriously hurt. The best time on the hill was made by W. Poege (Mercedes), viz., 5 minutes 15.4 seconds. Erle (Benz) drove



ROUTE OF PRINCE HENRY TOUR.

up the hill in 5 minutes 27 seconds, and Opel (Opel) in 5 minutes 44 seconds. At the conclusion of the trials on the evening of June 17 nobody could yet tell who the winner was, as this depended upon quite a number of factors, including the performance in the level race and the hill climb, and the performance in the endurance run, the time made in the two speed trials by any particular car being compared with that which would be expected of the car in view of its cylinder displacement, and plus or minus points being accorded, depending upon whether the actual time was better or worse than the expected time.

The finish took place at Frankfort-on-Main. At the finishing point a pavilion, prettily draped with yellow cloth, had been erected, and a large space reserved for invited guests, while the opposite side of the road was packed with curious crowds, who arrived as early as 4 p. m. to witness the finish, and had to wait for three hours until the first car arrived. The delay was due to the fact that all of the contestants stopped for three hours at the castle of the Grand Duke of Hesse in Darmstadt, where refreshments were served to them. Within an hour after the arrival of the first car at the finish, 120 of the 130 cars which had left Berlin ten days previously had passed through the final control, after having covered a distance of 2,200 kilometres on the road without serious accident.

Early the next morning the technical committee of the Automobile Club went to work calculating the results of the road contest, which results were announced at a banquet given on the evening of that day. According to this announcement the contest was won by Fritz Erle, who drove a Benz car. Erle was also the winner in the hill climb. Only very little behind Erle in the general classing came W. Poege, who drove a Mercedes, and third place was secured by A. Paul, who drove an Adler. The banquet was attended by 300 persons, including Prince Henry and several other German princes, and numerous high Government officials.

In an address at the banquet in Frankfort Prince Henry said: "It was a touring contest, gentlemen; the idea of a touring car, it seemed to me, must have become somewhat distorted in some places, but those who entered these touring cars acted in a bona fide manner, being within their rights, and there can be no objection to their action." Some of the less successful contestants in their advertisements point out that only vehicles with freak bodies succeeded in obtaining leading positions. Probably next year the organizing committee will not stop at calling for touring bodies, but will specify the minimum height of seats and backs, and minimum amount of leg room, dimensions of fenders, etc., as they very wisely do in English touring contests.

English and Scottish Reliability Trials—II.

By Roy Lindsay.

In the previous portion of this report, written somewhat hurriedly so as to catch the mail, only a bare outline could be given of the fourth day of the Scottish trial. It was a day of experiences such as no driver ever wishes to repeat, and the avowed intention of the Scottish Club to make each year's event more strenuous than the last was more than realized when the competitors entered the wild and mountainous district between Pitlochry and Oban. Long and steep climbs of 10 miles on end were frequent, and when the drivers reckoned they had reached the summits they were faced by awful corners with steep pitches. The splendid maps and route directions provided partially prepared the competitors for what was in store, but, even so, nobody except a very few officials had the remotest conception of the hair raisers. The Amulpee Hill was the worst grade encountered during the day. The approach to this hill lay along a deep valley between the mountains, the rise for several miles never being less than 10 per cent. The road could be seen winding for 3 or 4 miles ahead at a time and appeared to gradually climb over the top of a distant hill. At one place what looked like a mere track twisted suddenly off the road and went straight away up along the hillside as though it were the roof of a house. The track first wound up by three zigzags in terraces one above the other, each having to be taken around a hairpin corner on a 7 per cent. grade; then came a fourth corner, and straight up beyond this was the fearsome slope of 3½ per cent. actual. And as if this was not sufficient, there was a fifth double hairpin right at the very top. This last corner had been widened a few feet specially for the occasion, but only the short wheel base machines could get around it, all the others having to run back up the steep bank at the corner when they had got half way round and then go forward again with front wheels twisted hard over. The driver of the 14-16 horse power Argyll failed to negotiate the last corner, and catching his near side steering wheel against the bank twisted the front axle. The engine of the 60 horse power Dietrich was stopped when attempting to reverse, another car had a broken fuel pipe because of the sudden impact with the high bank when reversing, and many of the cars had to shed their passengers and were penalized marks accordingly.

Perhaps the most remarkable performances on this hill were made by the 10 horse power Cadillac, 10 horse power Swift, 10 horse power Chambers and the 10 horse power Adams, these machines in the two seater class arousing loud cheers from the handful of spectators when they managed to surmount the last corner with passengers still aboard. The descent from the other side of Amulree was, undoubtedly, more appalling than the ascent, and in several cases it was impossible to check forward movement, despite the engine being switched off, bottom gear engaged and all brakes hard on. Prayers of thankfulness went up when the bottom was at last reached.

Two non-competing cars containing makers who were following the trials throughout caught fire from the brakes while descending Amulree, without much serious damage to either, and this will perhaps give some idea of the difficulties met with. It was surprising that only three cars were withdrawn on the fourth day, these machines being the 16-20 horse power Argyll, with broken propeller shaft coupling; 30 horse power S. P. A., with broken ballrace

The Hill at Amulree.

(Showing the numerous hairpin corners and the 3½ per cent. grade.)

in one of the steering wheels, and the 40 horse power Star, that ignominiously failed to climb one of the steep hills because too highly geared.

The last day's journey of the Scottish trial was from Oban to Glasgow, 131¾ miles, nearly half the journey being over roads that had been traversed the previous afternoon. Rain had fallen all night, and continued till after lunch, the surface of the claylike roads being churned up into liquid mud. The road led up through a mountain pass aptly christened Hell's Glen, and here quite a number of the cars that had gone through the first three days of the English trial and the four days of the Scottish trial without any mechanical troubles came to grief. Choked carburetors, slipping clutches, jammed gear levers and stiffened steering joints compelled stoppages, and the 12 horse power Shamrock stripped its bevel driving wheel on the end of the propeller shaft and had to retire. Within 20 miles of Glasgow was the timed hill climb of the day up Fintry Hill, a distance of 1 mile 694 yards, with average gradient of 7 per cent. and a worse grade of 5½ per cent. There were the usual sharp corners, but the whole of the roadway being very wide throughout every car went through in good style, and all had arrived and checked in at the last control by 6 p. m.

RESULTS OF SCOTTISH TRIALS.

The following cars made absolute non-stop runs on each of the five days of the Scottish trials and did not occupy more than one hour altogether for tire repairs: Class A—10-12 horse power Swift, 10-12 horse power Chambers; Class B—none; Class C—14-16 horse power Argyll; Class D—20 horse power Beeston Humber, 18-24 horse power Swift, 14-16 horse power Argyll, 20 horse power Italian Daimler; Class E—30 horse power Beeston Humber; Class F—24 horse power Albion, 18-24 horse power Piccard-Pictet, 25-30 horse power Maudslay, 18 horse power Benz; Class G, 40 horse power Armstrong-Whitworth. Of the seventy original starters for the purely Scotch portion of the combined trials fifty-six survived to the end. In Class A the 10 horse power Cadillac had non-stop runs on three days and the 37 horse power White steamer had a non-stop run on one day. In Class D the 20 horse power Cadillac scored four non-stop runs, the driver, who is an amateur owning his machine and having no connection with the trade, being unfortunate to lose the envied certificate for five complete days by a temporary choking of the gasoline feed pipe that was remedied in one minute, but lost one mark in consequence.

THE 15-20 HORSE POWER PANHARD AND 40-50 HORSE POWER ROLLS-ROYCE STOPPED AT A LEVEL CROSSING.

This picture shows how some of the cars carried detachable wheels, and also the manner in which all railway level crossings in Great Britain are protected by gates.

That extraordinary improvements have been made in tires was one of the noticeable results of the 773 miles covered in Scotland, only five new covers being fitted to the whole of the competing cars because of bursts. There was a total of but seventeen punctures in all, spread over 360 wheels, and the longest time any machine was stopped on any occasion for tire troubles was thirty-eight minutes. Very few of the "boomed" detachable rims (about which so much has been written in the technical press during the past eighteen months) were fitted to machines, pretty good evidence that these devices cannot be relied upon for quick changing of tires in emergencies. Some twelve cars had Rudge-Whitworth detachable wire wheels, and the celerity with which these were changed was a revelation, the average time occupied from the moment the wheels ceased revolving until they got going again being six minutes. Drivers and mechanics have become such adepts at taking off and replacing the clincher type of cover, and compressed gas in steel cylinders lessens the work of inflating so much, most of the competitors preferred this method rather than be bothered with mechanical tire devices that might go wrong just when most needed.

The great severity of the Scottish trial considerably enhances the reputation of those machines that came through without loss of marks. The contention of the Scottish Club officials that it ought not to be impossible for a well constructed automobile to travel wherever a horse drawn vehicle can venture, appeals to the imagination; although there was much grumbling that the whole of the route was kept secret this year

DARRACQ AND NAGANT-HOBSON CARS ROUNDING THE DEVIL'S ELBOW ON CAIRNWELL HILL.

CAUSES OF WITHDRAWALS FROM SCOTTISH TRIALS.

First Day.

14-16 horse power Belsize, cracked cylinder.
16 horse power Sunbeam, defective radiators.
30 horse power White steamer, broken differential.

Second Day.

20 horse power Coltman, stripped differential.
25 horse power Werbell, burnt clutch leather.
24 horse power Porthos, too highly geared.
8 horse power Clyde, sheared differential gear.
12 horse power Riley, stripped gears.

Third Day.

28 horse power Belsize, driver's arm injured by a back fire.
25 horse power Ariel, broken ball race in rear wheel.
15 horse power Sheffield-Simplex, loose spokes in wheel.
15 horse power Hillman-Coatalen, geared too high for hills.

Fourth Day.

16 horse power Star, geared too high for hills.
30 horse power S. P. A., broken ball race in rear wheel.

until the machines had started (thus preventing local machines obtaining advantage over those coming from a distance), the fact that two of the smallest powered machines secured non-stops while the four left in Class A succeeded in climbing every hill without dropping passengers or having any trouble thereon, certainly exonerates the club from the charge made in many quarters that the trials were not such as an ordinary owner would submit his own car to attempt. The trial has conclusively shown that nearly all the cars above 16 horse power, particularly the very big machines of long wheel base, require radical alteration of the steering to enable them to negotiate the sharp bends met with on all Scotch roads.

The gold medal awards in each class will not be announced for some days, but it can be noted that out of seventy starters there were fifty-six machines which finished the distance of 773 miles and fourteen obtained absolute non-stop certificates. The conclusion of the English trials will be reported next week.

Road Oiling in Kansas City.

Kansas City, Mo., is setting an example to other Western cities in the matter of suburban road construction. For a number of years Jackson County, of which Kansas City is the seat, has been the foremost Missouri county in the extent of its macadam highways, and this in the face of the most adverse natural surroundings. At present the county, beyond the incorporated limits of the city, has something like 350 miles of rock roads.

For the last two or three years the county has been trying with excellent success the application of crude oil to a number of these roads as a preservative to the basic material, and an allayer of the dust evil. This project is being carried on this spring with more energy than ever before. The county road officials are now about to begin the oiling of more than 200 miles of highway in all directions from the city. Unseasonable rains have somewhat retarded the work.

Automobiling in Western Canada.

By D. J. Benham.

IN NEW PROVINCES.

The Provinces of Alberta and Saskatchewan, which have only just been admitted to confederation and which have scarcely as yet completed internal organization, have not any legislation affecting the auto beyond any bylaws which some of the towns or villages may have enacted to regulate the running of cars on the streets.

THE TRADE.

The first agency for automobiles in western Canada was opened in Winnipeg by the Canada Cycle and Motor Company in 1903, when they placed the Ford and Rambler lines on the market. McCulloch & Boswell took over the city agency from the company referred to when they opened Winnipeg's first garage, and consequently they, together with W. C. Power, who was more or less closely associated with them, are really regarded as the pioneers of the business. Joseph Maw, now the most prominent dealer, entered the field almost immediately afterward, handling the 1904 models of the Oldsmobile and Cadillac lines. He afterward added to these the Marion, Ford, Reo and Franklin agencies, several of which he still controls. The Dominion Automobile Company, which was organized in Toronto in 1906, invaded the west during the same year, establishing an agency in Winnipeg, under the management of W. C. Power. They controlled the sales of the Russell, the Winton, Packard, Thomas Flyer and Napier cars during the season. They also had the Ford for a time. Last year the management of the Winnipeg branch of the company was transferred to A. H. Sowers, who had associated with him during the latter part of the season Bruno Siebel, the "Flying Dutchman" and traveling partner of Barney Oldfield. Siebel is now employed by the Winnipeg Garage, Limited, a company recently organized to take over the business of McCulloch & Boswell.

The season just opened has witnessed several important changes in the agencies. A new company has appeared in the field, under the name of the Consolidated Motor and Bicycle Company, who have been appointed representatives of the Canada Cycle and Motor Company in Winnipeg, with the agency of the Russell cars. The Buick agency, which was held last season by McCulloch & Boswell, has been secured by the McLaughlin Motor Car Company, of Oshawa, Ont., who took over the business in these cars for the whole of Canada, and subsequently erected a factory for the assembling of engines and construction of bodies at Oshawa. The car is sold on the Canadian side as the "McLaughlin-Buick." The automobile department of their Winnipeg branch has been placed under the management of W. Power. They have disposed of over sixty of their cars in Winnipeg and throughout western Canada.

The agencies at present are distributed as follows:

Winnipeg Garage, Ltd.—Cadillac, Darracq and Babcocks electric.

Joseph Maw & Co.—Oldsmobile, Reo, Franklin and Ford.

Dominion Automobile Co.—Maxwell, Winton, Napier and Packard.

Consolidated M. & B. Co.—Russell.

The commercial value of the automobile, while quite appreciated, has not as yet been generally taken advantage of by western houses. There is undoubtedly going to be a big and ever expanding market for such machines in the near future. Prominent dealers here all share in that opinion, and are laying their plans for the trade accordingly. And what is true of Winnipeg in this respect applies equally to the entire Canadian west.

In Winnipeg Joseph Maw & Co. have had a large motor truck in operation for nearly a year, handling their own business and at the same time demonstrating to the public the utility of such a machine. The firm ran it all last winter, and never experienced any difficulties with weather conditions. Recently a delivery wagon was manufactured by a local firm of carriage builders, Boyce & Co., who are adding the manufac-

A Section of the Winnipeg Automobile Club Lined Up for a Run.

ture of automobiles and motors to their business, being thus the pioneers of the industry in this country; and no sooner was the handy little machine offered for sale than it was purchased and placed in commission. This was only a few weeks ago, and the experiment so encouraged the makers that they have decided to endeavor to cultivate the trade. They will also make a little runabout to be known as Boyce's Jewel, which will be specially adapted to western travel. The first of these machines has just been completed and is now on exhibition there.

Livery and taxicab services have not been encouraged by popular favor, and at present there are only four machines actually in the livery business, although several of the dealers have cars for such purposes if called for. A "Seeing Winnipeg" service was inaugurated a year ago, but it was not a financial success, and was soon discontinued, though both of the liveries now in existence have special sightseeing tours, which the chauffeurs adopt for the benefit of strangers. Their price of $3 per hour, however, is considered rather high by the average Westerner.

IN SALESMAN'S USE.

It remained for W. G. Bale, traveler for the Gilbert-Parker Manufacturing Company, of Cedar Rapids, Ia., to demonstrate the utility of the auto as a means of transportation for commercial men in western Canada, where the towns are small and the train service is often inadequate and inconvenient. Mr. Bale's territory extends from Winnipeg to Edmonton, and as he desired to establish connections in new centres springing up along the lines of railway which are being built into that future metropolis, he decided to try the auto. Steel was not yet laid to some of the places on his route. He accordingly purchased a second hand Cadillac car and left Winnipeg toward the end of April on his long overland trip, which led him through sections of the country where the trails were nothing more than mere tracks over the prairie. He was practically a novice in the use of an automobile, but by May 26 he had reached Saskatoon, about 450 miles out, and will be in Edmonton within a day or so. He is covering all the towns along two roads, and is enthusiastic over the increased business which he has been able to write as a direct result of his novel method of travel. Points that would be missed by the traveler dependent upon the railroads can be visited, and connections thus opened up handily that otherwise would require the expenditure of large sums for livery hire. Besides finding his experiment profitable to his firm, Mr. Bale also finds it healthful and comfortable, despite the difficulties encountered on pioneer trails and in negotiating streams where bridges are still considered nearly a luxury of the effete East.

A MOTOR BUS SERVICE.

Out in Calgary a bus company was organized last season for the purpose of handling omnibus traffic, as there is no street car system in that rapidly growing city of over 20,000. The experiment was watched with much interest by other cities in the West, because if successful it solved the problem of a rapid and comfortable system of transport on all streets instead of on a fixed route, as is the case with street cars. Three large 6,000 pound 40 horse power cars were imported from Scotland, which had been specially designed for the traffic they were intended to carry, but so far as can be learned the venture was not a financial success. At any rate the service was discontinued after only a few months, and so far has not been resumed. The streets in Calgary are not yet in such a condition as to enable such a system to be operated except under danger of damage to the heavy cars. Of course, other cities have declined to adopt the motor omnibus as a result of Calgary's experience. There is, however, an omnibus in operation in Calgary which stands the strain very well. It is a lighter and more adaptable machine, built by the Rapid Commercial Vehicle Company. Its owners claim that it has really solved the problem.

AGRICULTURAL MOTORS IN DEMAND.

The motor is believed to be peculiarly adapted to agricultural work on the prairies, and at present many experiments are in progress. This year a special department will be opened at the Winnipeg Industrial Fair for this class of machine. There are several makes, all of which have proved adaptable to almost any traction work. They are used for plowing, hauling, mowing, reaping, cultivating, threshing, sawing, running chopping machines, and for general farm work. Some of the makes being offered for sale are operated by either gasoline or coal oil, and although the cost at present is prohibitive to the homesteader and the very small farmer, it is thought that the agricultural motor really inaugurates the "horseless age." It has passed beyond the mere experimental stage, and for convenience, economy and utility the agricultural motor seems now to commend itself to the contractor, large land owners and grain growers. It is claimed that experiments have proved that it cuts the cost of cultivation practically in half, the actual figures quoted being as follows per acre:

By horses	$8.00
By steam (largely used)	6.40
By gasoline motor	4.25

On this basis it costs $1,280 to cultivate a quarter section with horses; $1,024 by steam and $680 by motor.

Attached to a gang plow the motor is one of the most effective means of fighting prairie fires ever devised. The competition at the fair in Winnipeg this year will be studied closely by everyone interested in agriculture. These motors are being introduced here by English manufacturers who had successfully tested them in England and found them adapted to work such as the prairie farmer has to do. The field for developing the market for such machines is really unlimited. The two principal makes of motor now being offered to the public are the Ivel and the Universal. The latter company have a branch office in Regina, although the manufacture is confined entirely to England as yet. Should it meet with a general demand branch factories will be opened in Canada at once. The Ivel already has a strong company organized.

MAKES OF CARS IN DEMAND.

Sales do not indicate that any make of car in particular can claim the distinction of a monopoly of public favor. It is probable, however, that there are more Oldsmobile cars running in western Canada than any other two makes of machines; but during the last year the Reo seems to have had the call. The Winnipeg agency sold over 100 of these last season. The same firm handled about seventy-five Fords and between fifty and sixty Oldsmobile touring cars. The Ford and Oldsmobile are manufactured or assembled in Canada, but the Reo is imported direct from the United States, as are the Franklin and other well known American cars. The Cadillac is also a very popular car, and so is the McLaughlin-Buick, a combination of Canadian and American manufacture which has a large demand this season in particular. However, the figures quoted above show pretty well what styles of cars the public prefer.

In Regina, the capital city of Saskatchewan, where motoring was only introduced a year ago, there are twelve cars privately owned, and of these only one, a Russell, is of Canadian make, the remainder being either Fords or Ramblers. Indian Head has four big Russell cars on its streets.

The buggy type of car seems destined to enjoy the popular call in the near future, because it is adapted to prairie travel. It thus avoids the great drawback to English and French cars, which have not sufficient clearance under the axle nor a broad enough base to run in the ruts of prairie roads. This is a serious defect so far as the Western market is concerned.

There is little difference in the price of the American and Canadian cars, but considerable complaint is made that the material used in the castings of the latter is defective, and the axle finish is not as desirable as in the imported autos.

In the city of Edmonton, Alberta, there are sixty automobiles, including several in liveries, and of these there are only two Canadian cars (Russells). The decided preference is for American makes, though there are a few English and French types in use. One car is the property of the Federal Government, which purchased it for the postal officials for use in collecting mail from the street boxes and in conveying mail to and from the depot.

The Manitoba motor vehicle law provides that all motor cars must be registered with the Government, and constantly display their registration seal on the vehicle, and also number plates both at the front and rear of the car. Searchlights are forbidden.

Maintenance and Repairs

A Quick Repair.

How often does the foreman of the repair shop hear "I must have my car in such and such a time," without consideration of the amount of work necessary to repair it? Although motorists as a whole are learning fast the work required to put a car in shape, there are still a great many who haven't the slightest conception of the working parts of the car, and when anything goes wrong turn the car over to the nearest repair man. Not long ago one of this type brought his car, a two cylinder chain-driven machine, into the shop and complained that the engine didn't seem to have power, and missed, and said that he wanted it that afternoon.

This engine has opposed cylinders and the top of the crank case is divided into two parts. The top is the cover and the next part holds the studs for the push rods and forms the upper half of the bearing of the cam shaft. Eight studs screw into this crank case and hold the two parts and the crank case together. We found that some wayside repairer had in some manner broken off all but two of these studs, and as these two were loose the cam shaft got out of alignment, and consequently threw the valves out of time. The owner was the type of man with whom argument is of no avail, and we had to get it ready in a couple of hours. We managed to drill out two of the broken studs and, after retapping the holes and cutting two new studs, assembled the parts. This, of course, gave us only half the number of studs as before, but spaced equally around the case to distribute the strain. After returning the valves everything was all right and we turned the car over to the owner and haven't seen him since. Perhaps the best course would have been to refuse the work unless time could be taken to do it properly.

Inspection of Lubricators.

Too much care cannot be taken in seeing to it that no dirt or waste is put into the oil reservoir, as the waste or dirt may clog up one or more of the valves and leads of the lubricator, and before it is noticed a bearing may be ruined. The writer has in mind a lubricator that hadn't been feeding properly and was taken apart for inspection. The first thing that drew his attention was the filter cap inserted in the filling opening. In assembling, instead of soldering the ends of the bottom of this cap together, a wad of waste had been shoved into the end to stop up the crack. It was evident that lint from this waste was gradually carried by the oil to the check valves used in this lubricator, because upon taking the valves apart waste was found jammed in the seats, preventing the valves from working. The whole lubricator was taken apart and thoroughly cleaned, and the filter cap soldered properly, after which we had no further trouble with its operation. We have always taken the further precaution of running the oil through a small funnel with a fine copper screen in it, to be sure to get all dirt out of the oil, and it is certainly well worth the slight extra bother.

Attaching Speedometer Driving Gears.

It is absolutely necessary to have the driving gears of the speedometer or odometer, which are mounted on one of the road wheels, exactly centred on the wheel, otherwise the gears will wear quickly and also be noisy. Very frequently these gears emit a noise that can be heard and distinguished at least 100 feet away. This is because the gear is mounted on the wheel eccentrically in regard to the bearing centre of the wheel, with the result that during part of the revolution the teeth are fully engaged, and during the rest only the edges are engaged. It is not always easy for the owner to mount these gears, especially if he has no facilities for doing so. If the centre of the hub cannot readily be found, then the inside of the rim can be used, taking care to have all points on the circumference of the gear equidistant from the rim. It requires some patience to set this gear, but it is worth the trouble to get it exact.

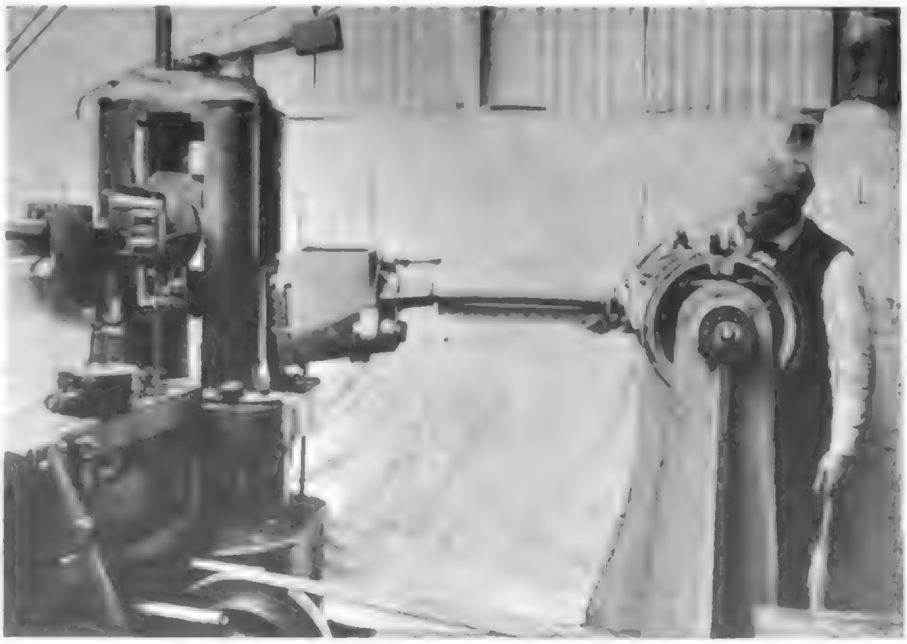
Rambler Method of Testing Strength of Transmission Members.

The accompanying illustration shows the method used at the Rambler factory in Kenosha, Wis., for testing the strength of the torsion tube, driving shaft and axle in the 1909 cars, the object being to determine how much pressure the driving shaft and other members will support without twisting, and also to determine the amount of twist these members will sustain without rupture. Thomas B. Jeffery & Co. furnish us the following description of the tests made with this apparatus.

The three vertical rods extending up from the gear case and the rear axle housing were used as indicators or sights to denote the deflection. They were originally in line with each other. The ends of the rear axle were firmly held in the brackets supported on the floor and the twisting stress was applied to the forward end at the point where the power is applied from the engine. A sustained pressure of 12,000 pounds at a point 2¼ inches from the centre of the shaft (which is the length of the crank) produced a twist and permanent set in the rear axle, but no effect was noticed at the sights of the torsion tube.

The gears were then locked together so that the force was spent entirely in twisting the torsion tube. This was done in order to duplicate the conditions obtaining when the low gear is used. A pressure of 24,000 pounds was required to distort the torsion tube. The attachments of the tube to the transmission and rear axle housing were not in any way injured, the twisting occurring in the tube itself.

In a 4½x½ engine the greatest turning moment approximates 2,800 pounds, and as the pressure required to twist the shaft is 12,000 pounds, it will be seen that this rear axle possesses a factor of safety of about 4½. This, of course, does not take account of the strain imposed on this part by a sudden check to the progress of the vehicle while the clutch is in.



Testing Torsion Tube and Driving Shaft in Rambler Factory.

NEW VEHICLES AND PARTS

The 1909 Peerless Models.

Two models will be manufactured by the Peerless Motor Car Company, of Cleveland, Ohio, for the season of 1909, to be known as Model 19 and Model 25, respectively. The former model is equipped with a 30 horse power, four cylinder motor and the latter with a 50 horse power, six cylinder. These two models will be ready for delivery early in September.

The changes in 1909 Peerless cars are in no way radical. An increased wheel base is one of the principal changes, which provide for a greater distance between the dash and front seats, for a slightly lengthened hood and for setting the radiator further back on the frame than on the 1908 model. The front and rear fender design is improved, an increased clearance for the wheels being allowed. Other features of improvement are new adjustable universal shaft connections between the clutch and the change gear, improved propeller shaft driving joints, a new universal coupling between the live axle and the differential, a new style water pump and a novel method of lubrication. Special attention has been directed to the design and construction of the different universal joints throughout the car, and improvements have been made in respect to their strength and wearing qualities.

The cylinder dimensions for the new models 19 and 25 are 4⅞ inches bore and 5½ inches stroke. The cylinders are cast in pairs, with offset intake and exhaust valves on opposite sides, and are bored, reamed, ground and then lapped with pistons and rings in place to secure good compression. The water jackets are spacious, allowing great freedom for water circulation throughout the motor. These jackets taper so that the greater amount of water is at the top where the temperature is highest. Large openings over the water jackets provide means to remove all sand and are covered with brass plates.

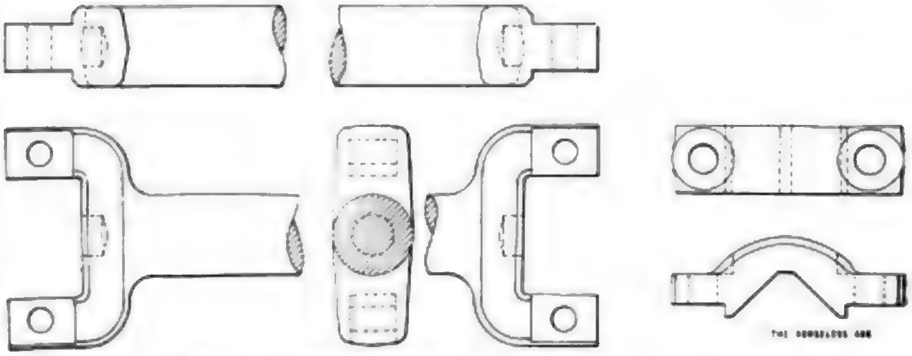
The crank case proper is a single aluminum casting designed for lightness and strength. Aluminum hand hole plates on the bottom of the crank case give access to connecting rods and bearings. Each of these plates is provided with a settling chamber or pocket at its lowest point, into which drops dirt or sediment from the oil.

The crank shaft is a solid one piece drop forging, heat treated and ground to size. The front bearing is an annular ball bearing, and is fitted with a stuffing box to prevent leakage of oil. The rear bearings are of large size, provided with oil grooves and pockets, so they are constantly flushed by oil by splash from the crank case. Every gear is housed in an oil tight compartment of the crank case and runs in oil.

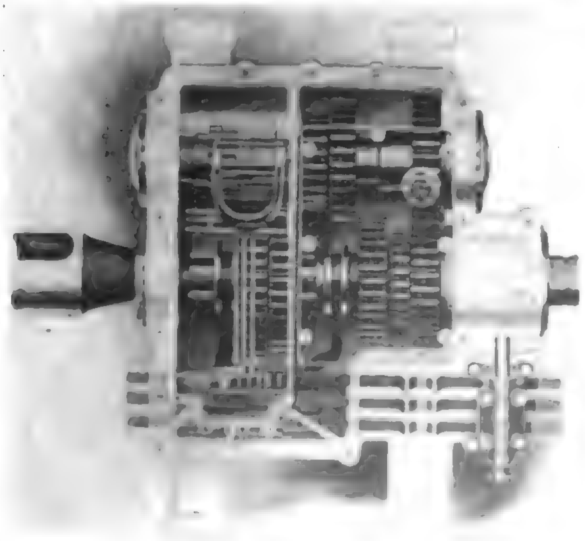
The intake and exhaust valves are made of an imported alloy valve steel and are taper seated, mechanically operated and interchangeable. The carburetor is automatic in its action. A double seated throttle is used, admitting the mixture to the intake pipes through both seats, so that there is no suction force to overcome, and consequently the throttle control is very smooth. The throttle is controlled by a hand lever on the steering wheel, by a foot accelerator pedal and a governor located on the water pump shaft.

A gear driven mechanical oiler is located on the exhaust side of the motor, and supplies oil to each cylinder and to the compartments of the case. The oil reservoir is cast integral with the aluminum crank case and holds over a gallon of oil. The oil is pumped from the reservoir to adjustable sight feeds located on the dash in view of the driver. The crank case compartments are supplied with oil from the oil pump through the sight feeds, as described, and may also be replenished by means of a hand pump, which is made a part of the reservoir. This pump is fitted with an indicator so that the oil may be directed to any of the compartments at will. The level of oil in the crank case compartments is regulated by means of standpipes extending upward through the bottom cover. These standpipes are fitted with pet cocks underneath the car, which when opened determine the proper level of oil in the compartment.

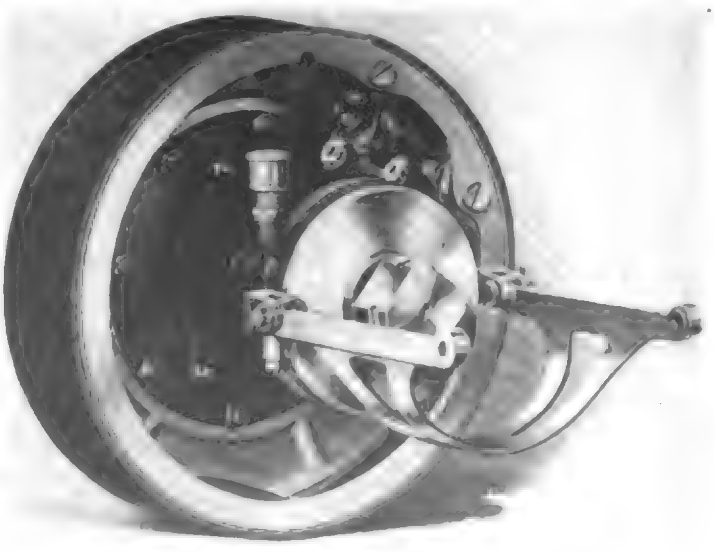
The radiator is the well known Peerless design, of the same construction as used in 1908, and of ample size. The circulation of water is effected by a herringbone gear pump. The fan is driven by bevel gears, with a friction disc joining the driving shaft with the hub of the fan spider. By this construction no belts or pulleys are used, and



CLUTCH UNIVERSAL JOINT COUPLING SHAFT AND SLEEVE.



CHANGE GEAR.

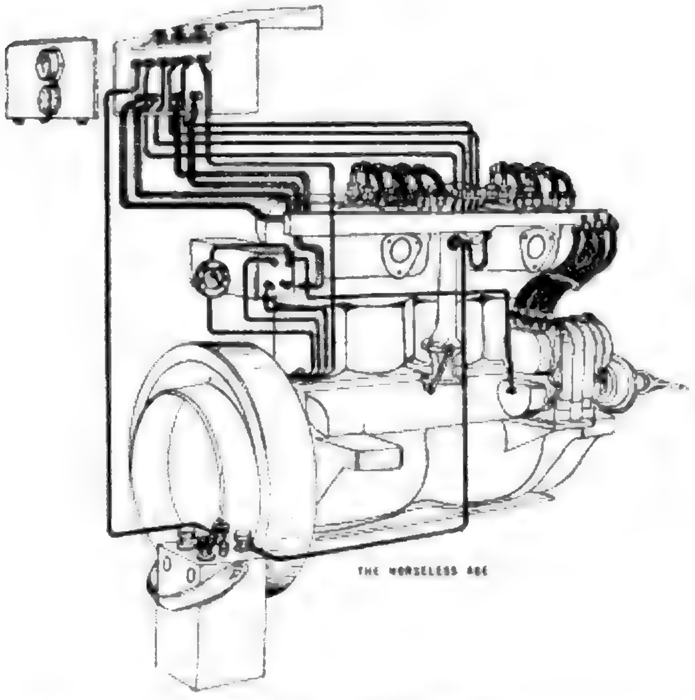


CLUTCH.

the fan shaft is operated by gears directly driven from the half time gears on the motor.

The ignition system consists of an Eisemann low tension magneto, the current of which passes through an induction coil on the dash, giving a high tension current at the spark plugs. In addition to the magneto system there is provided an entirely separate coil, commutator and battery system. All wires are connected with their terminals by spring attachments, so there are no thumb nuts to release and wires may be instantly detached and the magneto removed in about a minute. By the use of a solid rubber bar the length of wires has been reduced to a minimum, and the whole ignition system rendered simple, compact and of neat appearance.

The clutch is of the internal expanding band type, carefully balanced and designed to stop rotating as soon as disengaged, that the gears may be shifted noiselessly. Between the clutch and the change gear is a shaft made of special alloy steel, the ends of which are fastened and fitted into universal joints. These joints connect with the squared ends of the clutch and transmission shafts, respectively. The object of the universal joints is to take care of twisting of the frame over very rough roads, and consequent loss of power as well as excessive wear. This forked end construction is capable of adjustment, and the parts are easily removable.



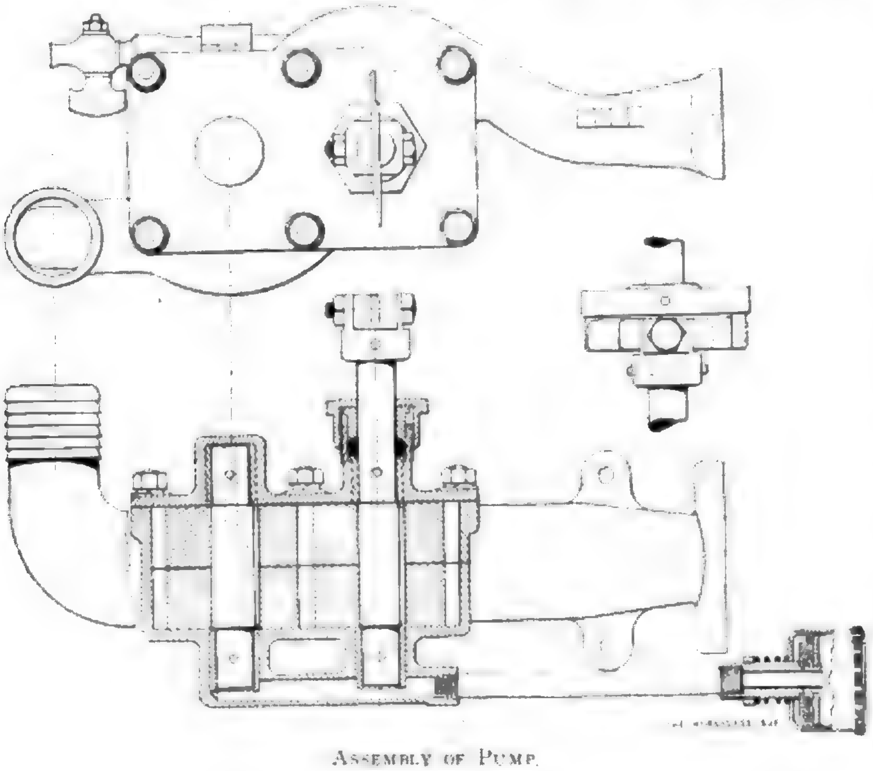
Peerless Ignition System.

The change gear case is an aluminum casting made in two parts, the base containing the main shaft, driving gears, countershaft and its pinions. The upper part of the speed case holds the mechanism for shifting the reverse gear. The change gear is of the selective sliding type. The mechanism for meshing the reverse consists of a rack, rocker arm and sector with a cam. The feature of the change speed mechanism is the locking device which prevents the gears from sliding out of place. The gear case proper is filled with lubricant through a hole fitted with a brass plug, and the bearings are lubricated by means of a manifold oiler.

The propeller shaft is fitted with universal joints at both ends. The type of universal joint on the propeller shaft of the 1909 cars has not been changed, but the joint has been improved in detail by the use of ball bearings and by increasing the dimensions. The universal joint pin now has a groove ground upon it and is filled with balls upon which an annular ball race turns. This ball race takes the place of the rollers on the older models. The joints are of specially treated alloy steel and ground to size. The joint is provided with a steel cover to hold sufficient grease for proper lubrication.

All the weight and load of the car is carried on heavy gauge steel axle tubes fitted into a cast steel differential housing centrally located between the rear wheels. The power is transmitted by means of bevel gears, a differential, and live axle shafts operating clutch plates engaging with the wheel hubs. On each side of the driving gears and connecting with the live axles are improved universal joints, which allow for camber and dish of the rear wheels. These joints are of a different type than in previous years. In appearance they look like a positive jaw clutch, the end of the axle proper ending in a jaw similar to a spur gear and meshing with a female jaw (shaped like an internal gear) on the differential. There are fourteen teeth in these jaws, and they are of peculiar shape to allow for universal action. By virtue of the greatly increased number of engaging joints (fourteen) over the previous year's construction (two), the universal action is more uniform, the wearing qualities are claimed to be greatly improved, and because the driving or engaging faces are at a much greater distance from the centre of the shaft than on the other types, the construction is stronger. They are made of imported steel specially treated.

The front axle is a solid one piece drop forging of I section, with spring saddles forged integral. The centre of the axle is the lowest point of the car. The pivot point



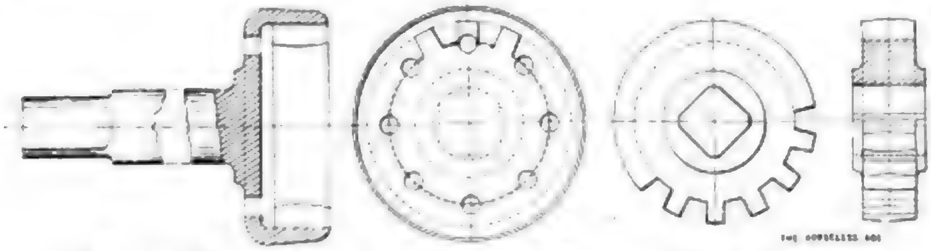
Assembly of Pump.

of the steering knuckle is supported on imported self seating ball bearings of large size. The steering mechanism is of the worm and gear type. The gear is a complete wheel and forged integral with the shaft, providing greater wearing surface. Thrust bearings are placed above and below the worm, and are self seating. An 18 inch hand steering wheel is used on both new models. The steel rod connecting the steering knuckles is placed behind the front axle.

The frame is of cold rolled pressed steel, of truss pattern, with a sub-frame on which the engine and transmission are carried. The drop frame adopted in 1906 is a feature of importance, since the load is brought down lower and does not interfere with road clearance. The springs are made by Lemoine of France, of silico manganese steel. Both front and rear springs are flat, giving easy action.

The wheels are of the artillery type, 36 inches in diameter, with dished spokes. The front fenders are flat and fitted with a wing which extends to the frame, thus preventing mud and water from splashing through the opening.

The body has a wide rear seat, and the tonneau is long and affords ample room for five people. The folding seats provided are claimed to be comfortable and easily removed. A new door latch affords an easy method of opening the door from the tonneau seat.



Female Member—Rear Axle Universal Coupling—Male Member.

Models 19 and 25 may also be equipped with limousine or landaulet body, which are interchangeable with the standard touring body. Both limousine and landaulet carry five people. Both models may also be equipped with a body of the roadster type. The roadster body, however, is not interchangeable on chasses equipped for touring limousine or landaulet bodies.

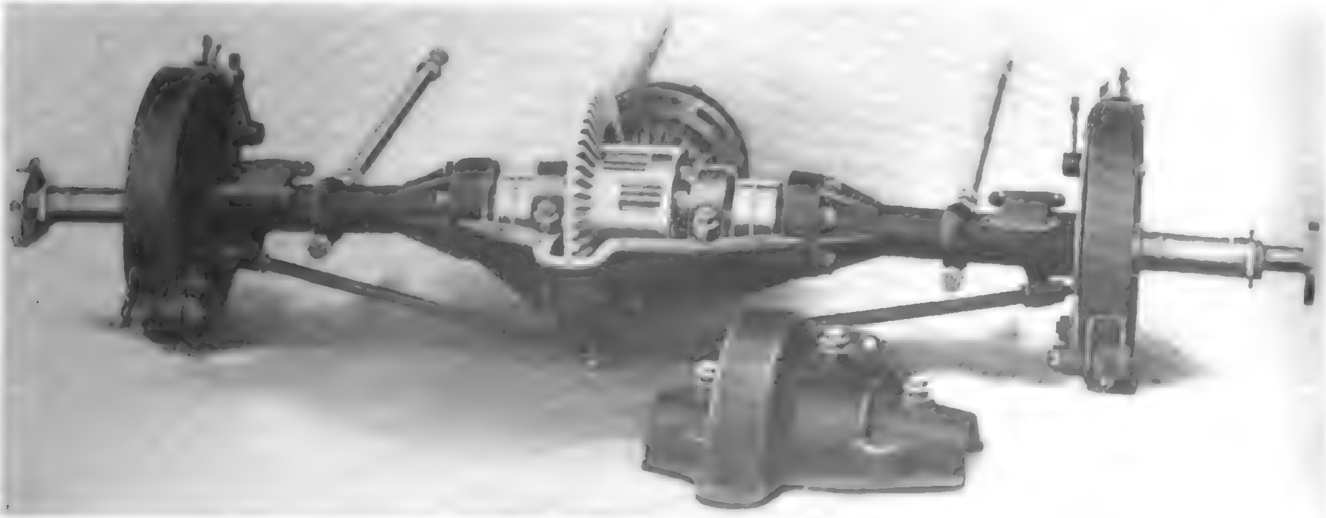
Model 18 Peerless, With Close Coupled Body.

The Walker Single Acting, Compound Automobile Steam Engine.

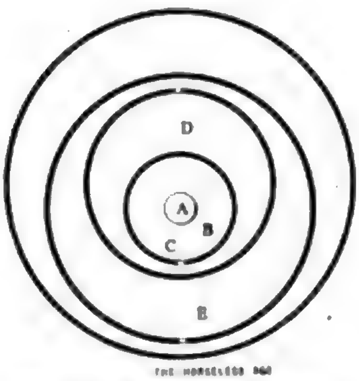
Wm. N. Walker, of Rome, N. Y., who has built double acting, compound steam engines for automobiles for a number of years, has recently brought out a single acting engine, which is herewith illustrated. It will be seen that there are four cylinders in all, two high pressure and two low pressure, and two crank shafts connected by spur gears, one of the cranks being acted upon by the two high pressure cylinders and the other by the two low pressure cylinders. The two cranks of each shaft are set at right angles, and the two shafts are so geared together that when the high pressure piston is at one end of its stroke the corresponding low pressure piston is at the opposite end of its stroke. The steam distribution is effected by means of two rotating balanced valves, one for the two high pressure and one for the two low pressure cylinders, located on top of the cylinders. By means of a change-over valve the engine can be operated as a simple engine, with high pressure steam in both cylinders. The valves are driven from the crank shafts by means of vertical shafts with spiral gears. Attached to the engine are two double piston pumps, which are driven through rock levers and links from the pistons.

The Oldberg Muffler.

This is one of the few mufflers which appear to have been designed with special at-

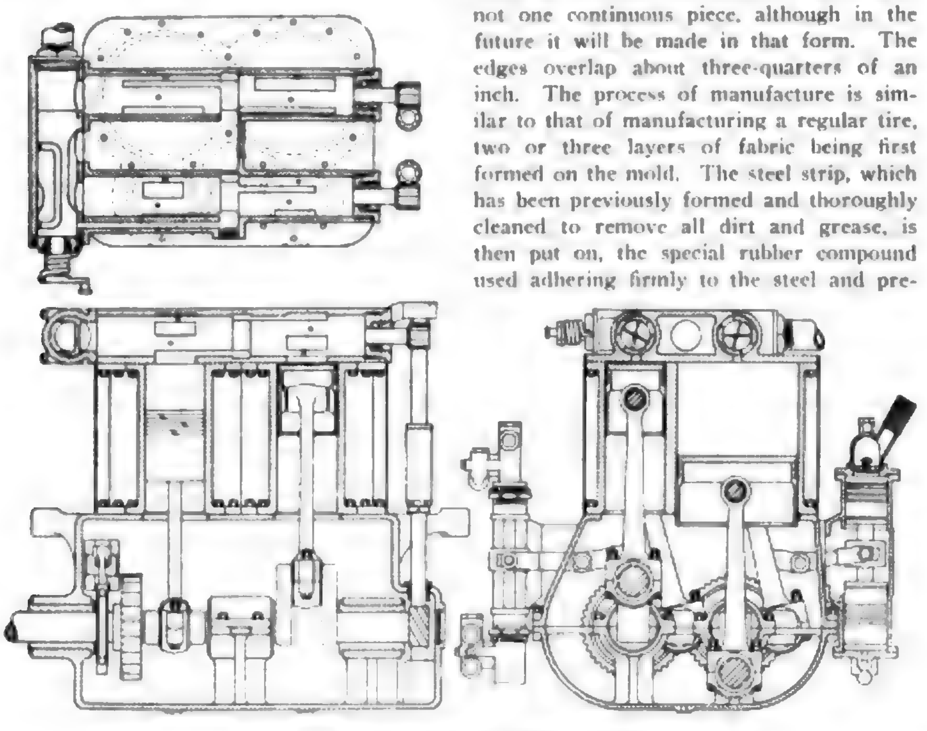


Peerless Arched Rear Axle.



Sketch of Oldberg Muffler.

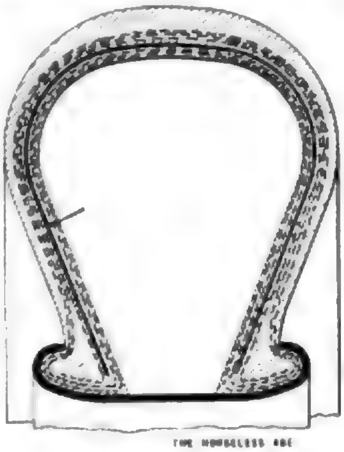
tention to the principles involved in the silencing of engine exhaust without the production of back pressure. It is made up of several cylinders placed with their axes eccentric, one within the other. The sketch shows an end view, and simply serves to illustrates the principle. The gas enters the inner chamber B through tube A. It passes from B through a series of holes C, entering the next larger chamber at its narrowest point. By passing through holes C its pressure is reduced 30 per cent., according to the law of flow through small orifices in a thin plate. Sound waves set up at C, pass from C equally to right and left and meet at D, where they tend to form a node, neutralizing each other. It is along this line that communication is made, by another series of holes, to the next larger chamber E. It will be seen that by properly proportioning the chambers the gases will expand adiabatically, and that pressure, noise and heat may be reduced to any degree desirable. The only precaution necessary to avoid back pressure is to have the inner cylinder proportioned to the size of the engine and to have so many holes that the gases will discharge rapidly enough, so that the pressure in the inner chamber will not rise if the engine is run rapidly. This muffler is made both in iron and aluminum. It is manufactured by the Gas Motor Testing and Engineering Company, 202 Pontiac Building, Chicago, Ill.



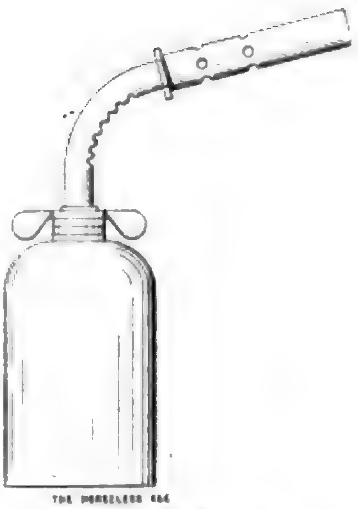
Walker Single Acting Compound Engine.

The Non-Blowout Tire.

A new tire of this name is being put on the market by De Camp & Lefferts, 284 Halsey street, Newark, N. J. It is said to be puncture proof and not to blow out. These qualities are obtained by incorporating in the tire during the process of manufacture a strip of specially annealed sheet steel a little less than one-thirty-second of an inch in thickness. Experiments have shown that it is almost impossible to break this strip by bending. As shown in the cross sectional illustration this strip extends around the tire from bead to bead, and is thus held secure when the tire is in place on the rim. At present this strip is not one continuous piece, although in the future it will be made in that form. The edges overlap about three-quarters of an inch. The process of manufacture is similar to that of manufacturing a regular tire, two or three layers of fabric being first formed on the mold. The steel strip, which has been previously formed and thoroughly cleaned to remove all dirt and grease, is then put on, the special rubber compound used adhering firmly to the steel and preventing any loosening of the strip and layers of fabric during the life of the tire. The rest of the tire is then built up. While the tire is less flexible to the touch than the ordinary tire, it is said to be just as resilient under load. During a test by the manufacturers they were surprised to find that they had been running without air in the inner tube, as it had been pinched when inserted. The tire retained its shape, however, even under load, and thereby showed its safety from rim cutting. The tires will be made in all standard sizes and cost from $5 to $8 more than the corresponding ordinary ones.



Non-Blowout Tire.



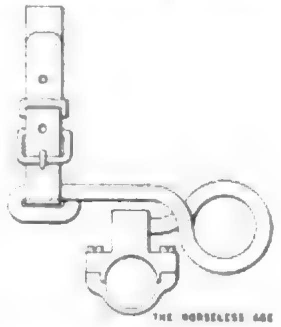
"Imp" Gasoline Torch.

The "Imp" Gasoline Torch.

The Frank Mossberg Company, Attleboro, Mass., have brought out a small gasoline torch for automobile and general use. It can be lighted by holding a match under the wick for about thirty seconds. It weighs only 3½ ounces and burns with one filling of gasoline for two hours.

The Thomas Upthrow Cushion Springs.

The Thomas Spring Works, Canisteo, N. Y., are marketing coiled springs designed to cushion the upthrow or rebound of the vehicle body. They consist of a stout steel wire, one end of which is secured by means of a clamp to the axle and the other end by means of a strap to a forged hanger bolted to the inside of the frame, the wire being coiled into two convolutions. The action is obvious.



Thomas Up-Throw Cushion Spring.

COMMUNICATIONS

The Gould Differential Once More.

Editor Horseless Age:

I have again read your last comments on the Gould balance gear, and also Mr. Gould's letter, and between the probable differences in the use of language and the complicated movements of the gearing I do not yet see the matter as you do. As I understand you, your contention is that if one shaft is fixed or held the case cannot be revolved, and so no power can be applied to the other wheel. If Mr. Gould admitted this I feel certain he misunderstood you. This is equivalent to saying that the eccentrics will not convert the motion of the case into revolutions of the axle at all. I do not believe this to be true, but that a statement of yours made in a former answer is the correct one, namely, that the eccentrics are not efficient converters of this motion. And in this fact is the merit of this device. Considered simply as a device for turning corners, it is very likely not so good as the common forms, but when you consider the many rigs running without balance gears you must admit that an efficient device for turning corners is not a necessity. But when it comes to one wheel being in the air or on a piece of ice, then the efficiency of this device is manifest, for it is then that its admitted inefficiency in driving one wheel with the other standing still results in driving the vehicle forward instead of losing propulsion altogether.

The point between us, therefore, seems to me to be whether with one wheel standing and the other moving the case can revolve and transmit any power to the moving wheel. If the case can not revolve at all then it clearly cannot drive one wheel without the other, but if it can drive even inefficiently then it can perform the functions of a balance gear. And this I feel sure it can do. It is admitted by all that with the case stationary one axle can be turned in one direction and the other in the opposite direction. This any balance gear will permit, and it represents a vehicle turning around a vertical axis passing through the centre of the rear axle. To make a vehicle do this force must be applied to it other than through the case, for we suppose the case to be standing still, and since one wheel goes back as the other goes forward it is manifest that there is no application of power to the case. Further, the Gould gear permits this movement as freely as any gear. I assumed in my last letter that such turning was due to force applied by means of the steering. I do not see that it matters how it is applied. If the front end of the auto is mounted on a wheelbarrow and trundled to one side or the other the motion of the balance gear will be the same. If a caster wheel was at the front and the driver steered by pushing the front to one side with a push pole, I fail to see any difference so far as the actual relation of the rear axles and balance gear parts are concerned. But having motor propulsion with an inefficient gear the outer wheel will not be driven so forcibly as with an efficient gear. With ratchet wheels the outer wheel is not driven at all. And on straightaway roads both wheels are driven alike, with either the regular, the Gould or the ratchet. Surely we agree thus far. And these two conditions are the simplest extremes. Why should we assume any different or unexperienced action for the intermediate positions where the inner wheel moves some, the outer more and the case at a speed between them? It seems to me the Gould device occupies the golden mean position between the regular which sends all the power to the outer wheel and the ratchet device which sends none of the power to the outer wheel. Further, the size of the eccentrics and how they are made up determine their efficiency and permit a maker to get just the result desired.

You are right about the differential action being necessary in turning an uphill corner, and the Gould device permits freely the different speeds of the wheels, just as does a ratchet device, but because of its inefficiency it will not drive the outer wheel so hard as it does the inner one (which does not mean lost power, however), and just in this same proportion will it drive the non-slipping or non-spinning wheel harder than the other, and so be of value on the ice or on the track where the wheels are off the ground much of the time. This is why I believe it to be "the thing" for solid tires or winter use or racing.

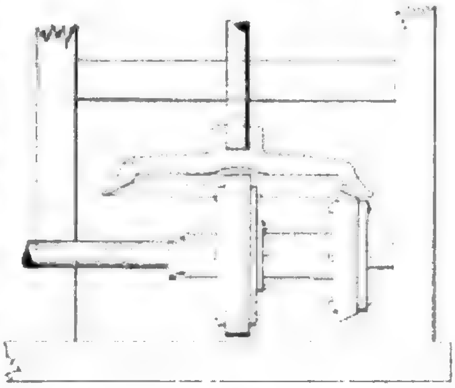
Chas. E. Duryea.

Friction Change Gear With Depression in Centre of Disc.

Editor Horseless Age:

I am much interested in Mr. Clough's articles on friction, change speed and transmission gears. I have a patented variable friction, and enclose an engraving of a sawmill feed which I have used for some time, which embodies a device for stopping the disc when the feed lever is at the central position. A slight concavity in the centre of the disc allows the friction wheel to revolve without touching the disc and does away with any side motion of the feed lever. The device has proved eminently satisfactory.

Geo. S. Comstock.



Who Furnishes Gear Muffling Grease?

Editor Horseless Age:

The writer thinks he remembers seeing an advertisement in your columns some time ago which described a grease for automobile crank and change gear cases and back axles which would make the running of the gears noiseless. In trying to recall what this was we think it specified very finely shredded cedar wood, but do not feel sure. In trying to find this advertisement we have looked without success, and appeal to you to tell us what you may know concerning the above, and if you are able to give the address of parties who furnish the grease in question.

Greenwood Brothers & Co.

[We regret to be unable to give the required address, but probably some reader can furnish it.—Ed.]

Cylinder Graphite Lubrication.

Editor Horseles Age:

I had thought not again to use your valuable time in matter of graphite lubrication, but the letter of Mr. Caverly prompts me to say this: I, too, tried the deflocculated form after my first experience with another variety (and I then used that just as Mr. Long suggested, a teaspoonful to the pint), and, while I had better results for a longer time, yet the final result was like the first experiment, viz., a short circuited spark plug.

The first symptom of this was a mysterious weakening of the engine, which gradually increased until the engine began to "skip." This loss of power was noticeable for two days before I was obliged to remove the plugs, place the cores in a chuck and grind off with carborundum cloth what looked like a film of graphite, which extended from the tip of the sparking point up to the rim of the cylinder. This was not carbonized oil, for these plugs have been in use for over a year, with no trouble whatever, until the graphite paste was used, and they are now in commission since removing the graphite, which had to all appearances burned on to the mica core.

In using this graphite paste I cut down the oil supply fully one-half, but it may be I was using too much oil before this, yet there was no smoke from the exhaust or other indication that this was so.

I am confident that this graphite paste is the best form of engine lubricant so far discovered, yet it seems to be a matter of experiment as to the proper quantity to use, and I should be greatly pleased to have someone else make such experiments.

R. L. Selden.

The Unit System of Power Transmission in Automobiles.

(Paper by Frank Beemer, read before the Society of Automobile Engineers at Detroit.)

Perhaps one of the most serious problems that confront the average automobile engineer in America and Europe today is the best and most economical way of transmitting power. There have been a large number of experiments made in various types which are commonly known as the transmission axle, the results most of which are in favor of this so-called unit system. There are quite a number of reasons why this system should and does save considerable power.

First—That it requires but one universal joint, either single or double. This is one of the points which, most engineers agree, consumes considerable power, while the driving at various angles of the propeller or cardan shaft through two or three universal joints is also very undesirable. The transmission applied on the rear axle allows the universal joint to be placed immediately back of the clutch and a considerable distance forward of the point where it would be placed in a car, with the transmission carried on the sub-frame, thus reducing the angularity of the propeller shaft to a minimum, and in most cases bringing it practically on a straight line with the crankshaft.

Second—The transmission and differential mechanism being placed in a single housing makes it very easy to have it in perfect alignment; this is one of the features that has proven from all experiments to be the principal factor in the saving of power. It is quite necessary, and has been recommended by all ball and roller bearing authorities, that to obtain the best results from the use of any type of anti-friction bearing it is absolutely necessary that the bearings be in perfect alignment. This question has been taken up in a very practical way, and it has been found that the unit system of power transmission permits freer action to the bearings, thus reducing the effect of the abnormal shocks and vibration to the bearings.

The tests that have been made of this system of transmitting power show a saving of from 16 to 20 per cent. of the power applied, or, in other words, it utilizes this much more power at the driving wheels in the ordinary designs, this amount being consumed by universal joints, angularity of Cardan shaft, disalignment of bearings, and many other sources of imperfection which are more easily taken care of in the transmission type of axle than in the various types of plain axles commonly used.

The automobile buyer of today in most cases considers very carefully the simplicity of the car, more than its style or appearance. He is not repeating the troubles which were experienced in the early days of automobiling, when many purchasers endeavored to secure a car which, in plain language, consisted of the greatest number of pieces for the money. It is a well known fact that where the acme of simplicity lies is the maximum of durability.

The automobile equipped with the unit system of power transmission has been taken by many reliable engineers as a parallel to the direct connected power set or unit found in the latest power plants, having the engine, which corresponds to the automobile motor, and the generator, which is the equivalent of the transmission devices. This has been found to be the most practical and economical method of producing electricity, and it is this idea, carried out as herein described, that forms one of the most economical ways of transmitting the power of an automobile motor to the road wheels through a system based on mechanical principles. It should appeal to most engineers as being one of the best and most practical methods of obtaining the result desired.

The saving of power, as above stated, is based principally upon hill climbing tests which were made with several cars equipped with the unit transmission system. I have been present at a number of these tests, and have driven some of these cars, which were equipped with the transmission on the sub-frame, and have noted carefully the working of all parts of the car. I have also taken the same cars equipped with the transmission axle, and in repeating the same tests have found that there is a very considerable increase in both speed and ease with which the motor will handle the car on the same hills.

I have also made certain speed tests with a car with all parts in good condition. The motor at its very best was unable to secure on good roads more than 40 to 45 miles per hour, while the same car, equipped with the transmission axle and with all conditions as nearly alike as possible, would develop with ease 55 miles, and even as much as 60 miles per hour. These and other efficiency tests tend to prove that the unit system of power transmission is without question one of the long looked for improvements in automobile design.

There are a number of arguments advanced in favor of the side chain drive for heavy cars. A car equipped with this drive, all adjustments being as correct as they were when leaving the manufacturer's hands, or as they were intended to be by the designing engineer, will prove efficient to a certain degree. There are, however, a number of annoyances connected with this system of propelling a vehicle that are very unpleasant, the principal one being the noise caused by the chains. It is essential, in this design, to have what is commonly called a radius rod to insure the proper distance between the centres of the sprockets. These are frequently adjusted to different distances, causing the chain to ride on the side of the sprocket, adding undue wear.

There are a large number of cars equipped with this system that are not provided with cases to protect them from dust and dirt, which quickly cause an extreme amount of wear, as the accumulation of dirt upon these parts absorbs the oil or grease used for lubrication, and it is only a matter of a short time until the correct pitch of the sprocket and chains are destroyed, and it is at this time that the greatest inefficiency must arise. I have also noticed on a number of chain driven cars, owing to the improper adjustments of the radius rods, that the rear axle does not set square or at right angles to the centre of the car, which causes friction and undue strains upon the bearings, sprockets, chains, as well as excessive wear on the tires.

While we have a few of these discrepancies in the bevel gear drive, it must be conceded that all the gears and other parts of the construction are properly protected from dust and dirt, and that at all times it has sufficient amount of lubrication, which not only adds to the life of the parts but reduces the friction, especially when working under excessive strains. Quite a large number, if not all, of these imperfections have been overcome in the unit transmission system, and the last, but not least, important feature of this system is the silence with which it transmits the power. I should say that it is physically impossible to obtain as quiet a running car with either the side chain drive or with a car equipped with the transmission on the sub-frame and using the plain type axle as it is with the unit system as has been herein described.

In the discussion of this paper Mr. Foljambe brought up the question of additional weight not supported by springs, where the change speed gear is carried upon the rear axle, and Mr. Alden agreed to contribute a paper discussing this point. The question of the practical advantages and disadvantages of a single universal joint in the propeller shaft was raised, and the opinion was expressed by Messrs. Wall and Coffin that while it was wrong theoretically it worked satisfactorily in practice. Mr. Wall will submit a written discussion of this point.

Testing Lubricating Oils.

By Henry Souther.

(Paper read before the American Society for Testing Materials, June 23-27, by Henry Souther; read by title.)

The automobile gas engine presented new problems. For high temperature work it might be assumed that high flash and high fire test oil would be most suitable. This has proven to be an incorrect assumption. Such oils would clog the cylinder of an automobile engine at once. An oil leaving behind it no solid residue in the combustion chamber of the cylinders is sought. To find a measure for this quality a new test has been developed that does not seem to be a correct one at first glance. All automobile cylinder oils are distillates. They should, therefore, not contain solid cokelike carbonaceous matter. It has been found that they do leave behind such a deposit which raises the compression of the engines and becomes incandescent, causing preignition under heavy duty, one of the worst of engine troubles. Heavy steam engine cylinders oils do this the quickest. This is not to be wondered at, as they are residue and not distillate oils. Such distillates also do it quicker than others, and the test which follows will indicate the relative quality of oils in this respect. Unfortunately, this test involves a large element of the personal equation. At the same time closely comparable results are obtained by several operators in the same laboratory. An effort has been made in the following detail of method to make it possible for a reader to duplicate all conditions of manipulation.

An oil showing more than .50 per cent. of cokelike residue is not suitable for automobile engine work. The best of oils contains .06 to .08 per cent.; a large number contain .20 to .40 per cent., and are entirely satisfactory. Steam engine cylinder oils contain in the neighborhood of 4 per cent., and are impossible to use.

The other desirable characteristics are as follows:

Flash point (as determined in open cup) not less than 360° Fahr.

Fire test, not less than 410° Fahr.

Viscosity at 100° Fahr. Saybolt Viscosimeter, not over 300 seconds.

Viscosity at 210° Fahr. Saybolt Viscosimeter, from 40 to 55 seconds.

Viscosity at 210° Fahr. Tagliabue Viscosimeter, from 60 to 75 seconds.

Carbon residue, not over .050 per cent.

The flash point shall be the lowest degree at which the vapor ignites and goes out. The fire test shall be the lowest degree at which the vapor ignites and continues to burn.

CARBON RESIDUE.

The apparatus used in this test is a glass retort of approximately 100 cubic centimetre capacity, with plain glass tubulature for cork stopper. Ground glass tubulature will not do, as heat will break it. These retorts are furnished by Bausch & Lomb Optical Company, and are known as No. 16,384 Special.

The method of operation is as follows: Take the above retort, clean it carefully, then heat over a Bunsen burner to remove the moisture and allow it to cool. Suspend by a light wire to balance, and weigh in about 40 grams of oil. Place the retort over a Bunsen burner for distillation with the cork stopper loosely fitted in tubulature. Distillation is commenced with the flame high enough to distil the 40 grams over in about 30 minutes, or at the rate of from 40 to 50 drops per minute. The rapidity of distillation is regulated by the dropping of oil. A slight smoky vapor will accompany the distillate if at the rate above mentioned. Toward the finish the rapidity of dropping will diminish to a very few drops per minute during the removing of the last trace of liquid oil.

Distillation is continued until the residue in the bottom of the retort is nearly dry. Increase the Bunsen flame to its full extent, and apply all around the sides and neck of the retort, until the oil condensed on the sides is also driven over. To accomplish this it is necessary to blow the vapor out of the retort several times by removing the cork and blowing through the tubulature.

The retort is then held over a blast lamp with a flame hot enough to wrinkle the glass but slightly. This heating is continued until all traces of oil are burned off, leaving only the carbon residue in the bottom of the retort.

The endpoint of the determination is clear. All except the desired carbon residue disappears very rapidly under this treatment. The carbon residue itself will begin to curl up if heated too strongly. The heating must be continued only long enough to dry the carbon residue proper. This is very easy if the amount of residue is small, and requires strong heating if considerable. Heating must be stopped before the carbon begins to burn even on the thin edges.

When the retort is cool it should be again weighed and the percentage of residue as compared with the original weight of the oil determined.

When this crude idea was first broached to me I combated the possibility of there being any virtue in this idea. All those skilled in the art of testing also do. Now I am a convert in its favor, having learned by experience of a very practical kind that oil tested in this manner that gives high results also gives trouble in an automobile gas engine.

Patent Commissioner's Annual Report.

Frederick I. Allen, Commissioner of Patents, has just issued his annual report for the year 1906, a portly volume of 1,200 pages.

In 1906 there were received 55,471 applications for mechanical patents and 806 applications for design patents. The number of patents that expired was 23,360. The number of allowed applications awaiting the payment of final fees was 10,800, and the number forfeited for non-payment of the final fees 5,021. The total receipts were $1,790,021.38, the expenditures $1,554,890.20, and the surplus of receipts over expenditures $236,030.18. The total balance to the credit of the Patent Office in the Treasury of the United States on January 1, 1907, was $6,427,021.86.

In proportion to population more patents were issued to citizens of Connecticut than to those of any other State—1 to every 1,074. Next in order are the following: District of Columbia, 1 to every 1,180; California, 1 to every 1,331; Colorado, 1 to every 1,400; Rhode Island, 1 to every 1,414; New Jersey, 1 to every 1,451; Illinois, 1 to every 1,551; New York, 1 to every 1,595.

As to foreign patents, 901 were granted to citizens of Germany; 852 to those of England; 461 to those of Canada; 314 to those of France; 133 to those of Austria-Hungary; 78 to those of Switzerland; 60 to those of Scotland; 61 each to those of Belgium and Sweden, etc. The condition of examining divisions at the close of the year 1906 was excellent.

The commissioner complains that a large number of the examining force resign annually because of the low salaries paid by the Department. Thus in 1906 the number of resignations from the examining corps of the office amounted to 32, distributed as follows: 2 principal examiners, 3 first assistants, 5 second assistants, 15 third assistants, and 7 fourth assistants. It will be seen that the largest number of resignations came in the grade of the third assistant, a grade in which an assistant may be supposed to have reached a capacity for effective and independent action in the transaction of the work of examining applications. At the present time the temptation to resign in order to accept employment with practicing attorneys or with large manufacturing establishments which have patent departments is not able to be met by any inducements which the office can present in the way of salary.

Another complaint to which the commissioner gives voice in his report is that the building now occupied by the Patent Department is inadequate for the purpose.

Imports and Exports Declining.

The returns for May show a considerable falling off in the value of both automobile imports and exports. The only consolation to the American industry is that the exports have not shrunk as much as the imports, and the parts manufacturers will be glad to learn that the exports of parts for the month actually show a considerable increase over the same month last year.

In May, 1908, there were imported 72 automobiles valued at $170,185, and parts valued at $42,515, as compared with 105 cars valued at $333,657, and parts valued at $75,768, during May, 1907. Of the cars imported last May, 52 were from France, 15 from Italy and 2 each from the United Kingdom and Germany. During the 11 months ending with May, 1908, there were imported 974 cars valued at $2,346,613, and parts valued at $428,078, as compared with 1,113 cars valued at $3,831,045, and parts valued at $717,234, during the same period the previous year.

During May, 1908, there were exported 229 cars valued at $389,487, and parts valued at $60,570, as compared with 281 cars valued at $618,018, and parts valued at $47,432, in May, 1907. During the 11 months ending with May, 1908, there were exported 2,206 cars valued at $4,008,724, and parts valued at $558,201, as compared with 2,567 cars valued at $4,221,316, and parts valued at $548,871 during the same period the previous year.

There appears to be no appreciable change in the number of owners of foreign cars who take them to Europe for tours. The numbers of foreign cars exported were 12 in May, 1908 (13 in 1907), and 94 during the eleven months ending with May, 1908 (68 in 1907).

Commercial Applications.

Gasoline Records in Taxicab Operation.

An accurate record kept of the gasoline consumption shows not only the fuel cost of operating each cab but also prevents small leaks, which may not be large for one day but become an important item for a month. Especially is this true where the driver is compelled to pay for his own fuel, as is the case with at least one large company operating in New York city. Unless the system is such that the man in charge of the gasoline has nothing to do with the money, there will be a great temptation for him to divert some of the money to his own pocket. In case the driver must buy some kind of check, which will be negotiable for gasoline, at the cashier's office, there will be a temptation here also for the clerk handling the checks to divert some of the receipts for his own use and make no entry of the sale. The writer has personal knowledge of several instances of drivers working for weeks at a time without the records showing that they had bought any fuel. Somebody else than the company got the money, and it undoubtedly amounted to a good deal, but just how much could not be ascertained, as at the end of the month, if the receipts ran behind the cost of the fuel, it was either charged to the repair department or to profit and loss.

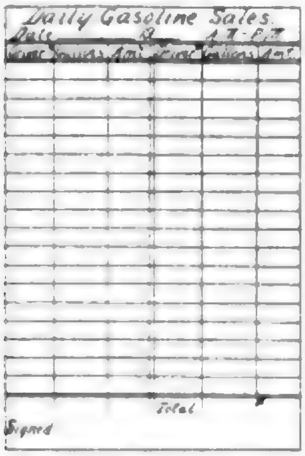

Daily Gasoline Sales.
Date 19 A.M.-P.M.
Total
Signed

FIG. 1.

From the writer's experience the following system, if properly installed and operated as any system must be to be successful—will eliminate these leaks and give an accurate record of the gasoline consumption for each cab, per day, week or month, and also the total consumption. If the driver does not pay for the fuel his cab uses the statistical importance of a system of this kind cannot be overlooked.

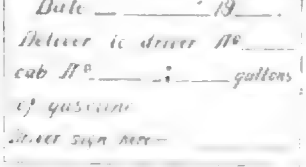

Date ___ 19___.
Deliver to driver No.___
cab No.___ ; ___ gallons
of gasoline
Driver sign here—

FIG. 2.

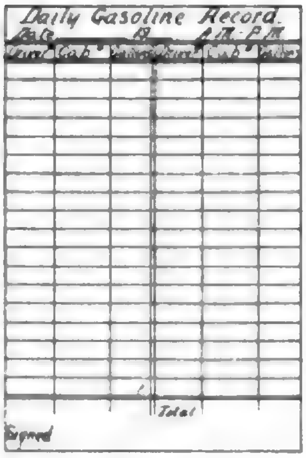

Daily Gasoline Record.
Date 19 A.M.-P.M.
Total
Signed

FIG. 3.

The system will first be described as applied to the case where the driver pays for his fuel. Some kind of check must be supplied which the driver buys at the cashier's office and later turns over to the man in charge of the gasoline, when he gets his fuel. These checks should be in charge of one man, who keeps an accurate account of them and checks them with the clerk and gasoline man. They should be of some durable material, such as sheet brass, and stamped with either the company's initials or some other means of identification. The reason for a careful and accurate account being kept of these is that they are easily counterfeited. Cards must be provided of a size convenient to fit any standard card system—properly ruled and printed on a good quality of Bristol board. These cards are for the use of the statistics clerk, the cashier and his clerks and the man in charge of the gasoline. The size depends largely upon the size of the business, but the forms illustrated in this article and which are 4x6 inches will be found convenient. Fig. 1 illustrates what we will term "Daily Gasoline Sales" card, and is used by the clerk in the cashier's office. When he starts to work he first fills in the date and his shift, whether it is a. m. or p. m. When a driver comes to buy his checks—having ascertained beforehand how many gallons he will require for his day's work—he gives his number and the number of gallons he needs, and the clerk enters this on the card and gives him the checks, one check being equivalent to one gallon. At the end of his day's work the clerk foots up the "gallons" and "amounts" columns, proves them with his cash and checks on hand, signs his card, and turns all over to the cashier, who rechecks them. For instance, the number of checks he started with, less the number sold, should equal the number on hand, and the number of checks sold times the price per check should equal the total of his cash.

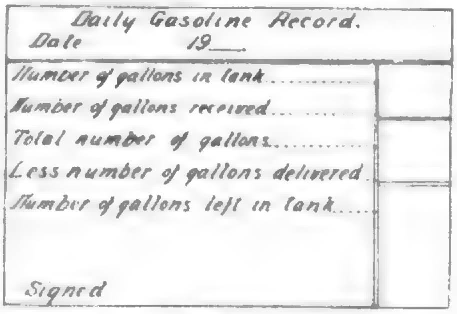

Daily Gasoline Record.
Date 19___
Number of gallons in tank..........
Number of gallons received........
Total number of gallons..........
Less number of gallons delivered.
Number of gallons left in tank....
Signed

FIG. 4.

Fig. 2 is the slip that the driver fills out, signs and hands with his check to the gasoline man, who then gives him the number of gallons he wants. Fig. 3 is the front of the card used by the gasoline man, and Fig. 4 the back. The front is filled in from the driver's slip, which can be kept on a spindle until the end of the shift, and then entered. At the end of the day he foots up the "gallons" column and proves his account. On the back, Fig. 4, he first enters the quantity in the tank when he starts. If more is received during the day this is added to the amount already in the tank. This total, less the number of gallons delivered to drivers, should equal the number of gallons left in the tank. The total number of gallons delivered should also equal the number of checks he has. After proving this card and his checks, he signs it and turns everything over to the cashier, who rechecks them.

Fig. 5 shows the card used for keeping the total gasoline consumption for the day, week and month. For a daily cab consumption this card can be ruled in columns for the cabs, as many cards being used as found necessary. This card is filled out from the card shown in Figs. 3 and 4. If the repair department needs gasoline the foreman fills out one of the driver's slips, inserting "Repair Department" in place of cab number, and signing it. It will thus be seen that it is a very simple matter to keep an accurate record of the gasoline supply, and by checking the clerk's cards by those of the man in charge of the gasoline any discrepancy can be at once located. If the driver does not pay for the fuel the only cards necessary are Figs. 3, 4 and 5, and perhaps Fig. 2.

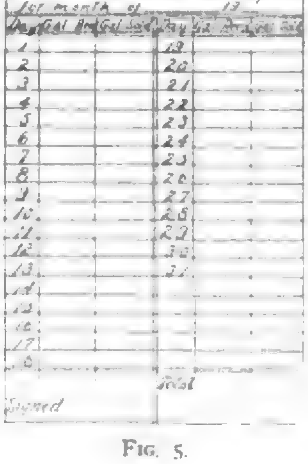

Gasoline Summary
for month of 19
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27 28 29 30 31
Total
Signed

FIG. 5.

Pennsylvania Railroad Adopts Motor Trucks.

The Pennsylvania Railroad Company, as an experiment, has introduced the use of electric trucks to expedite the handling of freight between stations in large cities. Such a service has been started between Kensington and Shackamaxon stations in Philadelphia, and if that is a success it is planned to try the same experiment in other large terminal cities, such as Pittsburg and Baltimore.

The motor truck which the Pennsylvania Railroad is using in Philadelphia is claimed to have saved between six and twelve hours in the handling of package freight between the stations named. This truck has a capacity of 5 tons, and is driven by a 6 horse power electric motor. It averages about seven and a half trips a day, carrying 2.2 tons per trip; its daily mileage averages about 8 miles.

Previous to the introduction of the automobile in the Kensington district, small lots of freight were sent from station to station in cars. With the automobile service congestions are relieved, and the movement of freight by a direct route instead of a circuitous one saves both time in delivery and the use of freight cars.

The Pennsylvania Railroad is also bringing the automobile into use in its passenger service. In Jersey City motor trucks of about the size of a three horse wagon are used in the baggage service. They are so built that when being loaded the floor of a truck is on a level with and flush against that of a baggage car. Many hard knocks are in this way saved to every trunk handled in this way through the Jersey City station. In moving a trunk from the car to the truck it receives about the same handling it would get in being shifted about inside the same car. This is but one of the trunk protective features of the trucks. Another is that they are enclosed entirely with a wire grating and leather top, preventing any scraping or falling in the trip across the river.

The service to which the new trucks are being put entails through trips between the baggage cars and the Twenty-third Street station in New York. They are loaded to their full capacity and are raised and lowered between the ferry level on elevators. The electric power does away with the manual labor formerly necessary to push loaded trucks up the heavy grades at the approach to the ferries at certain stages of the tide.

The truck is about 15 feet long and 5 feet wide, with a seat in front for the driver. Its height of about 9 feet is necessary that the floor of the truck may meet the baggage car floor on a level.

In Broad Street station, Philadelphia, trucks of about the size of an ordinary hand truck are in use for baggage and mail. The electric mechanism is placed under the body of the truck and is operated from the handle or "tongue." These automobiles have proved so satisfactory that there are now being built a number of small electric trucks for use in the new terminal station in Washington which will embody improvements to overcome the slight difficulties experienced with the first motor trucks placed in service.

The Taxicab Situation in Philadelphia.

At the present writing there are thirty-four taxicabs in active service upon the streets of Philadelphia. Twenty-five of these are operated by the Bergdoll Motor Car Company, of 323 North Broad street, and are Thomas cabs; eight are Mors, operated by the Pennsylvania Taxameter Cab Company, of the Bellevue-Stratford Garage. These last named cabs are remodeled touring cars, fitted with the regulation landaulet bodies. Several new concerns have announced their entrance into the field, but have not as yet put any cabs in operation, some being still in the incorporating stage.

Philadelphia is a city peculiarly situated with regard to taxicab service. In large cities like New York, where there are considerable portions of the city not covered by street car service, such as the Riverside Drive section, the taxicab is well patronized. In Philadelphia it is possible to reach almost every portion of the city by street car or motor bus, so the taxicab will have but a limited patronage at the rates now charged. Besides, the Pennsylvania Railroad has a most efficient horse cab service, the fares of which are somewhat below the rates of the taxicabs, which is another factor to be considered by prospective taxicab operating companies. The question of rates is an important one just now, and is said to be one of the causes why no more taxicabs are at present in service.

The field being limited to the habitual cab users (a very small proportion of Philadelphians), out of town visitors and those desiring short drives, it would appear that if the taxicab were placed in service in increased numbers its profit earning ability would be doubtful. At present the taxis are well patronized, and the demand is beginning to slightly exceed the supply, but as one interested in one of the taxicab companies recently said: "The company that puts on ten more cabs will probably write off a good loss at the end of their first year's operation. We have not quite enough now, but next month we may have to cut off five or put on a dozen."

Observations made at a taxicab headquarters on two successive afternoons resulted in the following table being made up from the call cards:

Trips of 2 miles or under, 57 per cent.
Trips of 2 to 3 miles, 25½ per cent.
Trips out of town, 1 per cent.
Trips of 4 to 5 miles, 9½ per cent.
Shopping or calling trips, 2 per cent.
Railroad calls, 4 per cent.
Trips over 5 miles, 1 per cent.

It will be seen from the table that most of the customers took a trip less than 2 miles; in fact over half of the total number. The second item embraces both those taking cabs home and those ordering them from their residences, and includes most of the habitual cab users. One out of town call was received to go to Merion, Pa., a round trip of 14½ miles. The 4 to 5 mile trips were mostly made by visitors to the city, riding for pleasure. Railroad calls were for trips from Pennsylvania and Reading stations to the hotels. One party hired a cab for a "seeing Philadelphia" trip, and this is indicated in the last item.

Motor Coaches for Philadelphia.

The Auto Transit Company, of Thirty-first and Dauphin streets, Philadelphia, have recently added twenty new electric coaches to their equipment, and are using the same over a portion of the route covered by the double decked buses, viz., from Penn square up Broad street, along Diamond street to Fairmount Park and return. These coaches carry twenty-eight passengers, seating them in either "pair seats," as in a trolley car, or on broad cross benches. The coaches are all supplied with standing tops and storm curtains, and are capable of a speed of 9 miles an hour with full load. The chasses of these coaches are of the same type as used for "sightseeing" and light omnibus service. The vehicles are steered by hand wheel and are fitted with five point controllers, with two braking positions, operated by the drivers' left hands. In addition a ratchet retained foot brake acts upon drums on each motor. Solid twin tires are fitted all around. There is a motor for each of the rear wheels, direct geared. It is purposed to increase the number of coaches in service as the summer advances.

The Dixville Notch Hotel Bus Service.

The Dixville Notch Corporation, owners of "The Balsams" and cottages at Dixville Notch, N. H., have had two Stevens-Duryea motor cars in use during this summer for regular bus service and for the carriage of pleasure parties about the neighborhood. The chasses are the regular six cylinder, 35 horse power type, and are fitted with a specially built body to accommodate seven passengers and the driver. The cars are housed in the garage belonging to the hotel.

The roads around Dixville Notch and Colebrook are for the most part of good dirt surface, with a small sprinkling of dust, which becomes bad during rains. The distance usually covered by these buses in performing the hotel's passenger service is about 10½ miles. The country thereabouts is quite hilly, necessitating the horse power with which the cars are equipped to carry eight in order to make better time than horse buses. The need for repairs has been chiefly due to poor judgment upon the part of drivers in not properly negotiating slippery roads, etc.

Commercial Notes.

The Mid-Missouri Transportation Company has started an automobile bus service between Ashland and Rocheport, a distance of 30 miles. Two trips will be made per day.

It is proposed to add automobile chemical wagons to the St. Paul, Minn., fire department.

C. F. Perry, a real estate operator of San Diego, announces that he is prepared to place in operation an automobile stage line between Los Angeles and San Diego as soon as passable roads can be made. The trip can be made in one day.

Juan R. Zavala, Guadalajara, Mexico, has been given a fifty year concession for an automobile renting business in that city. Mr. Zavala intends to purchase omnibuses, express wagons and pleasure cars, and to let them as horse carriages are let.

The contract for the automobile for Fire Chief James S. Canterbury, of Minneapolis, has been let to the H. E. Wilcox Motor Car Company, a local firm, the price paid being $1,750. The car will be the regular 1909 Wolfe, fitted with a 30 horse power Continental engine.

According to a report from London John Naughton, of New York, who is stopping at the Savoy Hotel, has placed a contract for 100 Argyle taxicabs for use in New York, and is also purchasing some of the necessary equipment, such as French horns, chauffeur outfits, etc., but no leather goods, which he claims are cheaper and better made in America.

The Taxi Motor Cab Company, with offices in the Motor Mart, Park square, Boston, last week placed in service fifty taxicabs of Thomas make. The rate of fare charged is 30 cents for the first half mile, 10 cents for each additional half mile and 10 cents for each six minutes waiting. Sub-stations will be maintained at the popular hotels and clubs, and at the two railroad stations.

Plans are under way for establishing a motor bus service between Shelby, Tyro, Sulphur Springs and Bucyrus, Ohio. H. W. Hildebrant, of Shelby, is interested. It is intended to purchase a Plymouth motor bus and to charge a round trip fare of 75 cents. A similar service has been in operation between Norwalk and New London, Ohio, and is said to have proven successful.

E. H. Clark & Co., who represent the Baltimore Taxicab Co., will conduct a taxicab service in Baltimore, starting with fifteen cabs on August 1, and intending to increase the number to fifty within five or six months. The rate charged will be 50 cents for the first mile, 20 cents for each additional mile, and 10 cents for every 10 minutes the cab is kept waiting. The cars used will be fitted with 22-24 horse power motors, and will accommodate four persons.

Opportunity for Automobile Service.

Three years ago the old stage coach which plied between Milford and Port Jervis, N. Y., the terminal of the Erie Railroad, was almost put out of business by the installation of three large passenger automobiles which covered the distance in half the time taken by the stage, and for the same price. Now, however, the people are taking to the stage coach again, because the automobile company has raised the fare to 75 cents. The busy season is almost on, and the automobiles should be kept very busy, but many people feel that they can ill afford to pay the additional price for automobile transportation. The automobiles used in this service are in commission only during the summer, which is one of the reasons why the company cannot operate them profitably at a fare of 50 cents. An out of town enterprise operating elsewhere during the winter months might be able to run an automobile service at the old rate. The transportation business is dull in the cities just at present, and some of the metropolitan concerns operating passenger automobiles might find it profitable to run a number of cars between Milford and Port Jervis during the height of the season there.

Foreign Clubs Stand by A. C. A.

A meeting of delegates of the recognized national automobile clubs took place at Dieppe, France, on July 6. W. K. Vanderbilt, Jr., and A. E. Batchelder, members of the recently appointed committee on foreign affairs of the A. A. A., made an attempt to induce the international committee to reverse the recent decision of the A. C. of France to disqualify any French manufacturer who may take part in the Vanderbilt Cup race, that is to be held under unsanctioned rules in this country next fall. Messrs. Vanderbilt and Batchelder were not admitted to the meeting, but their case was presented to the delegates by Count Sierstorpff, of the Imperial German A. C. The A. C. A. was represented at the meeting by Dave Hennen Morris, who was assisted by W. S. Hogan, the club's regular Paris representative, and George Heath, the race driver. The refusal of the delegates to admit the A. A. A. representatives to the meeting may have been prompted by the tenor of the reply sent by the A. A. A. to the foreign clubs upon the occasion of their protests against the Vanderbilt Cup race rules.

It is stated that the question brought up by the A. A. A.'s demand for recognition led to a heated discussion. The claims made on the association's behalf are that it is the largest and most representative organization in this country, and that it never received proper notification of the Ostend international racing rules. It was generally admitted by the delegates present that it would lead to no end of trouble if more than one club were recognized in any particular country, and in consequence the meeting was unanimous in approving the action of the French club. It was pointed out by the Marquis Ferraro, of the Italian recognized club, that a situation similar to that in America had obtained in Italy, where also a large local club is the recognized national club.

At the meeting a letter of good wishes from President Roosevelt was submitted through Judge Gary, president of the A. C. A., to Baron de Zuylen, president of the A. C. of France.

The Rockville (Conn.) Hill Climb.

A hill climb was held at Rockville, Conn., in connection with the centennial celebration there on June 30. Eight events were scheduled in the program, and fifty entries had been received from owners and dealers in Massachusetts and Connecticut. There were no entries, however, in the event for steam cars, and consequently only seven events were actually run. The scene of the contest is known as the New England Hill, the course being seven-tenths of a mile in length, with no bad turns and only two easy curves. The surface of the hill had been oiled. The only bad place along the course was a stretch of a couple hundred feet from the starting line, where the road leads under a viaduct and is quite narrow, and as the cars had quite considerable speed at this point, great care was required on the part of the drivers to prevent collision with the solid rock walls. The contest began at 2 o'clock. Some 5,000 people and perhaps a hundred automobiles lined the course. The McMurtry electric timing apparatus was used. Following are the summaries:

Event No. 1—For cars at $850 and under. Won by a Ford in 1:05 3-5.

Event No. 2—For cars at $851 to $1,250. Won by a Buick in 1:07.

Event No. 3—For cars at $1,251 to $2,000. Won by a Ford in 1:08 3-5.

Event No. 4—For cars at $2,000 to $3,000. Won by a Knox in 50 3-5.

Event No. 5—Won by a Knox in 50 seconds.

Event No. 6—Won by a six cylinder Stevens-Duryea in 41 seconds.

Accidents at Elkwood Park.

In spite of the almost universal condemnation of automobile racing on horse tracks, such a race was again held at the Elkwood Park mile track, Long Branch, N. J., on July 4, and resulted in two serious accidents. Owing to the rain which fell during the day the oiled track was exceedingly greasy, and both accidents were the results of bad skids in soft ground. Both occurred during the 50 mile "free for all" event in which seven cars started and five finished. In the first lap the Stearns, driven by Warren, slewed around square across the track, turned over and crashed into the fence. The driver jumped, breaking his collar bone and left leg, while his mechanic, Harry Crawford, was pinned underneath the machine, and had his left foot almost severed from his body. An Autocar, which was contending with the Stearns for the lead at the time, crashed into the overturned machine, and both its occupants were thrown out but not injured seriously. Later on in the same race the competing Renault car hugged the fence too closely, caught and tore away about 30 feet of it. Both occupants were thrown out, and the mechanic, Arthur Meyers, broke his right arm.

LEGISLATIVE and LEGAL

Rush of Registrations Under New Ohio Law.

COLUMBUS, Ohio, July 1.—Four thousand applications have been presented to the Secretary of State during the first twenty days that the State automobile law has been in effect, and owing to the fact that nearly all owners waited until the last day the new department has been swamped. The original force of two has been increased to eight, and they are still behind. It will be impossible to tell the number of automobiles in the State until after January 1 next, as the new law provides that persons holding annual licenses issued by municipalities need not apply for State registrations until the beginning of the next calendar year.

A question has been raised by a number of municipalities as to whether a city registration may still be required of owners, as well as the State registration. Owners in Cincinnati, where a vehicle license has been exacted for a number of years, will be subject to a double tax unless someone takes the matter into the courts, for the city solicitor of Cincinnati has held that the city may still exact tribute for use of the streets, notwithstanding the State fee. The law specifically states that municipalities may not make any speed regulations, but it is silent as to a municipality exacting a license—at least, it does not specifically prohibit it.

Brandt Whitlock, mayor of Toledo, wrote to Secretary of State Thompson asking if the city of Toledo might still continue to collect a license, but the Secretary refused to give a decision, saying it was not within his province to do so, and that he was merely enforcing the State law as he found it. There seems to be but little doubt that some one will take the question to the courts.

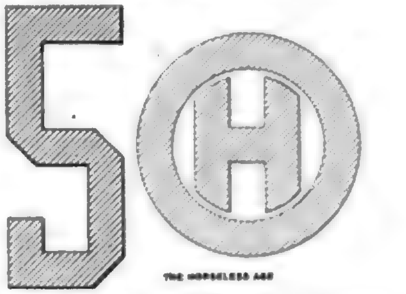
All the large cities of the State have been issuing an annual license except Cleveland, so applications from them will not come in in very great numbers until after the close of this year. In Cleveland the license was not an "annual" one. A $1 fee was exacted for a license, which was good indefinitely. In consequence Cleveland owners must immediately register under the State laws. There are about 7,000 machines in Cleveland. Fred Caley, in charge of the new automobile department in the State Secretary's office, has made arrangements with the Cleveland A. C. for the distribution of tags at Cleveland.

To ship the tags to each individual owner would cost 35 cents expressage for each tag. As now arranged, they will be sent by freight to the Cleveland club, which will put a man in charge of the distribution under Mr. Caley's direction. The action of the Cleveland men will save the State about $2,000 in express charges.

In response to requests for information, Secretary of State Thompson has ruled that municipal tags issued before June 10 will protect the holder until January 1, 1909. Municipal tags issued after June 10 will be of no value to any owner using them beyond the limits of a corporation, and will not furnish any exemption from the workings of the State law, even within corporate limits.

Five hundred paid chauffeurs have applied for registration and badges. The Secretary of State's office was unable to get license tags by the time the law went into effect, and issued letters for the owner to carry, certifying that registration had been legally applied for. The tags are now being received at the rate of about 400 a day from the manufacturers, and in a few days the bureau will have caught up with the applications, and no more letters will be issued.

Tag No. 1 was issued to Thomas B. Paxton, member of the House of Representatives from Hamilton County (Cincinnati), one of the enthusiastic workers for the State law.



DESIGN ADOPTED FOR OHIO AUTOMOBILE TAGS.

New Solid Tire Patent Decision.

The Grant patent on solid rubber tires (No. 554,675, of February 18, 1896) has again been declared valid by Judge Coxe of the United States Circuit Court of Appeals in New York city. The action was brought by the Consolidated Rubber Tire Company and the Rubber Tire Wheel Company, owners of the patent, against the Diamond Rubber Company, of New York, who were alleged to be making solid rubber tires in imitation of the Grant patent. A final decree sustaining the patent claims was entered March 2 last, but the defendants took an appeal. The appeal has now been decided by Judge Coxe, who also wrote the former decision. The judge holds that the appeal is a reargument of the questions decided in the case brought against the Firestone Tire and Rubber Company under the Grant patent, and he decided that another defendant had no right to go over the same evidence and call upon the court to reconsider it.

The Diamond Rubber Company, of New York is restrained by the decision from any further infringement of the Grant patent. A rather peculiar fact in this connection is that another court of the same rank has declared the Grant patent invalid in an appeal of the Goodyear Tire and Rubber Company, who had also been sued under the patent.

Garage and Repairman's Lien on Automobiles.

Following is the full text of the New York State law which gives garage and repairmen a lien on cars stored, supplied or repaired by them, which became a law on May 19:

Section 1. Article 6 of Chapter 418 of the laws of 1897, entitled "An act in relation to liens, constituting Chapter 49 of the general laws," is hereby amended by inserting therein a new section, to be Section 75 thereof, to read as follows:

Sec. 75. Lien of Bailee of Motor Vehicles. —A person keeping a garage or place for the storage, maintenance, keeping or repair of motor vehicles, as defined by the motor vehicle law, and who in connection therewith stores, maintains, keeps or repairs any motor vehicle or furnishes gasoline or other supplies therefor at the request or with the consent of the owner, whether such owner be a conditional vendee or a mortgagor remaining in possession or otherwise, has a lien upon such motor vehicle for the sum due for such storing, maintaining, keeping or repairing of such motor vehicle or for furnishing gasoline or other supplies therefor and may detain such motor vehicle at any time it may be lawfully in his possession until such sum is paid.

Sec. 2. This act shall take effect immediately.

Legal Notes.

Commissioner of Motor Vehicles J. B. R. Smith of New Jersey announces that he has provided all the identification marks for which applications have been made, and that hereafter no excuse will be accepted in the case of failure of motorists to display the proper number plates.

A temporary injunction has been issued by the Superior Court at Boston on motion of Charles P. Cummings, restraining W. S. Daniels from selling or revealing a secret process for a tire filling compound said to be the invention of Dr. Joseph P. Bodge, of Portland, Me., with whom Cummings is in partnership.

Representative Wilson, of Tangipahoa, La., has introduced in the Louisiana House an act providing for the registration, identification and regulation of motor vehicles. According to the provisions of this bill every car must be registered with the Secretary of State, and a license fee of $1 must be paid. License numbers in black Arabic numerals not less than 3 inches high and of not less than one-half inch width of stroke must be carried on the car. Anti-skidding devices must be applied to the tires when the roads are slippery. The chauffeur's registration fee is fixed at $2. The penalties for violations of the various acts range from $25 to $1,000 fine or imprisonment up to one year, or both.

An ordinance has been introduced into the Montclair, N. J., town council prohibiting the tooting of automobile horns in the streets at late hours.

The grand jury of Oakland, Cal., has requested the judges of the city courts to adopt more decided measures to repress automobile speeding, and the judges have agreed to impose a minimum fine of $5 on all drivers found guilty of violation of the speed ordinance.

Commissioner of Motor Vehicles J. B. R. Smith of New Jersey, has informed the Mercer County Board of Freeholders, who had complained to him regarding the destruction of the county roads due to excessive speeding, that the State can do nothing to suppress speeding, the policing of the roads being a duty of county and municipal authorities.

The road committee of the Board of Freeholders of Passaic County, N. J., at a recent meeting of the board at Paterson recommended that the State Supervisor of Roads be notified regarding the damage done to macadam roads by heavy motor trucks, and that he be asked to inform the board what steps might be taken to restrict the use of the highways by these vehicles, and also to ascertain if the companies might be called upon to bear the cost of repairing the damage.

Entries for A. A. A. Tour.

The following is the complete list of entries for the A. A. A. Tour up to date:

FOR GLIDDEN TROPHY.

1. Chas Clifton, Pierce, Buffalo.
2. Chas. Clifton, Pierce, Buffalo.
3. J. W. Maguire, Pierce, Buffalo.
4. R. M. Owen, Reo, Buffalo.
5. E. H. Parkhurst, Peerless, Columbus.
6. E. H. Parkhurst, Peerless, Columbus.
7. E. H. Parkhurst, Peerless, Columbus.
8. R. M. Owen, Premier, Buffalo.
9. H. O. Smith, Premier, Buffalo.
10. Paul Gaeth, Gaeth, Rochester.
11. Gus G. Buse, Thomas, Rochester.
12. H. H. Franklin, Franklin, Syracuse.
13. John Wilkinson, Franklin, Syracuse.
14. G. H. Stillwell, Franklin, Syracuse.
15. Andrew Cuneo, Rainier, ———.
16. J. F. Duryea, Stevens-Duryea, Springfield.
17. I. H. Page, Stevens-Duryea, Springfield.
19. F. H. Nutt, Haynes, Chicago.
20. Loring Wagoner, Haynes, Chicago.
21. Frank E. Wing, Marmon, Bay State.
22. W. C. Marmon, Marmon, Bay State.
23. W. C. Marmon, Marmon, Bay State.
24. E. B. Stratton, Studebaker, Rochester.
25. E. B. Stratton, Studebaker, Rochester.
26. E. B. Stratton, Studebaker, Rochester.
29. A. R. Davis, Garford, Cleveland.
30. A. R. Davis, Garford, Cleveland.
31. A. R. Davis, Garford, Cleveland.

FOR HOWER TROPHY.

100. R. D. Garden, Pierce.
101. R. M. Owen, Reo.
102. W. H. Vandervoort, Moline.
103. Charles Clifton, Pierce.
104. George A. Weidely, Premier.
105. John Breyfogle, Peerless.
106. F. A. Barton, Franklin.
107. U. T. Moore, Stoddard-Dayton.
108. E. W. Shirley, Overland.
109. H. C. Tillotson, Stoddard-Dayton.
110. J. N. Willis, Overland.
111. J. N. Willis, Overland.
112. P. G. Cox, Stoddard-Dayton.

FOR CERTIFICATE.

27. J. B. Eccleston, Oakland.
28. E. M. Murphy, Oakland.

NON-CONTESTANTS.

18. C. H. Foster, Gabriel Horn Car.
96. Official Car, Packard.
97. R. M. Owen, Reo (pilot).
98. R. M. Owen, Premier (pilot).
99. Charles Clifton, Pierce (chairman's car).

Ford Motor Company to Erect New Factory.

On June 16 last, five years after the Ford Motor Company, of Detroit, was organized, it was announced that plans had been accepted for what it is claimed will be the largest automobile factory in the world. It will consist of one main building, a separate office building, a separate power house and a large group of saw-tooth roof buildings. The main building, which will be 865x75 feet and four stories high, will be of fireproof construction, of reinforced concrete, glass and steel; it will have a total floor space of 258,000 square feet. The site of the new factory is the old Highland Park Race Track property, a tract of 60 acres, which is owned by the Ford Company. The mile track on this property will be used for testing purposes.

New York-Chicago Motor Cycle Run Starts.

The endurance run of the Western section of the Federation of American Motor Cyclists started from the Hotel Empire, New York, on Monday morning, July 6. There were seventeen starters, comprising five teams of three riders each and two unattached entrants. The route to be followed leads through Albany, Utica, Syracuse, Rochester, Buffalo, Erie, Cleveland, Toledo and South Bend, and it is expected to finish at Chicago on July 16, although no definite schedule has been fixed in advance. This is the first long distance motorcycle event ever held in this country. The first prize is a trophy valued at $500. Following is a list of the starters:

Indian Team.—S. T. Kellogg, George N. Holden and B. S. Barrows, all of Springfield, Mass.

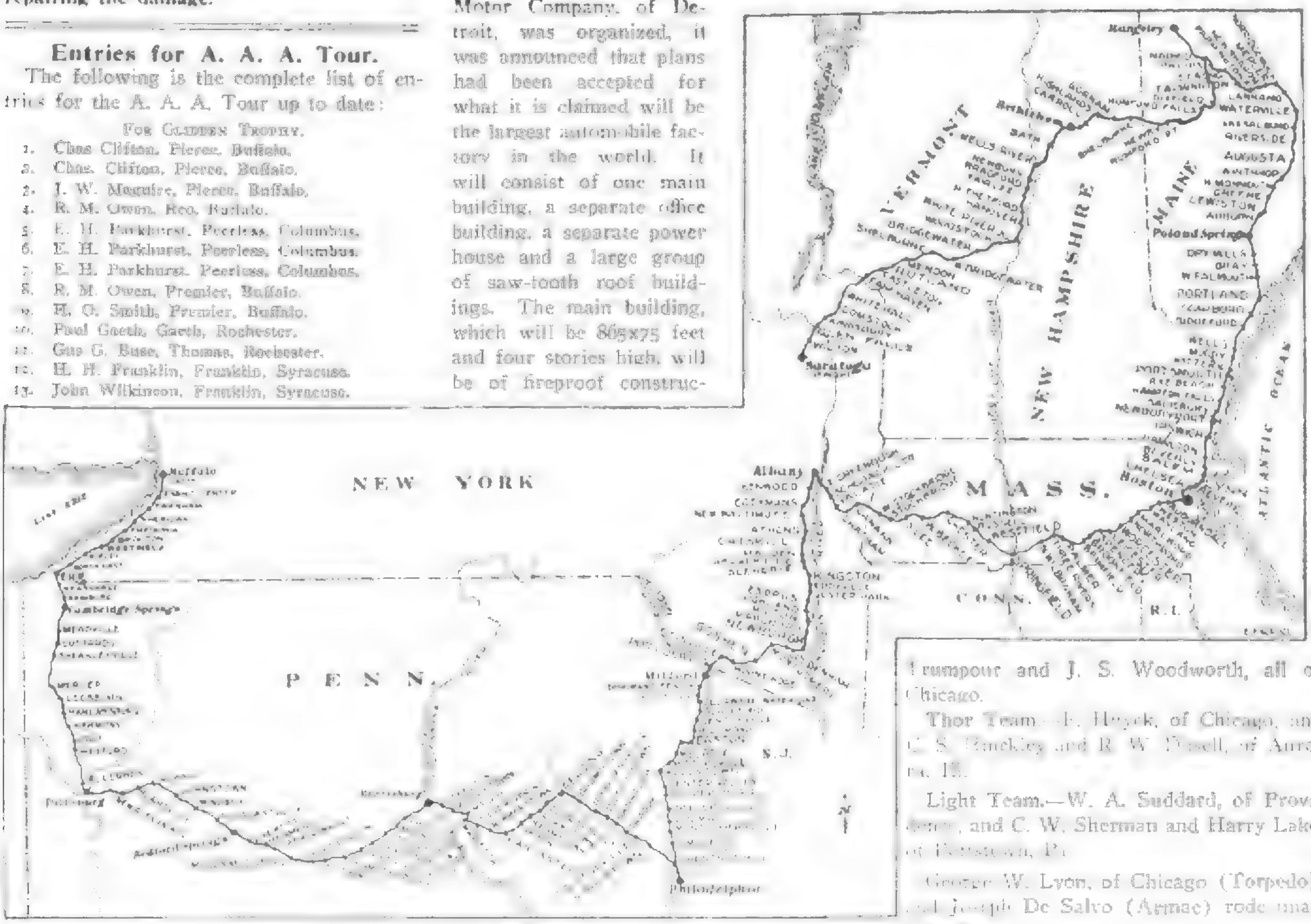
Merkel Team.—Edward Buffum and W. P. White, of Milwaukee, and J. A. Turner, of Chicago.

Excelsior Team.—Arthur Lyons, N. C. Trumpour and J. S. Woodworth, all of Chicago.

Thor Team.—E. Hoyck, of Chicago, and C. S. Hinckley and R. W. Powell, of Aurora, Ill.

Light Team.—W. A. Suddard, of Providence, and C. W. Sherman and Harry Lake, of Pottstown, Pa.

George W. Lyon, of Chicago (Torpedo), and Joseph De Salvo (Armac) rode unattached.



ROUTE OF GLIDDEN TOUR.

Germany Wins the Grand Prix Race.

Lautenschlaeger, driver of one of the Mercedes cars, proved the winner in this year's Grand Prix race, which took place on the Dieppe circuit on Tuesday. He covered the ten rounds of the triangular course of 47.83 miles in 6 hours 55 minutes 43 4-5 seconds, which is equivalent to an average speed of something over 69 miles per hour. Hemery (Benz) took second place, and Hanriot (Benz) third. Fourth place went to a French car, the Bayard-Clement, driven by Rigal. The next three places also went to German competitors. Following are the times of all the twenty-three competitors who finished the race:

1—Lautenschlaeger, Mercedes	6:55:43 4-5
2—Hemery, Benz	7:04:24
3—Hanriot, Benz	7:05:13
4—Rigal, Clement-Bayard	7:30:36
5—Poege, Mercedes	7:32:31
6—Joerns, Opel	7:39:40
7—Erle, Benz	7:43:21
8—Dimitrievitch, Renault	7:54:12
9—Heath, Panhard	7:55:36
10—Perpere, Germain	7:59:08
11—Cagno, Itala	8:07:56
12—Gabriel, Clement-Bayard	8:11:44
13—Courtade, Motobloc	8:12:42
14—Garcet, Motobloc	8:19:56
15—Caillois, Renault	8:19:57
16—Jenatzy, Mors	8:24:44
17—Jarrott, Mors	8:30:20
18—Brabazon, Austin	8:42:50
19—Resta, Austin	8:46:50
20—Fournier, Itala	8:47:20
21—Opel, Opel	9:08:11
22—Degrais, Germain	9:13:34
23—Farman, Panhard	9:24:40

Of the forty-nine entries for the race, forty-eight started, one of the three Mors cars, which had been entered after the preliminary closing date at the double fee of $2,000, being withdrawn without any reason being assigned. The weather was fine, and the course, which had been tarred over its entire length, was in good condition. A terrific pace was struck right in the first lap, the record for a single lap, set by Nazzaro last year, viz., 38 minutes 16 seconds, being beaten by no less than six competitors during this round, the best time being made by Salzer (Mercedes), viz., 36 minutes 31 seconds. In judging this speed it must be taken into account that a strong gale was blowing along the coast stretch of the triangular course directly in the face of the drivers, which retarded them considerably. Another factor to be taken into account is that the cylinder bore was limited, while last year only the fuel consumption was limited. In the second lap Nazzaro (Fiat) gained the lead, which he held until the fourth lap. Among the leading cars in the first several laps were Salzer (Mercedes), Thery (Brasier), Bablot (Brasier), Szisz (Renault) and Wagner (Fiat). In the fourth lap Lautenschlaeger gained the lead, followed by Thery (Brasier), Hemery (Benz) and Hanriot (Benz) in the order named. This order remained unchanged during the next three laps, when Thery had trouble with his tires and dropped behind, from which point on the three German cars remained at the head.

The Thomas car had an accident with its gear box shortly before the start, the first and second speed gears being stripped and the reverse rendered inoperative. Nevertheless, Strang started and completed four rounds of the course in the following times: First round, 53:44; second round, 63:46; third round, 56:47; fourth round, 58:01. In the fifth round he retired, owing to the bursting of a cylinder. He also complained of tire trouble in every lap.

Two of the contestants were killed in an accident during the race. These were Cissac, driver of one of the Panhard cars, and his mechanic, Schaub. The accident occurred during the last round, and was due either to the bursting of a tire or the breaking of a detachable rim at a sharp turn. The machine turned turtle and fell on the two men, who were killed almost instantly. Two of the English Weigel cars, driven by Harrison and Laxen respectively, also turned turtle during the race. Harrison was pinned underneath the machine and seriously injured, but it is thought that he will recover.

The grand stand erected near Dieppe, with a capacity of 6,000 persons, was fully occupied, and hundreds of thousands of people lined the course. Many camped out along the course all night, and some of the spectators came all the way from Paris in taxicabs, the taximeters keeping on registering during the race at the rate of 50 cents per hour.

When the winning car passed the line Lautenschlaeger was taken to the presidential box and congratulated by Under Secretary of the Interior Maujan, who represented President Fallieres. The winner was liberally cheered, although it was evident that the crowd had come to see a French car win. President Van Zuylen, of the A. C. of France, sent a telegram to Emperor William, congratulating him on the success of the German team. The winning car is a four cylinder machine, of the extreme permissible cylinder bore of 155 millimetres and a stroke of 170 millimetres. Lautenschlaeger, who is a foreman of the Mercedes works, is a comparative novice in race driving. All of the first three cars were equipped with Michelin tires.

As usual, there was a good deal of betting, Szisz and Nazzaro being the favorites. The odds against the single American entry were 35 to 1. One of the hits of the race was the plucky showing made by Hemery, who eventually secured second place. When the race was about half over a stone thrown up by one of the wheels of his car broke one of the glasses of his goggles and drove a bit of glass into his eye. At the end of the round he stopped for a moment at the grand stand to have the glass removed by an oculist, but as it could not be found he refused to stop any longer, and after some cocoaine had been injected to kill the pain he started off again at great speed.

Of the 48 starters 23 were French, 9 German, 6 Italian, 6 English, 3 Belgian and 1 American. Twenty-three cars finished, of which 7 were German, 12 French, 2 English and 2 Belgian.

Following is a list of the entries:

FRANCE.

Brasier—Drivers, Thery, Baras and Bablot.
Bayard-Clement—Rigal, Gabriel and Hautvast.
Loraine-Dietrich—Duray, Rougier, and Minoia.
Motobloc—Courtade, Pierron and Garcet.
Panhard-Levassor—Heath, Maurice Farman and Cissac.
Renault—Szisz, Caillois and Dimitriewitch.
Mors—Jenatzy, Landon and Jarrott.
Porthos—Stricker, Gaubert and Simon.

GERMANY.

Benz—Hemery, Hanriot and Erle.
Mercedes—Lautenschlaeger, Salzer and Poege.
Opel—Opel, Joerns and Michel.

ITALY.

Fiat—Nazzaro, Lancia and Wagner.
Itala—Cagno, Fournier and Pacienza.

ENGLAND.

Austin—Moore Brabazon, Resta and Wright.
Weigel—Laxen, Coleman and Harrison.

BELGIUM.

Germain—Degrais, Roch-Brault and Perpere.

UNITED STATES.

Thomas—Strang.

The Voiturette Grand Prix Race.

The race for small cars or voiturettes, which forms a sort of prelude to the regular Grand Prix race, was held on the Dieppe circuit in northern France on Monday, July 6. A total of 64 entries had been received for this event, but only 47 cars started, and of these 31 finished the six laps of the circuit. The race was won by Guyot, who drove an 18 horse power De Lage car, whose time for the 287 miles was 5h. 45m. 30s., corresponding to an average speed of nearly 50 m. p. h. Second place was taken by M. Naudin, driving a single cylinder Sizaire-Naudin, whose time was 5h. 52m. 6s. Naudin made a desperate attempt toward the end of the race to catch up with Guyot, making the fastest lap of the whole race, but Guyot, who had taken the lead at the very start of the race, held it till the end. Third place was secured by M. Goux, driving a Lion-Peugeot, his time being 5h. 56m. 1s. Ingernoy (Lion-Peugeot) was fourth, and Thomas (De Lage) fifth. The De Lage team won the regularity cup for the best team work. All of the first five cars were fitted with Michelin tires. Forty of the starters were French, three Italians, three Swiss and one German.

Several accidents marred the race, these being due to collisions between competing cars. In one of these collisions the mechanic of one of the cars was thrown out and broke his arm. The race was witnessed by a crowd estimated at 100,000 by one authority, while according to another source the attendance was very small. A grand stand had been erected opposite the start at Dieppe, facing toward the ocean, but it was only one-tenth occupied, being capable of seating 6,000. The course was guarded by a whole brigade of troops, who were stationed at distances of 50 feet.

MINOR MENTION

According to a report from Toledo, Ohio, an offer of $400,000 has recently been made for the Pope plant in that city by a Virginia capitalist.

The Oakland Motor Car Company, of Pontiac, Mich., are considering the purchase of magnetos for their two cylinder vertical motors.

The Stromberg Motor Car Devices Manufacturing Company have secured offices in the Thoroughfare Building, Broadway and Fifty-seventh street, New York city.

The Media Auto Supply and Construction Company has been organized at Media, Pa., with John H. Flemming as president. The company will locate at Front and Orange streets.

The J. V. Lindsley Company, of Chicago, who recently bought the Lake & Neff automobile factory in Dowagiac, Mich., will enlarge the plant. Frank Lake has been retained as manager.

The Palmer & Singer Manufacturing Company has discontinued the New York agency for the Selden car. The Selden Motor Vehicle Company is now represented in New York by its engineer, E. T. Birdsall, who has an office at 41 West Sixty-third street.

The A. Burdsal Company, Indianapolis, manufacturers and wholesale dealers of paint, have purchased a 30 horse power motor delivery wagon to attend to their deliveries in that city. This is the first concern of its kind in Indiana to make use of such vehicles.

A change in the running schedule of the Glidden Tour was announced by Chairman Hower last week, according to which the tourists will remain in Boston for two days, Saturday and Sunday, July 18 and 19, and the whole event will extend over fifteen days instead of fourteen.

The National Auto Accessories Company has been formed at Salem, N. H., with W. D. Pulver as president; F. W. Woodbury, treasurer, and Arthur England, secretary, to manufacture the national carburetor, which was formerly manufactured in Merrimac. A four story brick building, with 12,000 square feet floor space, has been secured for a factory.

The receivers of the Pope Manufacturing Company have received an offer from Howard Cole to purchase a block of Columbia Steel Company stock of a par value of $300,000, which is held by the Pope Manufacturing Company. Mr. Cole's offer being $135,927.75 cash, and waiving of allowed claim of the Columbia Steel Company against the Pope Manufacturing Company to the amount of $54,072.25, making together $190,000. The receivers state that this is the best offer they have ever received for this stock, and they have applied to the Court of Chancery of New Jersey for instructions whether or not they should accept this offer. A hearing of the creditors of the Pope Company in this matter will be given at the Chancery Chambers in Newark, N. J., at 10 a. m. on July 14.

The Nordyke & Marmon Company, Indianapolis, state that they will sell their cars in that city direct from the factory in the future. Last season the Marmon was represented in Indianapolis by the Gibson Automobile Company, while the H. T. Hearsey Vehicle Company had the agency this year. The company is bringing out a 50 horse power, water cooled, seven passenger car and a runabout for next season.

It is stated that the cost of the new Peerless building will be only $1.105 per square foot of floor space, although the plan calls for the highest class of construction, while a similar building erected by the same company last year, and in which wood was used instead of steel in some places, cost $1.36 per square foot of floor space. The total cost of the present structure is $29,500.

W. H. Shroyer, an automobile manufacturer of Miltondale, Kan., says that the automobile is actually supplanting the horse in his State. Mr. Shroyer buys the parts of his cars in the East and assembles them; builds the bodies and does the upholstering in Miltondale, where he owns shops. The motor car, he says, is especially practical in Kansas, where there are long stretches of level prairie roads and great distances between points.

The Piedmont Buggy Company, Monroe, N. C., has just completed a motor buggy, which is thought to be the first motor car built in the South. The car weighs 800 pounds, and is propelled by a 10 horse power, air cooled gasoline motor. The gasoline tank has a capacity of 4 gallons, the wheels are fitted with solid rubber tires, and all axle bearings are Timken roller bearings. A number of these buggies are to be manufactured for the market.

H. D. Wilson, who is in charge of the Packard office in Paris, reports to his company that from the middle of March to the present time no less than twenty-five parties touring Europe in Packard cars have called at his office, and several others have been visited by him at their hotels. In addition to these, a number are still in the south of France and Italy, and he believes that at least fifty Packard cars will be taken to Europe by their owners this year.

The automobile is mixing into Kansas politics. Senator Chester I. Long of that State, who wishes to go back to Washington, and Cyrus Leland, who would have the Republican nomination for Governor, are making tours of the State mainly by motor car. The cars save time waiting for accommodation trains, which run with painful infrequency in the rural districts, and have made it possible for the campaign orators to cover the State in half the time used under the old system.

In Iowa 1,436 cars were registered during the first six months of the year, 408 of these during May. The total number of registrations in the State up to January, 1908, was 4,700, which may permit some conclusions as to the actual state of the automobile business in the Hawkeye State.

Lewis R. Kirby, district attorney of San Diego County; Howard Cherry, auditor of the county; Mrs. Cherry and her daughters, were crossing San Diego Bay on the evening of June 26 in the ferryboat going to Coronado. All but Kirby were seated in an automobile, which Kirby began to crank. The car started and knocked Kirby overboard. Mrs. Cherry jumped to the deck of the boat, but the others went into the bay. All were rescued little the worse, except Cherry, who was taken to a sanitarium.

The Electric Welding Products Company, of Cleveland, Ohio, has recently installed a grinding and finishing department, consisting of several Brown & Sharpe plain and universal grinders, special imported machines for spline milling or slot cutting, as well as centering machines. The company is now able to turn out their combination valves, ground on both seat and stem, with a slot, groove or thread cut, or a hole drilled and the end hardened, so that it is all ready to slip into an engine in the assembling room.

C. C. Williams, a Louisburg, Kan., farmer, three years ago bought a Ford runabout and recently purchased a second machine of the same make. The Ford Company has sent us some photos showing Mr. Williams using the motor of the old car for sawing wood, and the new car for hauling a road scraper. The Ford Company states that it has secured some of its most aggressive agents among the farmers to whom it has sold cars, and who were then given the exclusive rights to sell cars in their town or village.

Club Notes.

The Little Rock, Ark., Automobile and Country clubs held a hill climb on the grounds of the Country Club on July 4.

The Buffalo A. C. is offering a reward of $50 for information leading to the arrest and conviction of persons damaging the road signs erected by it. It is claimed that these signs are used by many persons as targets for rifle practice, and that some of them have been so badly shot up that they are absolutely useless.

The six day reliability run for the McClure Cup, conducted by the Albany A. C., was concluded on June 26. All six cars returned in good shape. The distance covered was 936 miles, with six stops. Three of the cars contested for the cup for sealed bonnets. They were Joseph Taylor (Locomobile), Matthew Van Alstyne (Peerless) and Edward Wright (Elmore). All finished with seals unbroken and fulfilling all requirements. It is believed the Locomobile, having made a perfect record for three years, will receive the prize.

Members of the Kenosha (Wis.) A. C. are planning a campaign for the passage of a law that will place a heavy penalty on the crime of obstructing the roads used by motor cars.

The Bay State Automobile Association of Boston plans to hold a twenty-four hour endurance run to the White Mountains and back during the fall under very strict conditions, with observers.

The A. C. of Cortland County, N. Y., was recently organized with the following officers: A. F. Stilson, president; D. W. Van Hoesen, vice president; S. W. Sherwood, treasurer; F. C. Parsons, secretary.

R. P. Schwerin, president; John D. Spreckels, vice president; A. J. Frey, secretary, and Thomas Magee, having retired from the board of governors of the A. C. of California, a new board has been elected as follows: Samuel G. Buckley, president; George A. Newhall, vice president; C. Frederick Kohl, treasurer; L. P. Lowe, F. W. McNear, C. C. Moore and Arthur B. Watson. The executive commitee, made up of L. P. Lowe, chairman; George A. Newhall and C. Frederick Kohl, will at once press the work of providing the counties surrounding San Francisco Bay with automobile road signs, and will publish a road map for the use of members of the club. The offices of the club are now at 625 Pacific Building, San Francisco.

F. A. M. Motorcycle Contest.

The annual endurance contest of the Federation of American Motorcyclists started from Catskill, N. Y., on Monday morning at 6 o'clock. Seventy-four entries had been received and seventy contestants actually started on the run to New York city. The first control, which ended at Haines Falls, was over a mountainous country and included the hill climb. Nearly twenty-five riders were eliminated during this control. The contestants continued at a 15 mile an hour gait to Newburgh, 103 miles, reaching that city shortly after 1 p. m. The third control ended at Nyack, 152 miles. All of these controls were easy and successfully negotiated by the riders. The last control was at the Empire Hotel, New York city, 174½ miles, where about 50 riders reported at 6:30 o'clock.

Tuesday's run was from Brooklyn along the south shore to Good Ground, L. I., and return by the north shore, a distance of 181 9-10 miles. The controls were at Patchogue, 57 4-10 miles; Good Ground, 86 1-10 miles; Riverhead, 95 1-10 miles; Roslyn 156 7-10 miles; Flushing, 167 miles, and Brooklyn, 181 9-10 miles. The first man in on this day's run was B. A. Swenson, of Providence, R. I. William C. Chadeayne, of Buffalo, N. Y., rode from Freeport to Good Ground, the turning point of the run, and back, a distance of nearly 160 miles, with a broken nose, a cut eye and bruised face. He was patched up by a Freeport physician, and yet he came home at the starting point, Bushwick avenue and Stewart street, East New York, only twenty-six minutes behind the leader. The roads of Long Island were found to be much better than those from Catskill to New York. The contest will be continued on Friday.

On Wednesday the F. A. M. held its annual meeting and election of officers. E. L. Ovington, of New York, was elected president, defeating F. L. Priall by a vote of 57 to 22. Other officers elected were: Vice president of the Eastern district, E. L. Buffington, Providence, R. I.; Southern district; E. Y. White, San Antonio, Tex.; Western district, John Ball, Milwaukee, Wis.; Pacific district, R. K. Holmes, Los Angeles, Cal.; secretary, Henry J. Wehman, 108 Park Row, New York; treasurer, G. B. Gibson, Westboro, Mass.

On Thursday a fuel economy contest was held at Roslyn, L. I., on a 50 mile course. For the purpose of this test the machines were divided into three classes, Class 1, comprising all with a cylinder capacity not exceeding 21.10 cubic inches; Class 2, not exceeding 30.50 cubic inches, and Class 3, not exceeding 61 cubic inches. Owing to the fact that a great number of protests were filed, it is impossible to give the official results at the present time.

The annual meet wound up on Friday with a series of championship events on the new board track on the old race track site at Clifton, N. J. In these events J. B. De Rosier (Indian), of Springfield, Mass., made a new record for the mile on a six lap track, viz., fifty-six seconds. He also established a new record for the half mile.

American Locomotive Company Absorbs Automobile Company.

The American Locomotive Automobile Company has been absorbed by its parent company, the American Locomotive Company, and the name "Berliet," which has heretofore been applied to the cars turned out at the company's shops at Providence, has been dropped. These changes took place at the conclusion of a three years' contract which the American Locomotive Company had with M. Berliet, of Lyons, France. The automobile business will be continued as heretofore, and the company will manufacture motor trucks and cabs in addition to its well known touring cars, all of which will be sold under the Locomotive name. Heretofore the cars turned out at Providence have been exact duplicates of the French design, but it is understood that it is the intention now to make certain slight changes in design dictated by American conditions. The personnel of the Locomotive Company's automobile department remains unchanged, James Joyce continuing as manager, R. B. Van Dyke in charge of the New York office, Chas. E. Davis superintendent of the Providence factory, and B. D. Gray chief engineer.

Obituary.

Captain Henry Lomb, a member of the firm of Bausch & Lomb, Rochester, N. Y., died June 13 at Pittsford, Vt., aged seventy-nine years. He was born in Hessen-Cassel, Germany, in 1828, and came to this country in 1849. Mr. Lomb achieved much for the optical industry in this country.

New Incorporations.

Tibbals Auto Supply Co., San Diego, Cal.—Capital, $10,000. Incorporators, W. L. Tibbals, L. H. McGowan and A. J. Sherer.

Dallas Motor Car and Transit Co., Dallas, Tex.—Capital, $6,000. Incorporators, J. A. Bergfield, J. C. Hoober and J. H. Power.

Guarantee Faultless Auto Tube Co., New York City.—Under Delaware laws. Capital, $1,000,000. Incorporators, F. N. Hipple, Joseph W. Ebbs and M. L. Ward.

Peerless Leather Tire Co., Cal.—Capital, $30,000. Incorporators, S. Folmer Swain, Cecil H. Stone, H. R. Newbauer, Marcus Weinberger and Edward W. Gunther.

North Automobile Co., Chicago, Ill.— Capital, $2,500. Incorporators, A. B. Pease, L. Pierson and George A. Miller. General manufacturing and merchandise business.

Trade Personals.

J. C. Zimmerman has been appointed manager of the Chicago branch of the Fisk Rubber Co.

Walter S. Shawvan, of Chicago, Ill., has joined the sales force of the Schreiber Motor Car Co., Milwaukee, Wis., distributors of the Locomobile.

R. H. Cook has resigned as manager of the Chicago Royal Tourist branch, and will assume charge of the Philadelphia agency for Peerless and Cadillac cars.

A. B. Hanley, who formerly was connected with the Electric Vehicle Co., of Hartford, for a number of years, has been appointed manager of the H. H. Franklin Co.'s Boston branch.

Geo. F. Kebew, who was formerly connected with the Pope Manufacturing Co., has associated himself with the National Sales Corporation of New York, which he will represent in Detroit, Mich.

L. E. Hoffman, Southern traveling representative of the H. H. Franklin Manufacturing Co., who has been traveling through the Southern States and Central America for the past six months, has just returned to Philadelphia. Mr. Hoffman left on the 1st of January for Mexico City. After placing agencies in Mexico City, Monterey, Torreone, Guadalajara and Aguas Calientes, on re-entering the United States he found a Model D car awaiting him at New Orleans, and from there he started on a 17,000 mile trip, covering every Southern State except Tennessee.

New Agencies.

Fall River, Mass.—Peck & White, Buick.

Indianapolis, Ind.—George V. Miller, Brush.

New Bedford, Mass.—Central Garage, Buick.

Baltimore, Md.—E. L. Leinbach, Oldsmobile.

Milwaukee, Wis.—Charles Abresch Co., Kissel Kar.

Chicago, Ill.—Levy & Fanning, Chalmers-Detroit.

An English automobile driver, Hal. Watt, was seriously injured while driving a racing car on the Dieppe circuit on July 3, owing to the bursting of a tire. The car was traveling at a speed of 75 m. p. h. at the time, and Watt was thrown a distance of 30 feet. Another racing machine practicing for the Grand Prix on July 3 killed an old man on the road near Saint Malery-en-Caux, 17 miles from Dieppe.

The Horseless Age

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The Glidden Tour.

By Harry B. Haines.

Buffalo, N. Y., July 8.

Another twelve months have rolled around, and here we all are in Buffalo, awaiting the start on the morrow of another Glidden contest, road race, endurance run, manufacturers' advertising event, pleasure tour, or whatever you have a mind to call it. Judging from past events the coming affair might justify any of the above names, or all of them for that matter, but just the same we are promised a real sedate and gentlemanly event this year (as we have been in the past), and just how hard a run it is to be no one dares surmise.

Having accompanied every one of the annual contests since the New York-Pittsburg run in October, 1903, I feel fully prepared for whatever may come in the way of fast driving, reckless chances and hair raising escapes, and despite the assurances of the committee that all is to be different this year I am free to say that I hardly believe it possible to prepare any set of rules that will keep the so called expert drivers sent out from the factories from speeding.

There is no use in beating about the bush in these matters, and as I have said in previous years, the Glidden tour is anything but the pleasure event that Charles J. Glidden planned it to be, and is in every sense of the word a manufacturers' event. This the committee themselves acknowledge this year. Most of the cars are entered by manufacturers and driven by their most skilled men, who are sent out with instructions to secure a perfect score no matter what the cost. They do not enter the affair with the idea of making a pleasure tour of it. They want to bring their machine through in record time in order that the factories may use the victory they gain for advertising purposes. This is legitimate enough, but it seems to me that the people of the trade at least should cease trying to fool themselves. There is no doubt but that the Glidden tour arouses a great deal of interest in automobiles and automobiling throughout the country, but there is a grave doubt in my mind if the sight of hundreds of travel stained people racing over the country at breakneck speed has a very favorable impression upon the ordinary man. Last year's accidents and casualties gave color to the stories that the tour was a mad race, and, I believe, did considerable damage in influencing people who were naturally prejudiced against automobiles to still greater opposition to horseless vehicles.

IMPROVED RULES.

At all events here we are at Buffalo ready for another big test which starts tomorrow, and it remains to be seen just how much of a race or a pleasure tour it is to develop into.

It is evident from the rules that the committee is following up its idea of last year in an endeavor to prevent the rebuilding of cars on the road. It will be impossible for entrants to put in new springs, axles, etc., after checking out in the morning and then race to the controls to make up time. Coming back to first principles, the committee has also decided to employ official observers, as was done in the first New York-Boston run. These observers will ride in the cars of other entrants than those by whom they are nominated, and to make it surer that they will be anxious to report any defect or delay in the car in which they are riding the committee has specified that the observers must be factory employees of the car entered when the entry is made by a manufacturer, or they must be officers of the company, agents for the car or an owner of the car they are nominated for. It is evidently the idea of the committee that loyalty to the car they are interested in will compel them to be honest in reporting things unfavorable to a rival competing car that they may ride in.

The formation of a class of non-contestants for those who desire to follow the run for pleasure will give an opportunity to mix in and eat dust, be crowded up in overstuffed hotels, to come into towns dirty and bedraggled at night, and to generally tire themselves out following the big procession.

Thomas Cook & Sons have charge of the hotel arrangements. They also handled this matter last year, and then there was some complaint when ladies were given rooms without baths and chauffeurs got rooms with baths. This was of course justified by the explanation that rooms were reserved without preference and all had to take their chances. Owners of cars were at times compelled to bunk with their chauffeurs, which was not altogether conducive to the maintenance of discipline and respect; but this will in all probability be entirely different this year.

The rules were printed almost in full in The Horseless Age of May 20 last.

OBSERVERS INSTRUCTED.

At the Wednesday afternoon meeting of the observers particular instructions were given by F. I. Stidham, who will have charge of the observers, and every rule

Cars Parked in Buffalo.

governing the tour was gone over in detail. The observers were told that they were not to be responsible to the entrant for figuring out the time of the car or deciding at what minute it should check in. Although the observer might assist in computing the time of the car, he did not have to do so unless he so desired, and if he made an error the committee would not absolve the entrant or driver from blame. It was also stated that the observers were in no way to regulate or control the speed of the car, this being the duty of the driver himself. The observer's sole function is to note the performance of the machine and to report all stops, their cause and duration, and to note all work done on the machines and report all new parts put in.

It was specifically impressed on the entrants that they must not in any way depend on the observer, and that if their score was spoiled by any error on the observer's part they would have no recourse to the committee, but would be out of the running. They were also advised that the assignments of observers would be changed each night and a notice posted on the official bulletin. It will devolve upon the entrant to hunt up his observer and have him in the car at the starting time each day. If his observer is not on hand he will not be allowed to start. In the event of spare parts being used the seals on the extra parts carried must be broken by the observer, who will make a record and report.

SPARE PARTS CHECKED.

The competing cars in both the Glidden and Hower contests, to the total number of fifty-eight, were lined up in an open field opposite the official A. A. A. headquarters at the Teck Theatre building, and the committee, composed of Messrs. Ferguson, Newman and Lewis, checked the official list of spare parts and sealed them. The entrants were obliged to spread out all spare parts on the ground, and these were checked from the inventoried list furnished the committee when the entry was originally made. The selections of the different entrants of parts which to their minds were most likely to give out was interesting.

Extra valves, parts of spark mechanism, roller bearings for wheels, in many cases extra springs and bolts, nuts and cotter pins galore, as well as a liberal sprinkling of spark plugs, made up most of the equipments. Steering knuckles were carried by many, but there was a pleasing absence of spare axles, wheels, etc., such as have been carried on other tours. It required all of the morning and part of the afternoon to check up all of the cars. After the parts on each car were listed the machine was covered with a waterproof tarpaulin and then no one was allowed to go near it, as it was officially considered in the hands of the committee.

The cars were left in the open overnight, guarded by special watchmen engaged by the association, and large crowds gathered to view them.

MR. GLIDDEN'S OPINION.

Charles J. Glidden, donor of the trophy, was on hand to greet the tourists at the official headquarters at the Teck Theatre building, Buffalo, and he expressed the opinion that this year's tour would be an ideal one, as the route selected led through an interesting and picturesque country, and the employment of official observers in connection with the time limits imposed by the committee and the pace car would effectually prevent speeding. He deplored the mad racing which had given bad odor to the tour in previous years.

Mrs. Andrew Cuneo, who is the only woman driver on the tour, was on hand promptly and attended all of the preliminary meetings, listening intently to the instructions given, as she is particularly desirous of finishing with a perfect score this year. She will drive her own car throughout the entire tour.

LINED UP FOR THE START.

EXPLANATIONS OF RULES.

The following letter handed to each entrant at Buffalo further explains and clarifies the rules:

Springs cannot be wrapped after placing car in custody July 8.—Air for tires cannot be taken from tanks in controls.—For every passenger less than four in a touring car 125 pounds of ballast must be carried. Baggage will not be counted as ballast.—Solder, acid and soldering iron can be carried as tools.—Detachable tire rings will be regarded as part of tires, and can be renewed without penalty.—Cars will be packed and not garaged. Advise carrying tarpaulin.—Official number should be painted on front of radiator as large as possible.—Shock absorbers permitted and very necessary.—No record of any previous performance, or sign, or other indication of the maker's name other than a name plate on the front of the radiator, shall be displayed on any car at any time during the tour.—Official numbers for each side of hood will be supplied by the management.—Read the rules every day.—Never miss the evening meetings at headquarters.—Also watch the bulletins.—There are two Milfords in Pennsylvania. Be sure and have any mail addressed there marked, Pike County.

A MANUFACTURER'S INSTRUCTIONS TO HIS MEN.

One of the big manufacturers who entered a number of cars issued typewritten instructions to all the drivers, mechanics and observers appointed by him. The circular first gives very definite instructions to the different observers appointed when and where they are required to report, and when and where they will be relieved, and then adds a number of pertinent comments on the importance of the event to the manufacturer and the conduct expected of the parties addressed. In the following abstracts from this circular of instructions we omit all names, as it was not written with a thought of publication. The passages quoted clearly show the light in which the manufacturers regard the contest:

To prevent any confusion as to the relief at the controls mentioned above, from any unavoidable cause, such as delayed trains, etc., the current observer will not be relieved from duty until he personally sees the man who will relieve him, and he and the relief man will both see the official at the control in ample time so that no confusion will arise, and the exchange can be properly made. In short we want to prevent technicalities from preventing us having an observer at all times.

For your information we wish to state that this contest is not a matter of purely the performance of the car, but one that requires brainy and heady work from start to finish. Please study and observe the rules most carefully. We want to make the most explicit and detailed report to the controls in reference to the cars. This refers most particularly to observers. This is largely a game of politics and good work on the part of the drivers and mechanicians, irrespective of the performance of the car, and we want to use the utmost precaution against being buncoed on technicalities. We want to point for every point, and make it win.

* * * To quote an abstract of Mr. ———'s letter to me of June 30

"Try and 'drill' into the head of every man who has anything to do with the tour that this thing means more to us than anything we have ever undertaken. We must not under any circumstances permit any of our representatives to say

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to us after the tour is over that he 'did not understand this or did not understand that.' Personally I will accept no excuse whatever."

It seems to me that Mr. ——— should name some penalty for any failure on the part of our men to make a perfect score unless it is positively unavoidable.

I have discussed this matter with a number of people who have ridden in previous Glidden tours, and the most important point and the one holding the most responsibility is the mechanic who rides with the drivers, and who must figure out the exact running time between the different controls and checking stations, and this will require some man with a "head." He must have a good watch, and have some idea of computing time as relating to road conditions. Please emphasize this more thoroughly upon ——— or any other mechanics, should you be compelled to appoint them. I am unable to emphasize this too strongly. Our entire record depends upon it. The cars may give an absolutely perfect performance, and the whole performance be spoiled by some "numskull" mechanic incapable of properly computing time and directing the driver. Personally I feel that there should be a penalty of dismissal given to every mechanic making a mistake in his timing. For that reason I figure that your mechanics, should you appoint them, should be the most competent men you can find; they should by all means be trained factory representatives, and if possible having had some experience in previous endurance contests.

Please impress upon each one of the observers that they are not in any sense of the word whatever a passenger of the ——— car—that they will be compelled to ride in competing cars, and that it is their duty to observe and report formally and officially every incident that happens in connection with the car in which they ride that could in any way detract from the car's performance; consequently, in order that we do not defeat our own interests, it is absolutely imperative that every observer you appoint be a thorough automobilist, know absolutely what a car should do, and if anything develops on the road the observer must report it and see that the report is made, because if the "kicks" are not registered in regard to the defects of our competitors' cars, it is apparent that we are working against our own interests, as you can gamble on it, every observer that rides in the ——— car will try his best to find something to "knock." Please do not fail to "drill" this into every observer that you appoint, as it is half of the game to see that we present our competitors' performance in the poorest possible light.

We do not want to carry excessive baggage. * * * The ideal way to travel would be in pajamas, but for obvious reasons this would be impracticable. We also want to conspicuously avoid "booze." If we all root together we ought to make it win.

In reference to uniform time, all timepieces should be regulated; old alarm clocks are prohibited, especially if they lose an hour every five minutes. You had better get you watch timed beforehand.

Final List of Entries.

By way of comparison it is not uninteresting to note the entry list last year and that of the present tour.

There were fifty-three entrants for the Glidden Trophy last year and six non-contestants. There were twelve entrants for the Hower contest, of whom two were non-contestants. There were no air cooled cars entered. The list this year shows only thirty entrants for the Glidden contest, but fourteen entrants for the Hower contest. The following is a copy of the list as issued Wednesday evening at Buffalo:

1G. Charles Clifton, Buffalo A. C., Great Arrow.
2G. Charles Clifton, Buffalo A. C., Great Arrow.
3G. J. W. Maguire, Buffalo A. C., Great Arrow.
4G. R. M. Owen, Buffalo A. C., Reo.
5G. E. H. Parkhurst, Columbus A. C., Peerless.
6G. E. H. Parkhurst, Columbus A. C., Peerless.
7G. E. H. Parkhurst, Columbus A. C., Peerless.
8G. R. M. Owen, Buffalo A. C., Premier.
9G. H. O. Smith, Buffalo A. C., Premier.
10G. Paul Gaeth, Rochester A. C., Gaeth.
11G. Gus G. Buse, Rochester A. C., Thomas.
12G. H. H. Franklin, Syracuse A. C., Franklin.
13G. John Wilkinson, Syracuse A. C., Franklin.
14G. F. H. Stilwell, Syracuse A. C., Franklin.
15G. Andrew Cuneo, Rainier.
16G. J. F. Duryea, Springfield A. C., Stevens-Duryea.
17G. I. H. Page, Springfield A. C., Stevens-Duryea.
18NC. C. H. Foster, Gabriel Horn car.
19G. Frank H. Nutt, Chicago M. C., Haynes.
20G. Loring Wagoner, Chicago M. C., Haynes.
21G. Frank E. Wing, Bay State A. C., Marmon.
22G. W. C. Marmon, Bay State A. A., Marmon.
23G. W. C. Marmon, Bay State A. A., Marmon.
24G. E. V. Stratton, Rochester A. C., Studebaker.
25G. E. V. Stratton, Rochester A. C., Studebaker.
26G. E. V. Stratton, Rochester A. C., Studebaker.
27NC. J. B. Eccleston, Buffalo A. C., Oakland.
28NC. E. M. Murphy, Detroit A. C., Oakland.
29G. A. R. Davis, Cleveland A. C., Garford.
30G. A. R. Davis, Cleveland A. C., Garford.
31G. A. R. Davis, Cleveland A. C., Garford.
32G. R. H. Salmons, Rochester A. C., Selden.
33. E. V. Stratton, press, Studebaker.
34. E. R. Estep, press, Packard.
35G. F. L. Smith, Chicago M. C., Oldsmobile.
36. M. E. Oliver, Diamond Tire car.
37. W. E. Rutherford, Goodrich Tire car.
38. E. H. Bradwell, Fisk Tire car.
39. R. M. Owen, Premier press car.
95. Official press car.
96. Red Cross car, Reo, Packard.
97. R. M. Owen, pilot, Reo.
98. R. M. Owen, pilot, Premier.
99. Charles Clifton, chairman's car, Great Arrow.
100H. R. D. Garden, Pierce Great Arrow.
101H. R. M. Owen, Reo.
102H. W. H. Vandervoort, Moline.
103H. Charles Clifton, Pierce Great Arrow.
104H. George A. Weidely, Premier roadster.
105H. John Breyfogle, Gearless.
106H. F. A. Barton, Franklin.
107H. G. P. Moore, Stoddard-Dayton.
108H. E. W. Shirley, Overland.
109H. H. C. Tillotson, Stoddard-Dayton.
110H. J. N. Willys, Overland.
111H. J. N. Willys, Overland.
112H. R. G. Cox, Stoddard-Dayton.
113H. A. I. Kull, Gyroscope.

The American Motor Car Manufacturers' Association issued the following bulletin to members in connection with the tour:

"Suggestions for wearing apparel: No more than is absolutely necessary—flannel shirt with collar attached, an old suit, rubber poncho, linen duster, gauntlets, rainproof hat or cap, sweater or 'jersey,' two pairs of goggles, leggings or four bucklet 'arctics' for muddy weather.

"Suggestions for car equipment: Extra tire, shoes and inner tubes, extra tire chains, full tool outfit, detachable rims, speedometer, top not necessary, two jacks, extra battery, extra spark plugs, mud apron to place between frame in front, extending to inches beyond radiator to protect it from mud; white sign or radiator; heavy strap to hold suit cases in place, and oil cloth covering for same; tarpaulin covering for car at night; air tank for tires; shock absorbers permitted and absolutely necessary."

Most of the tourists evidently considered these suggestions valuable and adopted them. The apron to protect the radiator from flying mud was almost universally used.

FINAL INSTRUCTIONS.

A meeting of all of the entrants and observers was held at the A. A. A. headquarters at the Teck Theatre building on Wednesday afternoon, and Chairman Hower explained the rules in detail, answering the various questions asked. All entrants were particularly warned against speeding; and were informed that if arrested for this offense the committee would not in any way support them. They were also told that if they speeded to make up lost time on the road they did so at their own risk.

Each car is to be furnished with a slate, on which its finishing time is to be marked and displayed when asked for by any other car. No car is to be allowed to pass the pace car at any time, and cars will be required to finish each night in consecutive order of finishing time. For instance, a car due to check in at 6:15 must give way to cars due to check in before that time. Contestants were also advised that there would be no penalization for time lost in repairing tires as long as the engine was kept run-

The Cost of Competing.

Chairman Hower received a letter from President H. O. Smith, of the Premier Manufacturing Company, of Indianapolis, giving an estimate of the cost of putting a car through the run. Mr. Smith itemizes the expenses as follows:

$4 or $5 per day, 15 days (one man).	$60 or	$75
Gasoline, 1,500 miles, 10 or 15 miles per gallon 20 cents	20 or	30
Oil, 1,500 miles, and grease	10 or	20
Tires problematical (conservatively).	75 or	100
Mechanic	60 or	75
Observer (1908)	60 or	75
Miscellaneous	25 to	75
Garage	10	10
	$320 to	$460

In explanation of the above bill Mr. Smith adds the following:

I have not included the expense of the fourth man required with a touring car, as it is probable that many can find friends who will gladly pay hotel expense to get the trip.

I have not included entry fee, which is a fixed amount, nor have I taken into account the expense of reaching the starting point or returning after the finish, as this varies according to conditions.

As to the cost of damage to the cars themselves—speaking from our experience—we found our cars in demand at a premium, which was, no doubt, due to the showing made. Barring a mishap which might be occasioned by accident, the unsuccessful cars should be put in condition with but little expense, and be salable at a price which would probably cover cost, or nearly so, should it not be decided to retain the car on account of the lessons it might teach.

ning, but no other work must be done on the car. If other work is done during the time that tire repairs or replacements are being made the entire time of the stop must be made up.

WANT SPEEDING DISCOURAGED.

The newspaper men on the tour were entertained at noon on Wednesday at an informal reception at the Buffalo Club. There were about thirty press representatives present. A most pleasing repast was served. The press representatives were asked to make any suggestions they might see fit, and all united in the opinion that speeding should be discouraged in every way possible, and the reckless drivers who have brought disrepute on previous tours curbed. The newspaper men united in the resolution not to notice in any way the performances of cars recklessly driven or sent over the course at high speed. All were of the opinion that life and limb should be protected and considered and the possibility of accident in every way minimized.

EQUIPMENT OF CARS.

In looking over the various cars it was noticed that most of them carried a clock, and some of them even carried two timepieces. A large number of the machines also carried two speedometers of different makes, some of the speedometers being fitted at the official garage. The entrants evidently did not want to take any chances. In addition to using shock absorbers, a number of the entrants had roped their springs, evidently profiting by the experience of previous years, when broken springs had caused the downfall of more than one entrant.

It was interesting to note, in connection with observations as to the kind and style of tires used, that all of the contestants had abandined tire protecting covers and various non-skid tires that figured so prominently in other runs. Very few of them carried blow-out patches or repair outfits, evidently having made up their minds that when it came to tire trouble the best thing to do was to make replacements. Many of the cars were equipped with non-skid Bailey treads. All of the contestants had their tire chains, of course, and many of them carried air pressure tanks, which will save both time and trouble.

ITINERARY AND HOTEL LIST.

Arrival.	Town.	Hotel.
July 9	Cambridge Springs, Pa.	Rider Hotel.
10	Pittsburg, Pa.	Schenley Hotel.
11	Bedford Springs, Pa.	Bedford Springs Hotel.
12	Bedford Springs, Pa.	Bedford Springs Hotel.
13	Harrisburg	Lochiel Hotel.
14	Philadelphia	Walton Hotel.
15	Milford, Pike Co., Pa.	Bluff House.
16	Albany	Ten Eyck Hotel.
17	Boston	Somerset Hotel.
18 19	Boston	Somerset Hotel.
20	Poland, Me.	Summit Spring House.
21	Rangeley	Rangeley Lake House.
22	Bethlehem	Hotel Sinclair
23	Saratoga	Grand Union Hotel.

The route as outlined above takes in seven States, and the tourists will have to cross five mountain ranges and innumerable streams and travel roads ranging from common dirt roads to the best macadam and asphalt.

WARNING TO THE PUBLIC.

Ten thousand notices similar to the following have been printed and are dated for distribution along the route of each day's run. They give the public due notice of the approach of the tour:

NOTICE.
DURING THE DAY OF
JULY 9th
THERE WILL PASS THROUGH YOUR TOWN
75 AUTOMOBILES
ON THE
FIFTH ANNUAL TOUR
OF THE
American Automobile Association
While this is a TOUR and NOT A RACE, I would suggest that care be exercised to keep unattended
Children, Pets and Live Stock
OFF THE HIGHWAY.
The tour is run under a schedule of fixed time that does not permit any participant exceeding the legal speed limit over any road.
F. B. HOWER, Chairman Touring Board
American Automobile Association.

Buffalo to Cambridge Springs.

Bright and early on Thursday morning the entrants, drivers and observers were on hand all ready for the start of the big tour, and they gathered in groups around the open lot opposite the headquarters of the Buffalo A. C. at 760 Main street, where the cars had been parked overnight. Each of the machines had been covered with a tarpaulin, and the entrant was not allowed to approach his car until he had his official observer with him. The start was somewhat different from that of other contests, inasmuch as the contestants and mechanics were unable to do the usual tuning up and adjusting, which would have entailed penalization. The noise of engines being speeded up and tested and the other usual preliminaries were missing.

The pilot cars were off on the route early, and F. B. Hower, the ever busy chairman, was hustling around completing final arrangements. He was ably assisted by Starter Ferguson and Chief Observer F. D. Stidham. There were fewer cars than usual, and the prospect seems to be that the tour will be more comfortable in the point of hotel accommodations, etc

At 8 o'clock, when the two confetti cars set out, a large number of people had congregated at the open air garage opposite the Teck Theatre building. Buffalo tourists turned out en masse, and the street in front of the starting point was crowded with automobiles. The A. A. A. official watchman kept all contestants and entrants out of the garage until a half hour before the time set for the start, and then the driver of the car only was admitted, and he not until he had his observer with him. Passengers and baggage were taken on after the cars had lined up at the starting point.

Each machine had the official number on either side of the radiator on a canvas sign, and the number was also painted on the radiator.

Wednesday was a clear and sunshiny day, and the indications were that there would be plenty of heat and more dust. All of the tourists had shown an inclination to be real sensible in their methods of dress, and flannel shirts and khaki suits were the rule. There were no stiff collars or new neckties, and everybody was fixed up to travel undisturbed in weather of any sort.

It was announced just prior to the start that the running time for the day would be five hours and fifty-two minutes. The first car was sent off promptly at 10 o'clock and the others followed at one minute intervals.

The day's run was from Buffalo to Cambridge Springs, Pa., 117.4 miles, over roads mostly gravel and fairly level. There were but three short hills on the run. From Buffalo to Erie, Pa., the roads were good, but from this point to Cambridge Springs clay and clay loam roads were encountered, with a stretch of heavy sand just before entering Cambridge Springs. There were crowds gathered at all of the cross roads as usual, and the tourists were given a warm reception by the summer guests at the Hotel Rider, which was the official headquarters for the night's stop.

Dust covered and travel stained, the greater part of the tourists rushed into Erie, Pa., 90 miles, in three hours from the time they had checked out. This speaks for itself as regards the speed they traveled at. An hour later they were at the garage, just a few blocks from the Hotel Rider, the night stop, where they were to check in. Five hours and fifteen minutes was the minimum time allowed for Class A cars, those of Class B being allowed ten minutes longer, and most of the machines finished two hours or more ahead of this time. It had been a case of "eat dust" all day long all along the line, and the faces and clothes of the tourists were dust covered. Most of them took advantage of the time they had made up by high speeds in oiling their engines and making general adjustments. Tanks were filled and every arrangement was made to have the car ready to start right out of the garage in the morning, no work being allowed on the car after it is once checked in.

NOT A PLEASURE RUN.

Some of the contestants protested to Chairman Hower at the Hotel Rider that the schedule was entirely too fast; that it required a continued high speed to maintain it, and that this was dangerous and invited accident. This seems rather peculiar in view of the fact that other entrants covered the course and had two hours to spare.

In reply to these criticisms Mr. Hower said: "You people must realize that this is not a pleasure tour. It is a touring endurance contest, and I intend to make it a most severe test throughout. The schedule is so arranged each day that if nothing happens to your car you can make the run easily and comfortably. We base our schedule on the presumption that nothing is going to happen to your car. In fact, nothing should. If you do have trouble and lose time and you race to make it up and are arrested you are out of it. If you don't make up the lost time you are out of it. We intend to test your cars to the limit, and if you are eliminated by delays and lost time it is not our fault. The schedule is no faster this year than it was last year, and differs only in the detail that this year you are not compelled to make up. Everybody will have an even chance and everyone will have to keep hustling to stay in the running. That is all I have to say."

In justice to the committee, however, it is only fair to say that the majority of the entrants were well pleased with the schedule, and deemed it too slow rather than too fast.

Each day the pace maker's car precedes the tourists by one hour, and about the only speed restriction is the rule which provides that no entrant shall pass the pace car. Each car is provided with a slate and white chalk, and upon coming up to the pace car must write in plain figures the time at which it is to check in. The cars must then give way to each other in the order they are slated to finish.

SPEEDING THE RULE.

In writing the report of this first day's run one can scarcely refrain from saying "I told you so!" Despite the pace car, despite local speed regulations, despite official observers, timekeepers, committee warnings and all else the drivers, as in the past, hit it up at 40 miles an hour and better in place and "let her rip." It was the same old Glidden race as in other years, smashing over the roads, jouncing the jounces and bumping the bumps. The people who gather along the road are in a way responsible for this speeding, as they all seem to have the idea that the contest is a race, and they cheer the drivers to still further bursts of speed, even the local constables joining in at times.

As usual, large crowds gathered in every town to see the cars go through, and autoists drove out from all nearby cities along the line of the course. The spectators were most enthusiastic, and some of the people along the roads traversed decorated their houses with flags and bunting. After filling up at the garage in the village, the cars pulled up to the official checking point at the Hotel Rider and waited until their time came to check in. They then went over the line and were officially checked by Dai Lewis. The occupants then removed their baggage and the cars were put into the garage, which simply consisted of covering them with waterproof covers and parking them in an open field back of the hotel.

List of Occupants of Cars.

(Given in the order, driver, mechanic, observer, passenger for each car.)

No. 1—Teddy Dey, A. J. Keller, John Wilson, T. J. Sullivan.

No. 2—Arthur Kumpf, A. A. Lederman, K. R. Otis, F. Ed Spooner.

No. 3—J. W. McGuire, Frank Zeimitz, John Kerrison, C. M. Babbitt.

No. 4—R. M. Owen, D. Cohen, John McDowell, J. O. Powers.

No. 5—C. H. Burman, C. R. Roth, H. K. McWhite, B. P. Kinney.

No. 6—W. C. Straub, R. B. Arcuff, H. H. Hower, J. H. Fox.

No. 7—H. D. Savage, J. B. Brock, James McLean, A. C. Mancher.

No. 8—H. Hammond, O. Fink, C. Peese, I. Nusshaumer.

No. 9—Joseph More, H. B. Smith, Frank Morrison, J. W. Grogan.

No. 10—Paul Gaeth, Otto Linder, Al Blatt, W. S. Gilbert.

No. 11—Gus Buse, Charles Miller, G. F. Fries, E. A. Buse, Gus Buse, Jr.

No. 12—Charles Talbot, Arthur Wheeler, Arthur Holmes, J. A. Walker.

No. 13—C. L. Caires, J. Burns, R. G. Stewart, H. F. Schepp, Guy Shields.

No. 14—W. S. Bates, J. Dowley, H. J. Bierhart, J. B. Jaines.

No. 15—Mrs. J. Newton Cuneo, John Boyle, L. A. Disbrow, Mrs. E. Berwick.

No. 16—Luther Young, G. Braithewaite, J. N. Maynard.

No. 17—C. L. Clark, Clarence Smith, T. L. Cowles, S. H. Evans.

No. 19—Frank Nutt, Ed Rose, Robert Moorman, Kent Blackledge.

No. 20—Loring Wagoner, Robert Murden, D. L. Watson, T. Ninagowa.

No. 21—Frank E. Wing, Roy Tinkler, Max Thoms, J. D. Murphy.

No. 22—H. H. Rice, William Clark, Bruce Keene, Allen Hill.

No. 23—W. C. Marmon, George Forsyth, William Asmus, Mrs. V. C. Marmon.

No. 24—Frank Yerger, J. Johnson, P. Austin, E. Gilchrist.

No. 25—W. G. Jones, R. H. Worster, C. A. May, P. Estey.

No. 26—R. Yerger, Harry McIntosh, D. McIntosh, G. R. Sharp.

No. 29—H. S. VanTine, William Bailey, Arthur Eley, C. E. Hadley.

No. 30—A. R. Davis, E. E. Ernest, W. W. Austin, George Stevens.

No. 31—W. B. Hurlburt, W. H. Lincoln, C. Nerocker, Thomas Heath.

No. 32—R. H. Selden, Peter Koersiag, E. B. Edge, A. H. Ross.

HOWER CONTEST CARS.

No. 100—J. S. Williams, George Quinlan, J. T. Pratt.

No. 101—R. L. Lockwood, J. H. Manning.

No. 102—W. H. Vandervort, C. H. Vandervort, E. Greenwald, W. W. Caldwell.

No. 103—Ed Rittling, Frank Bandrock, Robert Welker.

No. 104—G. A. Weidely, H. Gilterer, C. Waltman.

No. 105—J. W. Breyfogle, Al Glather, Felix Fisher, Frank Barnett.

No. 106—J. H. Daley, F. S. Young.

No. 107—G. P. Moore, J. F. Runkle, Lee Dyckmann.

No. 108—E. W. Shirley.

No. 109—A. C. Miller, Carl Wright, John Harcomb.

No. 110—W. H. Brown, Carl Brockway, E. T. Sombier.

No. 111—C. P. Forth, P. D. Stubbs, M. J. Prouty.

No. 112—R. G. Cox, M. H. Plank, Robert Seirk.

No. 113—A. L. Kull, H. M. Brummer, E. A. Ward.

THE FIRST ACCIDENT.

Despite the high speed the day's run was fairly uneventful for a Glidden tour. The Gearless car No. 105, entered and driven by John Breyfogle, came to grief just outside of Westfield, N. Y., when Breyfogle lost control of the car and it crashed into a telegraph pole. It seems that the car was about an hour ahead of its schedule, and Breyfogle was driving at about 20 miles an hour. The road divided at this point rather suddenly and Breyfogle took the left road. His front wheel hit a curbstone hidden in

THE START AT BUFFALO.

the high grass, and the steering wheel was jerked out of his hands. Before he could regain control of the car it crashed into a telegraph pole. The frame was broken on the left side near the front spring shackle, and the body of the car was smashed. A spring was also broken. None of the passengers was injured.

J. E. Mountain, president of the Norristown A. C., who was following the run, picked up the passengers from the Gearless. Mr. Breyfogle remained with the car and will make repairs.

The six cylinder Franklin entry No. 12 broke a rear spring as a result of dropping into a deep hole in the road near Irving. The spring was repaired and the car continued to the finish point. R. M. Owen's Reo had tire trouble, as did Oakland car No. 28.

THE AIR COOLED CARS.

Although the air cooled fraternity did not figure in last year's run, there are four air cooled cars in the present event, all of which made a creditable showing on the first day's run. The four cars are all Franklins, there being two six cylinder cars and one four cylinder entered for the Glidden Trophy and one four cylinder runabout in the Hower Trophy event. All of these cars made the run to Cambridge Springs without mishap with the exception of No. 12, which broke a rear spring. Mr. Walker, of the Franklin Company, said that it was necessary to ditch the car, as a woman had run directly in front of the machine as it came down the road and then, becoming confused, had stood still directly in its path. Temporary repairs were made on the spring, and it will not be replaced, as the entrants do not want to spoil their score by accepting the penalization imposed for the value of the new spring.

During Thursday's run a Stoddard-Dayton car which was following the tour was forced into the ditch by one of the contestants passing at high speed. The Stoddard-Dayton was slightly damaged. No one was injured.

Phil Sheridan, driving a White steamer, joined the tourists at Cambridge Springs, and will run along to Pittsburg.

READY FOR THE WORST.

A number of the drivers, fearing bad weather, with its consequent muddy roads and possible accompaniment of ditching accidents, took the precaution to purchase rope and tackle in order to be prepared to haul their cars back on the road should they be ditched. Most of them carried this equipment slung across the rear of the tonneau.

NO NOON STOPS.

The majority of the entrants are not making any noon stops at all and provide their passengers with lunches, which they eat en route. In fact, there are very few stops permitted for any purpose whatever, the primary idea in every driver's mind being to get to the night control as far in advance of the schedule as possible.

Mrs. E. W. Shirley, driving the Overland car in the Hower contest, finished the run to Cambridge Springs ahead of her schedule time. While waiting for the proper minute to cross the line she became confused and let the clutch slip in. The car started forward and crossed the line. She backed the machine up again and then checked in at the proper moment. She was not penalized.

At Cambridge Springs.

A meeting of the contestants was held in the theatre of the Hotel Rider on Thursday evening and proved to be an interesting session. The question was raised inasmuch as there was no penalization for time lost in tire repairs whether or not this time could be made up. It was decided that in order to discourage racing time lost in repairing tires must not be made up and must be added to the day's running time, the cars finishing that much later.

On the Road From Buffalo to Cambridge Springs.

It was further decided that in the event of a rain storm coming up contestants may stop their cars, and if they keep their engines running may put the chains on without time penalization.

It was stated that a number of cars had checked in at wrong times, owing to the fact that the contestants had failed to figure the time differences between Classes A and B cars properly. All penalizations were expunged, Mr. Hower explaining that he took this action because he believed that the contestants had not fully understood the rules. He gave a final warning that no excuses would be accepted in the future, and there would be no appeal from penalization if errors in time calculations were made. The chairman further stated that he had received complaints as to speeding along the roads, some of the contestants stating that cars due to check in after theirs had passed them at high speed on the road and then slowed down and compelled them to "eat their dust." The chairman stated that he did not intend to restrict the drivers to any greater extent than already imposed by the rules; if contestants passed each other at high speed they took the chance of penalization, but, in any event, they must maintain their speed after passing and must not at once slow down.

RED CROSS CAR IN LEAD.

Some of the tourists complained that the Red Cross car, which is presumed to follow the tour and minister to the wants of any persons who might be injured, had raced over the course at high speed and finished with the leaders. It was the idea of the tourists that this car should be the last to start, and it was so ordered.

The observers were notified that they must report at the garage ready to go into their cars at 6:30 each morning, as the cars will be allowed to check out at 7 o'clock. The chairman's car is to go first each day, followed by Nos. 16 and 17, the Stevens-Duryea entries, which are competing for Glidden certificates and carry the official garage watchmen.

The contestants were again warned that no one but the driver and mechanic would be allowed to work on tires or repairs, and that if the observer or passengers helped it would render the car liable to penalization.

It was announced that owing to bad road conditions the original course would be deviated from, and new route cards were issued, the new route taking the cars into Pittsburg via Mercer, New Wilmington, Clover, New Castle, Moravia, Newport, Wampun, Clinton, Hoytdale, Homewood, Beaver Falls, New Brighton, Rochester, Freedom, Conway, Economy, Ambridge, Fair Oaks, Teetsdale, Quaker Valley and Shields, Edgewood, Sewickley, Haysville Station, Glenfield, Emsworth, Benavon, Avalon, Bellevue to Pittsburg. The total distance will be 127 miles, and the minimum running time will be six hours and thirty minutes.

Cambridge Springs to Pittsburg.

Friday dawned bright and clear, and the main body of the tourists, despite the fact that they were up rather late on Thursday, had left 5 and 5:30 o'clock calls, and were out at the garage at 6:30, when the observers were presumed to take charge of their cars. Starter Ferguson called each entrant's number and then called his observer, and the two were allowed to go into the garage field and bring the car out, getting it into line for the start. The passengers were then permitted to put their baggage on board. It was highly evident that the majority of the tourists wanted to make an early start, and at 7 o'clock, when the first car was checked out, there was a long line of machines ready to start. They were sent off at one minute intervals. The summer guests at the Hotel Rider turned out in a body to give them a send-off.

Enthusiasm without bounds was shown throughout the entire course of Friday's run from Cambridge Springs to Pittsburg, and at towns along the line business was entirely suspended, factories and shops being closed, and everyone turned out to see the cars go through. The houses were decorated, and bouquets of flowers, fruit and other little gifts were thrown to the tourists. All along the line the cars were greeted with cheers.

The roads were of the rough mountainous kind, with numerous water breaks and sink holes which not only tested springs and running gears but the endurance of the occupants of the cars as well.

It was the old story of speed again, and, strange though it may seem, the highest speeds were made in passing through towns. Every town in Pennsylvania boasts of its mile or two of brick paved streets, and these were lined with rows of people. Local police were out and held the crowds in check, but joined in with them in cheering the tourists and coaxing them on to higher speeds. "Cut it out," "Speed for it," "Let her go," were the shouts heard as the cars dashed through the towns. Everyone seemed to be speed crazy, including the police officials.

At Newcastle, Pa., the population turned out en masse and the tourists were given a royal welcome. Even in the suburban sections houses were decorated with national colors, and the passing of the cars was made a gala event. At every country cross road parties had driven in and picnicked in order to see the cars go past.

The Lawrence A. C. had sent out men to mark bad spots in the road near Newcastle, and had also stationed them at dangerous railroad crossings.

The roads for the first 72 miles were loam and clay, and in wet weather would have proven very difficult to negotiate. The last 22 miles of the ride was over plank road and macadam boulevard, and was most enjoyable.

Typical Road in the Pennsylvania Mountains.

The cars ran very close together during the entire day, and, as usual, most of them made no stop for a noon lunch, and when they reached Pittsburg the tourists were a tired and dirty looking crowd. The day's run was 124.1 miles.

The course was full of dangerous turns and steep hills, but the scenery was delightful. Many grimy coal miners lined the roads at places and cheered the cars. Just out of Newcastle the largest tin mill in the world was passed, and at Ambridge the largest bridge works in the world was seen. Twenty miles out of Pittsburg P. S. Flynn, of the Pittsburg A. C., had put signs at each turn guiding the tourists, and had also marked bad turns and rough roads with red flags.

Many of the cars reached the finishing line an hour ahead of the schedule. One driver claimed to have covered the course in five hours and eleven minutes, which must have been a breakneck speed over the bad roads. The day's run was a most severe test on springs and running gears, and although no breakdowns were recorded there is no doubt but that the terrific strains will tell later.

Peculiarly enough, the number of cars having shock absorbing devices and those not so equipped are about evenly divided.

Car No. 29, a Garford machine entered by A. R. Davis and driven by H. S. Van Tine, came to grief while speeding at a high rate through Newcastle, Pa. Van Tine, like the other tourists, had responded to the requests of the crowds to "Hit her up," and at the end of the town came suddenly on a sharp right turn. He swung the car, but was unable to fully control the machine. It skidded sharply and the rear wheel on the right side smashed into the curb and the wheel collapsed. The party started at once to make repairs. The Garford car was laid up at Newcastle for two hours. In this town all side streets opening on the route traversed by the tourists were roped off and closed to traffic and the speed limit was suspended. After the accident to the Garford a non-contestant car came along and the occupants skirmished around town and finally located a man who owned a Studebaker car. They arranged to purchase the wheel and rushed it over at once to the disabled machine. The wheel was put on, and by driving at high speed the driver made up a half hour of the time and finished one and a half hours late.

Mr. Van Tine, driver of the car, stated that he had ditched the car in order to avoid striking a man stationed with a flag at the corner. Under the rules, his car having replaced a part not listed at the start, is disqualified, and must continue, if at all, as a non-contestant, and must accept a penalization of 1,000 points, which will mean a penalization of 333⅓ points for each car of the Cleveland team. The team may continue in the Glidden Trophy, but will only have two competing cars. Mr. Van Tine maintained that he had wrecked his car in order to save a human life, and that the committee should consider this and if possible allow him to continue as a contestant. The committee refused to consider his protest.

A baggage truck made by the Rapid Motor Car Company, of Pontiac, Mich., joined the tour at Cahmbridge Springs, and will continue the run carrying the Goodyear tires to supply the contestants who desire them.

At Pittsburg.

The regular evening meeting of the tourists at the Hotel Schenley at 8 o'clock Friday evening proved to be rather interesting. Chairman Hower announced that he had been informed that some of the tourists had stopped at Moravia, Pa., to take on water, and that word had reached him to the effect that the water there which was supplied to the cars was polluted with a

Crowds Seeing Contestants Pass Through Johnstown.

strong acid that would eat out the radiator pipes. He advised any of the contestants who had filled their radiators with water at this point to at once go to the open air garage opposite the hotel where the cars were parked and draw the water out of the radiators, stating that the committee would allow them to do so.

Attention was again called to violations of the rules, and the announcement was made that arbitrary penalties would be imposed if the rules were violated in even the most trivial detail. "This is not a pleasure tour. It is a touring contest," Mr. Hower said; "and you must expect nothing but a most rigid enforcement of the rules." A number of the tourists complained that cars passed them at high speed and then slowed down. All entrants were notified that after passing a car they must maintain the same speed as that at which they were traveling, and must get away from the car behind as quickly as possible. Any car holding another back is to be subjected to penalization.

Complaints were also received to the effect that some of the cars had gone through toll gates without paying the customary tolls. Entrants were warned that they must not do this again.

A vote of thanks was extended to P. S. Flynn, who personally paid the toll for all participants to cross the big bridge coming into Pittsburg, and also bought tickets for the Hotel Schenley orchestra concert and gave each of the tourists one of them. A vote of thanks was also tendered the Lawrence A. C. for sending out men to flag the cars on bad roads and at railroad crossings.

Mr. Hower stated that any entrant or mechanic who bought any bolts or nuts to replace old ones would be immediately ordered out of the contest and his car disqualified. Only such parts as were in the car when it started may be used. He gave the impression that he had received information to the effect that some of the contestants had purchased these parts.

The committee were asked to rule on the question as to whether or not it would be allowable for passengers to get out of a machine to lighten it in the event of its being unable to climb a steep hill. It was decided that all passengers must remain in the car, and it must take the grades with its full load under penalty of disqualification.

There was a great deal of discussion over the time allowance to be fixed by the committee for Saturday's run to Bedford Springs. The distance of 106 miles is over roads described as the worst on the tour, and about as bad as any in America.

Last year the tourists were allowed eight and one-half hours for the trip, and some of them were unable to make it in this time. There was a storm of protest when Chairman Hower announced that the running time between Pittsburg and Bedford Springs would be seven hours, with an additional allowance in the event of wet weather. Mr. Hower stated that a Pittsburg automobilist had gone over the course easily in seven hours, and it was arbitrarily decided that the seven hour schedule would stand.

The tourists were warned that the roads were very mountainous and full of bad spots and water breaks, and they were cautioned to drive carefully and exercise the greatest caution in order to avoid accidents.

The observers were then appointed and the meeting adjourned. Most of the tourists, tired out by the run from Cambridge Springs, turned in early.

PAPERS SERVED ON MRS. CUNEO.

Mrs. Joan Cuneo, of New York city, who is driving car No. 15 in the tour, was served with papers in a damage suit while at the Hotel Schenley in Pittsburg. Deputy Sheriff C. C. Mooar, Jr., served the papers on her, which summoned her to appear in the Common Pleas Court to answer to a suit for $500 damages done on last year's tour when she ran into and wrecked a car at Baden, Pa., owned by James B. Haines, of that city. It seems that on July 20, 1907, after Mrs. Cuneo had left Pittsburg on the run to Bedford Springs, she smashed into Haines' car, which was drawn up alongside of the road for repairs. Haines, who was under the car working on it, was badly hurt. He was accompanied by his wife and another woman, who were sent back up the road to warn the tourists. It is maintained that all of them slackened their speed with the exception of Mrs. Cuneo, who dashed on at a high rate and crashed into the car, and then drove on without waiting to see what damage was done. She made no reply to letters sent her by Don Roes, counsel for Mr. Haines, and when it was learned that she was to be on this year's tour arrangements were made to secure service on her. She will have fifteen days to file an answer. Mrs. Cuneo, in speaking of the accident, said that the top of her car had struck the other one as she rounded the turn, but she had thought that no material damage had been done. She will have her attorney file an answer to the suit.

Road Scene Between Cromer and Johnstown.

Mercer (Pa.) Crowd Seeing Cars Pass.

The Score at Pittsburg.

The official scores as given out at Pittsburg at 6 o'clock Friday evening showed that all the cars entered in the Glidden contest had perfect scores, with the exception of Nos. 27, 28 and 29. No. 27, the Oakland, entered by J. B. Eccleston, lost two points under an arbitrary ruling. One point was for allowing a garage man to put gasoline in the car, and the other point was for allowing the same man to put water in the car. Chairman Hower had warned the contestants that the rules would be strictly interpreted, and it is decreed that no one but the entrant and mechanic can work on the car at any time. Car 28, the Oakland, entered by E. M. Murphy, lost seven points, three for parts used and four for time. Car No. 29, the Garford, was penalized 1,000 points for replacing a smashed rear wheel and was officially declared out of the contest.

In the Glidden Trophy contest at Pittsburg all but the following teams still had perfect scores: Chicago M. C., Team 2, 997 points; Cleveland A. C., 666⅔ points. In the Hower contest all entrants still had a perfect score except No. 105, the Gearless, which had been penalized 1,000 points and withdrawn. Car No. 113, the Gyroscope, had not reached Pittsburg at 6 o'clock Friday night, and was reported as being down and out somewhere along the route. The two friction driven cars are thus eliminated from the tour in its early stages.

Pittsburg to Bedford Springs.

The road from Pittsburg to Bedford Springs vies with the rocky road to Dublin for honors as the roughest and most vexatious highway possible for a tour committee to pick out and ask contestants for any trophy to drive over. It was a case of up hill and down all day, and the grades were steep ones, over roads cut up with deep sink holes and spring wrecking water bars. The springs and running gears of the machines were never more severely tried, and the trip was a test of cars, drivers and passengers alike. Several chains of hills were passed over, and it required no end of changing gears to negotiate them. The large machines had a particularly difficult time of it, and the big six cylinder Thomas, which is a little short on clearance, came very near meeting its quietus. The big car was lifted up in going over a particularly high water bar, and came down on top of the raise. The dust pan was driven up against the flywheel and the exhaust pipes were broken at the expansion chamber. It was necessary to stop for repairs. Others of the cars experienced difficulty on the roads, and there were any number of narrow escapes. The tourists had been warned that the roads were in bad shape and that they might expect to have to use their brakes frequently and to drive very carefully. They were not at all disappointed, for their worst pictured ideas of bad roads were fully realized and exceeded.

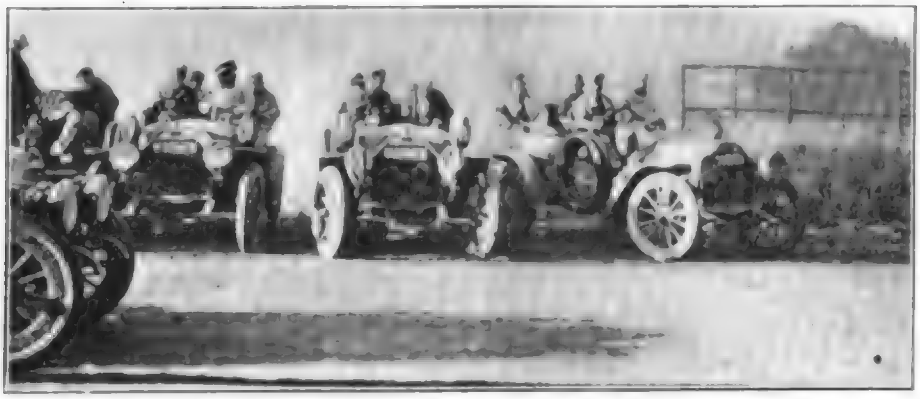
From Wilkinsburg to Johnstown the roads were clay and stone, but they were in horrible shape, and in bad weather would have been almost impassable. They were very rough and narrow, and the turns were abrupt and highly dangerous. From Cramer to Johnstown was over a fairly good pike, and the cars made up some of their lost time. After leaving Johnstown the road became slightly better in spots, with the exception of the ploughed cow path crossing the mountains between Rummel P. O. and Pleasantville.

The tourists received a great ovation all along the line, as usual,, and in many of the mining towns work had been suspended entirely and the entire population had turned out to see the cars go through. Mrs. Cuneo received a great ovation all along the line, and particularly at Johnstown, where the whole town had turned out and seemed to take a great interest in the plucky woman driver. She was also given a great ovation by the summer guests at the Bedford Springs Hotel.

Saturday's run proved to be a rather eventful one in many ways, and though not as many perfect scores were ruined as the committee had hoped for, there was enough doing all along the line to make things interesting. One surprising thing was that there was very little breaking of springs, and when the cars came in after the terrible gruelling of the day's run there were few signs of bent axles and no broken frames. This speaks volumes for the advances made in the strength of construction in these two most essential automobile parts.

The second confetti car, a Reo, had spark plug troubles along the line. The chair-

Chairman Hower Driving Through Pleasantville.



The Marmon Team Representing the Bay State A. A.

man's car lost the route and wandered 8 miles out of its way, but finally got back on the right path and came across the disabled Reo. Mr. Hower took the confetti on his car and continued its distribution.

No. 111, the Overland runabout, was disabled a few miles out of Pittsburg. The rear axle broke off near the right rear wheel and the car was ditched. The driver and his mechanic will endeavor to make repairs. Van Tine, driving the ill fated Garford, was delayed by tire troubles. No. 106, the Franklin runabout, broke its right rear spring, and after trying to make temporary repairs the driver came in with the spring as it was. All the leaves were gone but one. He will continue the tour Monday. No. 113, the Gyroscope, was not heard from after leaving Pittsburg, and is believed to be out of the Hower contest.

Car 31, a Garford entered by A. Davis, was seen near Blairsville with a hub cap off its rear wheel. Some repairs or adjustments were being made. It was later learned that this car had broken one of the drive shafts of its floating rear axle. An hour and twenty-three minutes were lost in making repairs and the car was then driven at high speed to Bedford Springs, coming in eight minutes late. This made its actual running time for the entire trip only five hours and thirty-seven minutes.

W. H. Vandervoort, driving Moline car No. 10, was given a bad scare at Blairsville. A stuffed dummy figure of a man was suddenly hurled in front of his machine, and he swerved the car and applied the emergency brakes, believing that he had hit a man. The dummy struck the front of the car and hung on the springs. The crowd laughed and considered it a great joke. They asked for the dummy back, but Vandervoort refused to give it to them, fearing that they might repeat their trick and cause an accident. He carried the "dead man" up into the mountains with him and threw it away.

No. 9, a Premier entry, was delayed by tire troubles, as was No. 95, one of the Reos. There was remarkable little tire trouble when the condition of the roads is taken into consideration. In fact, tire troubles have been the exception rather than the rule thus far, which seems to indicate that tires as well as other parts of machines are being strengthened and improved. Car No. 18 was also a victim of tire troubles. There seemed to be more punctures than blowouts, which is in itself encouraging.

Car No. 26, E. V. Stratton's Studebaker, lost its spare tires and tubes and a passenger's suit case when the rear door of one of the storage compartments came open. The lost things were not recovered.

At Bedford Springs.

In looking back over the past three days' runs, all of which have been over rough, mountainous roads, it is interesting to note the fact that the majority of the cars are standing up well under the terrific strains imposed by the high speeds maintained. In the list of mishaps broken springs do not figure near as prominently as might be expected. Franklin No. 12 and Franklin No. 106 have both broken rear springs. The Selden car No. 32 had a broken spring, Garford car No. 29 broke a rear wheel in a skid, and Overland No. 111 broke a rear axle. No. 31, Garford, broke one of the drive shafts of its floating rear axle. The runabouts of the lighter type were not standing the strain nearly as well as the touring cars.

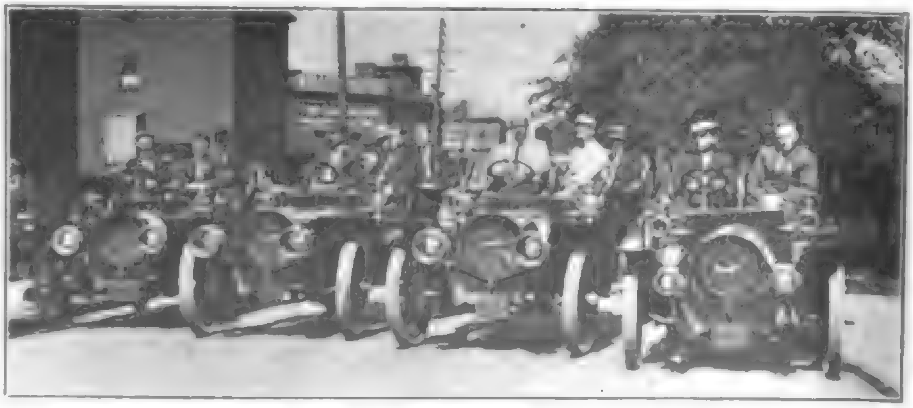
A report of a tour such as this must necessarily be a narration of troubles and accidents, for it is these happenings that furnish the real news on which to base a report, but it is no more than fair to stop for a moment and say a word in praise of the machines which start out each morning and finish at night with a perfectly clean score, and it is pleasing to note that these are in the majority. In this honor roll at Bedford Springs were the following: Nos. 1, 2, 3, 4, 8, 9, 16, 17, 19, 20, 35, 15, 27, 10, 11, 24, 25, 26, 21, 22, 23, 30, 5, 6, 7, 12, 13, 14, 100, 101, 102, 103, 104, 106, 107, 110, 112. It is safe to say that in the miles to come these cars will be operated with the same skill and care that has resulted in bringing them through with clean scores to this point. After all, success depends on the driver even more than on the car, and intelligent handling is more than half the game.

The tourists spent Sunday quietly, most of them taking advantage of the opportunity to cool off offered by the swimming pool at the hotel, and all turned in early in order to be on hand on Monday for the run to Harrisburg, which promises to be a hard one.

ON FRANKLIN NO. 14.

At the invitation of Edward Walker, who has charge of the Franklin contingent in the run, The Horseless Age representative occupied a seat in the 28 horse power, four cylinder, five passenger Franklin car No. 14. This car is driven by M. S. Bates, the well known transcontinental driver. The writer has had a good many thousands of miles of touring experience stretching over a period of eight years, but is free to say that he has never had the pleasure of riding behind a driver who was more skillful or exercised better control over his car than does Mr. Bates. Despite the terrible condition of the roads he made the run from Pittsburg to Bedford Springs, a distance of 106 miles, in less than six hours, and never at any time did the springs on the car "bottom," despite the fact that no shock absorbers were used. Mr. Bates is ably assisted by James Dawley, a Franklin factory expert. There has not been much use for Mr. Dawley's services to date, as the car has not been touched since leaving Buffalo and has a perfect score.

The writer has had a good deal of experience with air cooled cars of various kinds, having driven them for the past six years, but the performance of the little Franklin today was a revelation to him. Its climbing abilities are astonishing, and it



The Four Franklin Cars in the Run.

THE FOUR STUDEBAKER CARS IN THE RUN.

made better average time up hill and down than did some of the 50 and 60 horse power, six cylinder cars. The day was a very warm one, and despite the fact that there was no end of intermediate gear work the engine ran perfectly and without the slightest sign of overheating, although it was put to every test of hard pulling and overloading that it seemed possible for an engine to be subjected to.

AIR COOLED CARS IN THE RUN.

It is gratifying to note the fact that the air cooled cars have entered this year's contest and are on an equal basis with the water cooled. There is no doubt but that the air cooled has its place to fill and its mission in the automobile field, and after the fine showing made two years ago in the Canada tour by the Knox and Marmon cars, it was a matter of regret that there were no air cooled machines entered in last year's event. The Franklin Company are putting two six cylinder touring cars, a four cylinder touring car and a four cylinder runabout through the tour, and are doing much to demonstrate the fact that the air cooled car need not ask favors of any machine and can hold its own against America's best. They have certainly done so in the three strenuous days of this present tour, which have imposed obstacles and conditions that any car might be proud of its ability to surmount.

CAUSES OF SOME PENALIZATIONS.

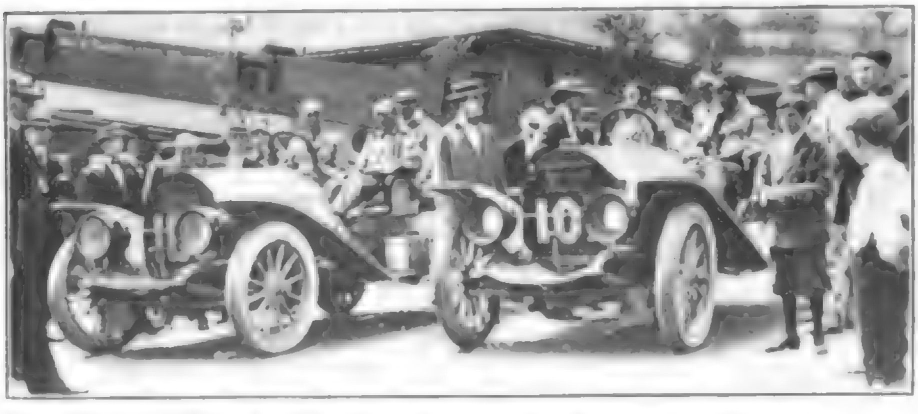
The Hower Trophy scores were varied again by the fact that the Stoddard-Dayton, No. 109, was materially delayed at Monroeville as a result of the machine taking fire. The mechanic was adjusting the carburetor with the engine running, when in some way the wiring became short circuited and ignited the gasoline. The mechanic, Carl Wright, beat the flames out with his bare hands and was burned in doing so. The observer, M. J. Prouty, was also slightly burned. Shortly after Dr. Hoag came along in the Red Cross car and dressed their wounds. The machine was then driven on to the finishing point at Bedford Springs. It was penalized 109 points. Overland car No. 111, which broke its rear axle, was penalized 1,000 points and is out of the contest. The Gyroscope car has been penalized 296 points, and had not reached Bedford Springs at 10 o'clock Saturday night. It is generally considered as out of the contest.

Car No. 108, Mrs. Shirley's Overland, which was penalized four points for putting in parts on the run to Pittsburg, it was stated at Bedford Springs had replaced a connecting rod. The engine had been run with insufficient oil, and the babbitt bearing in the connecting rod had been burned out. The Selden car, No. 32, entered by R. H. Salmonds, broke all of the leaves in its right front spring. The driver made repairs and reached Bedford Springs. The Premier car, which is attempting to do 100 miles for 100 days, and which is following the tour as a non-contestant, had engine trouble and blocked a narrow road. It had to be pushed out of the way to allow the other cars to pass.

It was unofficially announced at Bedford Springs on Saturday evening that the Selden car was to be officially declared out of the contest under a ruling of the committee. No reason was given for this action.

GYROSCOPE CATCHES UP.

At 2:30 Sunday morning the Gyroscope car, driven by A. L. Kull, reached Bedford Springs. The machine had been delayed by difficulty with its transmission while negotiating the steep hills. The plucky driver intends to continue in the run, but as a non-contestant, he stating that he did not think it fair to the official observers to ask them to ride with him and go through the experiences of the past three days again.



THE TWO STODDARD-DAYTON ENTRIES AT HARRISBURG.

The Meeting at Bedford Springs.

The evening meeting of the tourists on Saturday at Bedford Springs was a short one, but rather interesting. Chairman Hower again went over the rules in regard to time lost during tire repairs and stated that the committee had decided that the time so lost must not be made up. The committee's idea in this is to discourage a man from speeding to keep up with his schedule after having been delayed by tire trouble. The driver of the Fisk tire car was reprimanded, complaint having been made to the committee that he was continually speeding.

A very important announcement was made in reference to the penalty of two points imposed arbitrarily by Chairman Hower on car No. 27 for having allowed a garage man to put water and gasoline in the car. The chairman, despite his most positive assertions on Friday evening, seemed to be mellowing and stated that after due consideration he had decided to expunge these two points and so clean up the record of No. 27 car, which goes back into the perfect score class. Mr. Hower stated that he felt it was a hardship for a man to be penalized for an error of this sort when his car had made a perfect score on all other points. It was stated that the entrant or driver need not pour in and lug his own gasoline and water. This announcement was received with applause by the tourists.

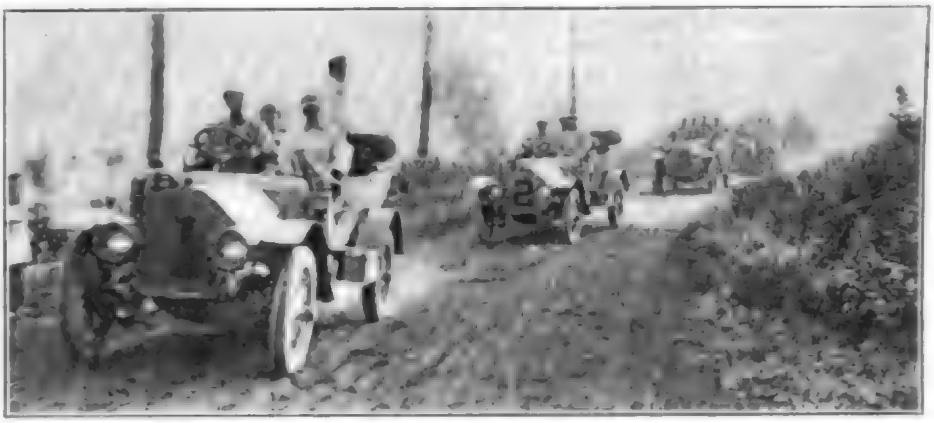
The tourists were notified that there were six toll gates in the run to Harrisburg, and were asked to have the proper change ready, in order not to cause confusion and delay on the road.

The tourists were all requested to purchase gasoline at the official station at McConnellsburg, as the man at this point had hauled it 8 miles over the mountains. The price was fixed at 25 cents a gallon.

The usual meeting of the tourists was held on Sunday evening, and observers were assigned to the various cars for Monday's run to Harrisburg. The much mooted question as to whether material such as wire, rubber, wood blocks could be used to make parts for repairs on cars was brought up by contestants whose cars had suffered broken springs and who desired to block them up in order to make them last the run out. It was decided that wooden blocks might be used without penalization and that crude rubber or an old inner tube might be employed as a bumper. It was further decided that a contestant might go into a blacksmith shop and make a bolt or any other part needed for his machine, and, provided that he did the work himself, there would be no penalization for the use of the part so made. The time employed in making it would have to be made up, however. The fact that springs could be blocked up and temporarily repaired was good news to the driver of Franklin No. 106, who broke a rear spring on Saturday's run.

The tourists were requested not to throw bottles in the road, as the glass was likely to injure the tires of cars coming on later. Returning to the question of the rules in regard to permissible repairs, it was further decided that a frame, if cracked, might be repaired if the work was done by the driver and his mechanic and only raw material was used. The contestants are only to be penalized for putting in manufactured parts. It was decided that it was not allowable to wrap springs with rope, as this was equivalent to a shock absorber.

The start was announced for 7 o'clock, and the running time will be six hours for the distance of 107.3 miles.



The Pierce Team Entering Harrisburg.

Bedford Springs to Harrisburg.

The tourists were up at Bedford Springs at 5 o'clock on Monday morning and were checked out at 7 o'clock for the run of 107.3 miles to Harrisburg. The route led over mountainous roads intersected every 50 feet with water breaks which racked cars and tourists alike and rendered high speeds dangerous and impracticable.

From Bedford Springs to Fort Loudon the roads were fair average country roads, up hills and down mountains. From this point to Sloughstown the road was good macadam. It had rained during the night, and at spots along the road there were deep water holes, through which the cars ploughed at high speed, splashing machines and tourists alike, and all of the tourists were mud and dust covered from head to foot when they reached Harrisburg.

The first 25 miles of the route was an almost continuous upward climb, until McConnellsburg was reached. The scenery was magnificent and inspiring, and the tourists enjoyed it thoroughly. At Shippensburg the town turned out in full strength. All of the houses were decorated with national colors and a large banner had been hung across the road with the words, "We hope U win" printed on it. In addition to this the enthusiastic residents had erected a large triumphal arch spanning the centre of the main street, on which were the words "Welcome Glidden Tourists." All of the cars drove under this.

At Carlisle many of the Indian pupils of the famous school there had turned out to greet and cheer the tourists. The Harrisburg Motor Club had also sent a delegation to this point to meet the chairman's car and pilot it into the city. In addition to this the Harrisburg club had also marked all of the turns on the road from Carlisle in.

Once out of the mountains and down on fairly good macadam the tourists began to "hit it up." Many of the cars got over the 50 mile an hour mark. The time for the day's run had been set at six hours, and this meant an average speed of nearly 19 miles an hour. It was not possible to maintain anything near this in the mountains, where the roads were so intersected with water bars, but the cars for the greater part made up their lost time and reached Harrisburg from a half to three-quarters of an hour ahead of their schedules.

W. R. Douglass, a prominent newspaper man of Harrisburg, and said to be the "real man" behind the Harrisburg Motor Club, welcomed the tourists at the Lochiel Hotel and notified them that they would be tendered a complimentary smoker at the new Metropolitan Hotel in the evening. Governor Edwin S. Stuart, of Pennsylvania, has been invited and is expected to attend. The tourists were invited to visit the swimming pool at the municipal baths and were given the freedom of the place.

There were a number of toll gates on the run, and the tourists were required to pay toll amounting in all to about $2. It was a day of tire troubles, and a large number of the cars were held up en route as a result of nails and other foreign matter puncturing their "wind bags." Among the cars so delayed were Nos. 1, Great Arrow; 5, Peerless; 16, Stevens-Duryea; 7, Peerless; 25, Studebaker; 99, Pierce Great Arrow; 29, Garford; 35, Oldsmobile; 31, Garford; 22, Marmon; 100, Great Arrow runabout.

The chairman's car, No. 99, when it received its puncture was near Slotestown. A number of the contestants had caught up with him, and when his car stopped they were obliged to stop also, as no cars are allowed to go ahead of it. It required less than ten minutes to make the repair. The chairman is a pretty fast driver himself, and his speed indicator permanent finger has often stood above the 50 mile mark at night, and it was not long before he had the tour in full swing again and the cars pounding over the road at good speed.

A number of the tourists had been priding themselves on the fact that they had not experienced any tire trouble and were riding on the same air which was put in the tires at Buffalo. Among this contingent were the Peerless cars and the chairman's car. There seemed to be a large amount of glass, bits of iron, rusty nails and other

(Continued on page 86.)

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The A. A. A. Tour.

The meagre entry list for the Glidden-Hower contest unmistakably shows that American manufacturers are growing tired of these long extended, expensive and more or less risky competitions. Although some of the oldest and best known makers are taking part, only a small fraction of the industry is represented by entries in the two competitions. No doubt many makers who have supported such contests in the past decided to keep out of it this year, because the rules really encourage reckless speeding, and in order to win great risks of accident must be incurred. It is a fair assumption that the competitors do not drive at high speeds simply for the sake of speeding, but because they think that it improves their chances in the struggle. No competitor can tell beforehand whether he will meet any delay from mechanical troubles in any particular stage, and in order to be prepared for what may be in store for him he starts in to gain on the schedule immediately after having been checked out from the night control. This feature was condemned in the recent criticism of the rules in these pages, and the turn of events has borne out the justice of the criticism. Almost all the cars eliminated so far have been put out of the contest by crashes due to speeding, and almost none due to mechanical breakdowns due simply to severe usage.

The pace required by the time schedule fixed day by day is a very hot one. The object of the tour management is, of course, to break all perfect scores, except one in each contest. It can be said without fear of contradiction that the average quality of the cars entered is very high, and the drivers' qualifications also show a high average. The chances are that if the cars were kept down to a moderate speed quite a number of teams would maintain a perfect score throughout the run. Therefore, in order to eliminate perfect scores more rapidly, high speeds are permitted and even encouraged.

The gist of the whole matter is that automobiles have now reached such a state of perfection that it is impossible to determine the most reliable car among a certain number by any known form of organized contest. The feature of a single winner is in reality incompatible with the idea of a reliability test. If the causes of eliminations were carefully analyzed it would be impossible to prove want of reliability in most cases.

The above also explains the obvious fact that certain manufacturers whose cars have a high reputation for reliability and have often done well in reliability contests before have been afraid to enter the event. With a reputation for reliability already established, a win could not do them much good, while the much more likely event of their record being spoiled by undue risks taken by a reckless driver would be sure to do them considerable harm. As the industry advances in age more and more firms seem to assume this view of the matter, and the end of these annual long distance touring contests seems not far off. The old established makers have no need of such events; to the purchaser they are only an imperfect guide, and only to the newcomers in the industry, desirous of a chance to publicly prove the quality of their cars, can such contests henceforth be of any decided benefit.

The Official Observer System.

With three days of the tour past and nearly 350 miles of the total distance traversed a good opportunity has been presented to determine the value of the new system of official observers. This is the first time in three years that official observers have been carried on competing cars, the committee in the two previous Glidden events depending on the word of honor of the competitors themselves, which did not work out altogether satisfactorily. The average driver in a tour of this sort is apt to believe that all's fair in love and war and motor competition, and not to hesitate to lie, and perhaps cheat, too, in order to get his car through with a perfect score. Under the present arrangement the observer named by an entrant cannot ride in his car, and is assigned to the car of some competitor, and the assumption is that he will be very anxious to report any mishaps to the machine he is in in order to help out the score of his own car and eliminate as many competitors as possible. As is known, on last year's tour the contestants were compelled to furnish a list of all spare parts carried and were to be penalized for all of those used. No one used any spare parts to speak of out of the checked list carried in the cars, but most of the drivers had complete duplicate sets of parts which they carried in their suit cases and used indiscriminately. This year the committee hit upon the plan of having heavy canvas bags made in which all parts carried are placed after being listed. There are two of these bags, one of which holds the regular parts usually supplied by manufacturers to a customer, and the other the parts carried as extras. Both of these are sealed and can only be opened in the presence of the observer, who makes a note of any parts used, and the usual penalty is imposed on the basis of one point for each dollar's worth of parts used. These bags will be inspected and rechecked at the end of the tour.

The observer system will without doubt result in a great deal stricter observance of the rules and will make the run more of a contest. It will also guarantee the accuracy of the final results and reports.

The Effect of Length of Stroke Upon Engine Power.

It has been generally supposed that within reasonable limits the length of the piston stroke had no effect upon the maximum power an engine would develop. For example, it was thought that a 4x4 inch engine and a 4x6 inch engine of otherwise identical construction would be equally powerful. This assertion is borne out by the fact that practically all the official formulæ for gasoline engine power take account only of the cylinder bore and disregard the stroke. The reasoning which led to this conclusion was that the power is made up of two factors, the mean effective pressure and the linear speed of piston, and there seems at first glance no reason why either of these factors should have any appreciably different value in the one case than in the other. It seems logical to assume that both engines will give their maximum power at the same piston speed, as with the same valve diameters the mean velocity of the incoming charge and outgoing spent gases would then be the same in the two engines respectively. It is a question, however, whether the gas velocity in the valve parts is necessarily the factor limiting the speed of maximum power of the engines. It generally does determine this speed, but if we should make the valves extremely large, say of a diameter equal to one-half the cylinder bore, or even more, other factors might intervene to determine the speed of maximum power.

It is conceivable that in a cylinder with very large ports and passages the speed of maximum power might be determined by the time required to completely burn the charge. In fact, there is absolutely no doubt that this is the case if the mixture is not perfectly proportioned and consequently slow burning. Although in the long stroke motor a proportionately greater volume of charge must be burned during each power stroke, this will not require a proportionately longer time. At the moment the power stroke begins, the distance from the point of the spark to the remotest part of the combustion chamber is practically the same for both types of engines, and even at the end of the stroke the ratio of these distances is not as great as the ratio of strokes. It is, therefore, evident that if the time required to burn the charge limits the speed of maximum power, instead of the time required to tolerably fill and evacuate the cylinders, then the long stroke motor will show its maximum power at a higher piston speed.

This question of the effect of length of stroke on horse power has come to be of considerable interest since the rule of a maximum bore was introduced in contests. The opinion has recently been expressed by several European writers that the power increases with the length of stroke, within reasonable limits, and that consequently there is an advantage in speed contests under this rule in using a comparatively long stroke. One European concern has put the matter to a test by building cars of the same bore and different lengths of stroke, and it is stated that the long stroke motors were more powerful, but no rule regarding the dependence of the power on the stroke has yet appeared in print, so far as we know.

Improving Double Ignition Systems.

On cars which are equipped with two separate ignition systems the arrangement usually comprises a high tension magneto, with a mechanical primary make and break, and either multiple vibrator coils and timer or a single vibrator coil and distributor as the reserve. The advance and retard of spark position in both systems is always effected by the same spark lever. Some attention is usually paid in the coupling up of the timing apparatus of the two systems to secure approximate synchronism between them, but it is not practicable to go very far in this direction. On account of the vibrator lag of the battery system, the equivalent of which does not exist in the case of the magneto, the actual instant of ignition for a given position of the spark lever is later when the battery is used than when running on the magneto, assuming that corresponding timer contacts and breaks in the magneto primary are arranged to be simultaneous.

On the average car the engine speeds up when the switch is thrown from the "battery" point to the "magneto" position, with the spark lever not shifted, on account of the earlier occurrence of the magneto spark. This phenomenon is often interpreted as proving the superior igniting power of the magneto spark, a contention which may be perfectly true, but of which the observed action is not in itself conclusive proof. Corresponding positions of the spark lever do not produce identical effects when used in connection with the two ignition sources, a much greater range of spark lever position being required to obtain maximum results with the vibrator coil than with the magneto. The lever requires considerably more advance when running on the battery than when operating on the magneto, other conditions being the same. An operator who is accustomed to driving with the magneto as the ignition source will not, as a rule, obtain as good results in fuel economy or otherwise when attempting to use the battery system, and vice versa. In order to obviate this difficulty a synchronized dual system of ignition has been devised, in which the battery spark and the magneto spark occur at the same cyclical point of the motor for any given position of the spark lever. The magneto shaft carries, in addition to its regular make and break, a similar single contact mechanical interrupter connected with the battery, timed to open exactly with the magneto interrupter. A plain coil is used in connection with this battery make and break, vibrator lag being thus avoided. In order to obtain synchronous results the coil of the battery system is made identical electrically and magnetically with the double wound armature of the magneto, which is essentially an induction coil. With this arrangement the operator can use his spark lever exactly the same with the two systems and obtain identical results.

The Good Roads Congress.

Favorable comment is being heard on all sides regarding the work of the Buffalo good roads convention which preceded the start of the A. A. A. tour. The earnestness of purpose of those who attended the meetings is being recognized, and it is held that good results for the cause will come from the exchange of views of motorists, grangers and road officials. The one vital point on which a majority of the delegates were agreed is that much damage is being done to macadam roads by motor cars traveling at high speeds. This being admitted, the next question to consider is whether ordinary macadam road construction shall be abandoned in favor of some form of construction in which the filling material is rigidly bound so that it cannot be sucked out from between the stones by the action of pneumatic tires, or whether a solution of the difficulty is best accomplished by suppressing speeding. The first remedy would be the most positive, and road construction with asphalt or tarry binding agents will undoubtedly become common in the future; but for the present we must look to the preservation of the many miles of macadamized roads already built and which are not likely to be built over, on account of the cost. If these roads are to be kept in a good state of repair, it is above all necessary that automobile speeding on them be absolutely suppressed. Here is a chance for the automobile clubs represented at the Buffalo convention to demonstrate their real interest in the preservation of our improved roads. Let them seek to suppress scorching, not only by adopting high sounding resolutions against it, but by aiding the authorities in apprehending speed offenders and by expelling members found guilty of repeated flagrant violations of the speed laws.

Conclusion and Results of English and Scottish Trials.

By Roy Lindsay.

Of the fifty-six cars that reached Glasgow on June 19, nineteen had been entered for the Scotch trial alone, leaving thirty-seven for the remaining week of the English trial out of the original forty-six that started from London on June 11, and these duly left Glasgow for Windermere, 168½ miles, on Saturday, June 20. After the tribulations of the awful Scottish weather and mountainous Scottish roads the competitors looked forward joyfully to a comparatively easy week. The hills selected for the timed climbs were well known and presented no difficulties except perhaps to the small 6 horse power De Dion, which had survived so far, but had only been able to ascend the mountain passes in Scotland backward on the reverse, this unusual method being permissible, though it was criticised.

The drive to Windermere, in the heart of the beautiful English lake district, was uneventful and formed a delightful change to the previous ten days, the sun shining from a cloudless sky, making the day's journey over the perfect road surfaces the best so far. Sunday was a welcome day of rest, and was spent by nearly everybody boating on lovely Lake Windermere. The distance of Monday's journey was 135 miles, the route including a roundabout course among the lakes, so as to bring the machines back to Windermere in the evening, the same arrangement, but over different roads, prevailing on Tuesday. There were two timed climbs Monday, the first being up Dunmail Raise, distance 1 mile 740 yards, and easy as to grade, the steepest portion being only 8 per cent. No actual times will be published for the many hill climbs, the system adopted being to treat the fastest car in each class as "X," and only announce the differences between that and the succeeding cars in the class. This secrecy is necessitated by reason of the 20 mile legal limit of speed on British roads, which was exceeded by many of the higher powered machines, and any publicity of this fact might have made trouble among anti-motorists. Following were the fastest in the various classes: Class 3, 15 horse power Singer; class 4, 20 horse power Talbot, by 6 4-5 seconds; class 5, 25 horse power Talbot, by 11 3-5 seconds; class 6, 30 horse power Adler, by 49 1-5 seconds; class 7, 38 horse power Italian Daimler, by 14 seconds, with the 37 horse power White steamer fourth, and class 9, the 48 horse power Rolls-Royce. There was only one competing car in classes 1, 2, 8 and 10 each, and these cars had a walk over on the hills to the end of the contest, and also the final speed run on Brooklands track.

For the second timed hill on the Monday 2 miles of the long Kirkstone Pass was selected, the results being the same as on Dunmail. A bad accident occurred here to the 25 horse power Thornycroft, in class 5, that had hitherto been penalized with the lowest marks in its class. When starting on the hill the driver's attention was called to the soft condition of all his tires, but sooner than lose marks for inflating them on the road he said he would wait till night time and inflate without penalty in garage. In attempting to maintain big speed round one of the bends a rear tire burst, and so wrenched the steering that a front tire followed suit, causing the car to strike the guard wall at the edge of the road and throwing the mechanic out of his seat. Both axles were badly bent, one of the wire wheels was buckled out of shape and the steering rods were bent. The car was got running again at 2:30 a. m. the next morning without any outside assistance, and continued through the trial, but under the heavy penalty of eleven and one-quarter hours, or 675 marks.

On the eleventh day of the trial the distance was 137½ miles, and included a timed climb up Shap Fell, distance 1 mile 1,157 yards, average gradient 6 per cent., the worst gradient 12 per cent.; also a timed climb up Alston hill, distance 5 miles 713 yards, average gradient 3½ per cent. and worst grade only 5 per cent. The positions of the cars in the various classes on these hills was the same as on Monday and, as was to be expected, very high speeds were accomplished up Alston. On the first hill this day the 17 horse power Benz suffered from a seized piston and retired from the competition.

Little is to be said in respect to the twelfth and thirteenth days, for which the distances were 162 and 160 miles respectively. The thirty-six machines still left did not alter their positions in regard to reliability. There were two timed hills, one at Harley, distance 1 miles 82 yards, worst grade 17 per cent., and the other Broadway hill, distance 2 miles 97 yards, worst grade 10 per cent. Two machines, the 15 horse power Shamrock and the 15 horse power Zedel, incurred serious penalties of over seven hours each for repairing springs and repairing a disc clutch.

The total distance covered on the road up to the moment of entering the Brooklands track was 1,076 miles, and on Friday morning, the fourteenth day, some of the classes were started for the speed run on Brooklands track which should decide the winners and positions of others in each class. Day by day, from the second when the timekeeper had given the word to go at the starting point for the road run on the first day in London, every happening to a car, great or small, had been faithfully recorded against it. Each gallon of gasoline consumed represented one minute, time occupied in filling water or lubricating oil tanks was debited, and all the time occupied in adjustments and repairs either to mechanism or tires. (Tire covers could be changed without penalty in the garage, but had to be carried on the machine for the whole distance of the road test.) All these penalties were totaled up, and for the final speed test the machine which had incurred the smallest loss of time was started *first* in its class, and the remainder of the machines belonging to that class followed in the order of penalty, the times on the eleven hills also coming in for the handicap in the same way. For instance, in class 5, the total of penalties against the 25 horse power Beeston-Humber was 131 minutes 9 3-5 seconds, while the 25 horse power Talbot had been penalized 142 minutes 17 2-5 seconds. The Talbot was therefore handicapped the difference of 14 minutes 37 4-5 seconds.

It had been originally intended that all the classes should travel 200 miles on Brooklands, but this would have occupied so much time for the smaller classes that it was decided to send classes 1 and 2 for 100 miles, classes 3 and 4 for 150 miles and the remainder for the full distance, a time limit being set beyond the various distances for each class of a maximum of seven hours from class 3 to class 10. In class 1 the 6 horse power De Dion; class 2a, the 8 horse power Adler; class 8, the 45 horse power Ariel, and class 10 the 59 horse power Ariel were the only competitors, and therefore drove over the course at speeds well within their powers. Undoubtedly the class that aroused the greatest interest was 2b, in which there were but two competitors, viz., the 10 horse power Cadillac and the 12 horse power Zedel. Although slower on the hills the Cadillac had lost but few marks for reliability, had consumed 6 gallons less of gasoline, and therefore started for the 150 miles run with the healthy lead of 33 minutes 28 1-5 seconds, and this gave it opportunity of covering exactly 18 miles before the Zedel started. At 36 miles the Zedel had gained 3 miles, and had just gained another 3 miles, after the Cadillac had covered 70 miles, when it lost seven minutes to remove dirt from the carburetor. At 114 miles the Zedel was only 8¼ miles in the rear when more dirt in the carburetor caused another stoppage of 4 minutes. The Cadillac had been pegging away at an average speed of 30 to 33 miles per hour, and when 135 miles had been covered speculation had become rife as to which would win, which eventually proved to be the Cadillac, with but the very small margin of 1 minute 14 2-5 seconds, or something less than three-quarters of a mile. The win was an exceedingly popular one.

The most remarkable performance of all the machines entered for the 2,000 miles trial was that of the 20 horse power Vauxhall in class 4. It covered the whole distance on 76 gallons of gasoline at an average of 26.29 miles to the gallon, never required to put a single drop of lubricating oil into the tank, never put a single drop of water into the radiators, had no mechanical troubles or adjustments whatsoever, and never had to stop for a second for tires, securing both the gold medal for its class in the Scottish trial and the trophy for its class in the English trial. Starting with a lead of 52 minutes 20 1-5 seconds over its nearest competitor, the 20 horse power Daimler, it finished 50 minutes 41 2-5 seconds in front, the other machines in that class being a long way off.

In class 3 the 15 horse power Singer had a lead of nearly 11½ hours, and although the other two machines in that class were in readiness in case the Singer should have a smash, the latter finished comfortably at an average pace of 31 miles per hour. In class 6 the superior speed of the 30 horse power Adler told heavily in its favor, as against the other three machines in that class, for although starting 45 minutes after the 32 horse power Beeston-Humber it traveled at the remarkable speed of an average of 63 miles an hour, and for many of the laps must have touched 70 miles an hour, because the average speed includes stoppages to replenish gasoline.

In class 7 the 40 horse power Armstrong-Whitworth started only 1 minute 45 seconds in front of the 38 horse power English Daimler, and the latter had gained 9 miles after 110 miles had been covered, but at 126 miles the universal joint on the propeller shaft broke and the Daimler had to stop, the Armstrong-Whitworth therefore winning. A similar Daimler in all details, except that it was chain driven, secured second position, and the 37 horse power White steamer ran third. The White had started 2 hours 7 minutes 26 seconds later than the winner, mainly because the gasoline consumed on the road was the heaviest of any machine in the trial, viz., 214 gallons.

In class 9 the 48 horse power Rolls-Royce started 61 minutes in front of the 48 horse power Deasy, and with so much in hand was not pushed, its driver being content to average 53½ miles per hour. The other machine in class 9, the 52 horse power Lorraine-Dietrich, was the worst driven machine in the 2,000 miles run, the gasoline consumed, 196 gallons, being the second highest, and 28 gallons more than the third (a 24 horse power Brown in class 5 that was also shockingly driven, and actually 42 gallons more than the 50 horse power Ariel). In anybody else's hands the Dietrich would have scored, but when a machine of its horse power fails to climb hills that the little 10 horse power Cadillac went up comfortably, it can be realized that the man, not the machine, was at fault.

The Scottish Automobile Club has worked out the results of the Scottish trial, and the gold medal awards to the winners of each class are as follows: Class A, 12 horse power Swift; class B, 14 horse power Argyll; class C, 16 horse power Bell; class D, 16 horse power Vauxhall; class E, 35 horse power Darracq; class F, 35 horse power Deasy; class G, 40 horse power Armstrong-Whitworth; silver cup for the lowest gasoline consumption per ton mile to the 24 horse power Albion. It is necessary to explain that in the Scottish trial the classes were divided according to price of chassis with tires, and in the English trials according to the Royal A. C. rating.

The Effect of Automobiles on Roads.

(Paper read by W. J. Taylor, M. I. C. E., before the Institution of Automobile Engineers, London, May 13.)

From the engineer's point of view, the most serious effect of automobiles on roads is the wear and damage which they cause to the road surfaces, and the strain which they occasion in the road crust and foundation.

Any increase or expansion of traffic on a road must obviously cause increased wear on the surface, augment the abrasion in the road crust, and hasten the development of any weak spots which may exist in the foundations or in a yielding or weak sub-soil. The effect of the heavy automobile wheel, however, is, so far as my experience teaches me, to hasten deterioration in these respects more rapidly and more seriously than in direct proportion to the extra number of journeys or to the additional weight carried over the road surfaces by them. This is no doubt due to the small diameter of the wheel usually employed by the designers of motor trucks, and by the more rapid pace, compared with ordinary traffic, at which the self propelled vehicles travel.

Even by the exercise of the greatest care in consolidating broken granite on a good foundation, and so bringing all its units into solid compact by dry and wet rolling that they interkey and bear on each other without an intervening film of "binding material," it is impossible to obtain an absolutely true surface; the wave effect is always present more or less, and is often developed until the surface is so badly corrugated that the fast traveling vehicle proceeds by a series of impacts. The greater the degree to which the surface fails to keep in close contact with the wheel, the quicker the trouble accumulates. The advantages of wheels of large diameter were shown by Morin and other investigators early in the last century, and they have been repeatedly and fully demonstrated in recent years, especially by the very instructive experiments of Dr. Hele-Shaw.

GOOD AND BAD ROAD MATERIALS.

In regard to light cars, it is usually conceded that on good macadam roads ordinary pneumatic tires, as a rule, inflict little damage: but on roads of flint and gravel, or other poor material, the suction of soft tires draws out the finer and loose particles from the interstices, and thus tends to unkey the metalling. The effect of armored tires is, however, very different; the many kinds of steel studs which have been designed with an evil ingenuity, which appears to have taken into account all things except the welfare of the roads, are being more and more used, and the deterioration of all kinds of surfaces -granite as well as flint —owing to the use of this form of tire is widespread, especially where the traffic is in one track. Monsieur Heude, Ingénieur en Chef des Ponts et Chaussées, in a series of very able lectures on motor traffic which he is now addressing to the students at the Ecole Nationale des Ponts et Chaussées, says:

"When the tires are metallic the shocks are evidently more violent than when the tires are of india rubber; further, some makers have furnished their wheels with rows of studs; then the effect produced is frightful; it is nothing less than a large toothed cogwheel; the roads are, so to speak, ploughed up"; * * * "the groove is sunk into the surface, and the horizontal tangential effort loosens and flings the stones backward."

The high speed of light cars is very destructive to the road, as the leaping motion acquired by the vehicle lifts the driving wheels from the surface, or, at any rate, so reduces the friction at the point of contact that there is "slip," and the metal is filed out of the road in a series of small depressions.

IMPORTANCE OF PROPER CROSS-FALL.

It has always been understood how vital it is to construct road surfaces with a moderate cross-fall—the least that is consistent with proper drainage—in order to induce traffic to use the whole width of the road from side to side, and thus distribute the wear, and obtain, as far as possible, an even and regular reduction of the road metal over the whole surface from margin to margin.

The rectification of defects in the cross-fall has made good progress since the renaissance of our roads, although on many of them it is difficult to accomplish. On long mileages of country roads it is too expensive to lower the centre; this method also often carries with it the very great objection of disturbing the thin road crust at its weakest part, and where the traffic is generally perilously near the sub-soil. The excessive fall is therefore usually rectified by filling up the sides or water tables prior to recharging with new coats of metal.

In towns and other similar places it is often impracticable to effect the desired improvement. The sides are usually at a level fixed by curbs, paths and doorways, while the centre sometimes carries a tramway; or it often is the case that a reduction of the centre level would bring down the traffic dangerously near to gas and water mains, and their connections lying just below the surface, or it might expose them to frost.

INADEQUATE FOUNDATIONS.

Perhaps the most obvious defect in our roads is the insufficiency of their foundations. Where roads run over hard strata, such as rock, compact gravel, or similar hard ground, no special precautions in the way of foundations are usually necessary; but where the sub-soil is clay or of other soft or mobile material, the necessity for providing an artificial foundation is, of course, paramount.

At the present the road engineer has to satisfy himself with providing a foundation by the method of "accumulation," that is to say, he endeavors each year to lay down a little more material than is actually worn out, and so gradually accumulate a support for his road, with the hope that one of these days it will be of sufficient thickness to spread and transmit the imposed load to the weaker subsoil, and so avoid rupture of the surface, and arrest that movement in the core of the road, which means grinding and waste of metal. Even this method of strengthening, while it makes the least immediate financial strain on the road authority, is a costly process.

NUMEROUS EXPERIMENTS MADE.

The roads under the jurisdiction of county councils are now, and have been for many years, the scene of innumerable experiments on all classes of materials, and while I fully recognize the value of the experiments on road stones conducted in the geologist's laboratory, the road surface must in the end prove to be the only real and trustworthy laboratory of the practical engineer. It is only by carefully noting the behavior of different metals on the varying sub-soils—on bed rock, moving sand, oozing chalk and slippery clay—under traffic of every kind, and by observing the effects of the varying climatic conditions which prevail in his particular part of the country, that he is able to gain a reliable knowledge not only of the relative wearing values of road materials but also of their qualities in regard to foothold and ease of traction.

It has been possible to pretty well determine long ago which are the best road materials available, but the determination of the best materials is the lesser part of the problem; the greater is to find the funds to procure the material.

One of the effects of the motor—as of any other increased traffic—is to render improvement in the character of the material of increased importance, and to accelerate a change which has been pressing since the first traction engine was put upon the road. The inferior material used cannot be at once replaced, bulk for bulk, by superior material, on account of the huge cost involved by the change; therefore this, which is one of the first and obvious steps in the improvement of roads, may only be carried out with painful slowness, and at a rate which, without financial aid from some source which is not at present apparent, will be slow enough to arouse the impatience of the road user, but quite rapid enough to throw a great and serious burden on the shoulders of the taxpayer.

DUST PROBLEM AN OLD ONE.

"The dust problem," about which so much has been said and written, is not by any means a new evil, although the effect of fast motor traffic has been to so very greatly increase it as to bring it to an acute stage and make it absolutely necessary that some remedy should be found. Dust was a great trouble to our forefathers—the numerous pumps on the old Bath and other roads will bear witness to this—but as in our own time surface watering was found to be insufficient to meet the difficulty, and they endeavored to find other and more effective palliatives. It was in 1856 that Claus proposed a solution of calcium chloride or magnesium chloride for this purpose, while in 1867 Mr. and Mrs. Cooper were granted a patent for the use on roads of a solution of common salt and some deliquescent chloride, such as that of calcium or magnesium.

We have on roads two very distinct kinds of dust; first, that imported by animal traffic, which is the most offensive and objectionable of all, and, secondly, the dust which is due to the wearing of the road material, either on the surface directly under the traffic or in the core of the road caused by attrition or rubing of the stones by movement, due to passing loads, and which may work to the surface, together with mud from a wet sub-soil, where the road crust is insufficient to prevent it. While it has always been realized that excellence of ordinary construction goes far to reduce wear, and therefore reduces the evil of dust, it has also been fuly understood that it does not by any means prevent it, and many and persistent have been the efforts during the past three-quarters of a century to so modify or improve ordinary macadam as to convert the road crust from the condition of a porous mass of stone units, more or less in a state of movement, to that of an impervious monolith, and by filling the interstices of the metal base with bitumen or other compound, to prevent, or at least to minimize the creation of dust by the causes to which I have last referred.

TAR MACADAM EXPENSIVE.

Ordinary tar macadam was one of the first attempts in this direction, and it is, of course, a very old form of road surface, and has been used in this country for upward of fifty years. When properly made and applied it is most efficacious in minimizing dust and mud, and as a consequence it carries with it the advantage of increased longevity, as compared with ordinary macadam. Unfortunately, the cost of *£2,000* to *£3,000* per mile has restricted its use to towns, and makes its general application to country roads impracticable. Much ingenuity and thought have been devoted to the task of finding simple and inexpensive methods of laying ordinary granite, basalt or other road stone in a bituminous matrix, in such a manner that the interstices between the metal base throughout the road crust may be filled with it, instead of rolling the broken metal dry, and then adding water and "binding" in the ordinary way.

The general application of the impervious road surface to trunk roads is not likely to be undertaken for the present; the initial cost has prevented its use, otherwise a large proportion of our roads would possibly be already of that improved form of construction.

TARVIA.

Granite chippings mixed with "Tarvia," the result of John Hutchinson's investigations, were used in the proportions suggested by Mr. Gladwell, but the cost of consolidating Mount Sorrel granite in this matrix was, with a top dressing of Tarvia and chips, 46 per cent. more than consolidating the same metal with water and grit. In another experiment, the cost of consolidating Rhenish columnar basalt in the matrix without a top dressing was 38 per cent. more than the cost of consolidating the basalt with water and grit, which is as nearly as possible the result which might be estimated from the costs of the materials employed; probably 40 per cent. would prove to be the average extra cost in country districts, bearing in mind the first cost, and in many cases the very long haulage of tarred matrix, as compared with the cheaper and shorter haulage of water and grit, and this method of consolidating the material on main roads alone would, therefore, add at least another three-quarters of a million per annum to the road bill.

BETTER FOUNDATIONS NEEDED.

Another great obstacle to the general adoption of the impervious road has been the necessity of immediately constructing adequate foundations to carry it, as in the absence of an unyielding bed the defects which quickly appear in the surface are much more serious than in the case of ordinary macadam, so that the method of "accumulating" a foundation must be abandoned and a solid road bed at once provided to carry the better form of surface. In addition to this, it is necessary to raise the sides in order to still further flatten the cross fall of those roads which may have a camber suitable for ordinary macadam only. The cost of these necessary improvements of foundations and cross fall on the main roads only of England and Wales is so vast that even if the cost of providing the impervious surface were much less there are no prospects whatever at present of finding the funds to carry out the work.

It was at first hoped that tar spraying might prove helpful by saving wear and tear on inferior materials such as flint and gravel, and so assist in tiding over the period necessarily occupied in making the transition to harder stone; but experience has shown that, in most cases, these poor materials do not behave satisfactorily under tar treatment, and in some cases disintegration is hastened—in wet weather the material is inclined to churn up, and the surface is covered with a thick, black and most objectionable mud.

As a method of laying dust, other than that of imported nature, the tarring of roads has met with considerable success, and its employment is rapidly extending, notwithstanding the objections raised on account of the tar being taken into houses, spoiling carpets or polluting streams.

I need scarcely point out that a most important consideration, from the point of view of the taxpayer, is the extent to which the tar treatment of roads saves wear and tear on the surfaces and adds to their longevity. Opinions both here and in France undoubtedly take the view that an increase in the life of the road is secured by tar spraying the surface, although it is difficult, if not impossible, as yet to fix the exact degree of the saving, and to say if it is, on the whole, very appreciable, varying, as it must, with all the differing conditions of weather and situation.

TAR SPRAYED MACADAM.

In whatever other way a tar sprayed macadam road may fail on comparison with a bituminous metal, a tar macadam, or a Tarmac road, it undoubtedly carries with it this advantage—it is financially possible to apply it over a vastly greater mileage; it does not interfere with that method of "accumulating" a foundation with which engineers have to be satisfied. It to some extent prolongs the life of the road, and, therefore, with the same expenditure on materials it gives increased opportunity of improving the cross fall and extending the hard stone surface in substitution for soft material, and it brings immediate, if not complete relief from dust to all those who use or live by the road. It is on these grounds that I agree with the opinion expressed by Mr. Maybury, the county surveyor of Kent, and many other road engineers, that the roads of the immediate future—except in towns and special places where costly pavements are warranted or justified—will, for financial reasons, be of ordinary macadam structure, granites, basalts and other such stones being substituted for soft local material, as funds will permit, and with a surface treatment of tar. But even this modest programme will not easily be realized. The cost of tar spraying 27,556 miles of main roads alone, assuming them to average 18 feet in width, including fencing and gritting, would amount to about £1,500,000 per annum.

NO ABSOLUTE DUSTLESSNESS.

Although by consolidating your material in a bituminous matrix of some kind or other, and, to a lesser extent, by tar spraying, you seal down your surface and reduce dust to a minimum, you still have to deal not only with that which is produced by actual surface wear under contact with traffic, but you have to cope with that most offensive form of dust which is imported on to the road surface, and which can only be entirely avoided by the abolition of horse and other animal traffic from the road.

It has proved a distinct disappointment to the public to find that improved forms of road surfaces, such as those we have just been considering, are not entirely free from dust; in fact, there is no such thing as a dustless road. Under certain conditions of the atmosphere, when ordinary macadam roads are moist, and by reason of this humidity hold down or fix the objectionable imported matter, the more impervious surfaces quickly dry, and the offensive dust being freed, is easily raised by traffic and becomes a great nuisance. I have on many occasions noticed this on a length of Tarmac laid down by the Hants County Council; in consequence, these impervious forms of road do at times and in certain localities require increased labor and expenditure in cleansing and washing.

Convict Labor Road Building in the Southwest.

The Southwest is awaiting with peculiar interest the outcome of two convict labor road projects about to be undertaken in Kansas and Oklahoma. The ascendency of the automobile even among the farming communities of this section has brought good roads agitation to an acute stage, and there has been more activity in the last two or three years than in all the previous history of the West.

It is largely in response to popular clamor that Oklahoma is about to withdraw all its prisoners from the Kansas State Penitentiary at Lansing and put them to work constructing State highways which are to bisect the State east and west and north and south. The Oklahoma roads are to be constructed of macadam, and each county touched will be required to furnish annually an appropriation sufficient to cover the maintenance of the grade and the repair of the way. The first road will probably start from the Oklahoma border near Little Rock, Ark., and be carried west, with curves to take in the principal cities along the line, to the western end of the new State.

In a recent interview Governor Haskell announced that the Oklahoma prisoners would be withdrawn from Kansas within ninety days and put to work. Oklahoma houses its prisoners in the Kansas prison because of the absence of a penal institution in Oklahoma, and notice of the withdrawal of prisoners has been served on the Kansas authorities.

The road in Kansas referred to will be a Government project, constructed to accommodate the moving of artillery between Fort Leavenworth and Fort Riley, a road travel distance of about 160 miles. This also will be constructed by convicts, probably those in the military prison at Fort Leavenworth. The macadam and teams will be furnished by farmers along the line of the road without cost to the Government, and, in return, the road will be open to all kinds of travel.

Experimental as is the use of convicts in road building, the authorities are confident that there will be little trouble. On the Kansas road no ordinary felons will be worked. The men confined in the military prison are all soldiers guilty of infractions of the regulations. They are in no sense dangerous prisoners, and the Government has the additional advantage of furnishing troops as guards. In this way it will kill two birds with one stone—building its road and giving the soldiers on guard desirable work in the open.

In Oklahoma the problem is far more complex. Wardens of penitentiaries have always maintained that the problem of guarding several hundred felons in the open country was one involving great expense and trouble. Among their friends in the open prairies of Oklahoma attempted rescues of prisoners may be no uncommon occurrence for one thing, and then there are the matters of sanitation, field hospitals and commissary, all vexing details to the general proposition.

What the final outcome of the experiment will be Oklahoma intends to find out for itself.

Motor Buggies Not Popular in Indianapolis.

Automobile manufacturers and dealers in Indiana are watching with considerable interest the progress being made by the high wheeled motor buggy in that State. Present indications are that the manufacture of that type of vehicle will be somewhat curtailed in Indiana next season, until the design has been more thoroughly developed. There are now eleven concerns manufacturing high wheeled motor buggies in Indiana, although some of the cars have not yet been placed on the market.

For some reason this type of vehicle has not received the reception anticipated. This is especially true in Indianapolis, only three such companies being now represented in that city, and none by dealers with established showrooms. Only one of the largest Indianapolis dealers has tried to sell vehicles of this type, and his experience was such that he relinquished the agency after one season.

According to the British Patent Office annual report, recently issued, there was in motor vehicle patents a decrease of 35 per cent. as compared with 1906, while in flying machine inventions there is an increase of 100 per cent. over 1906, and 500 per cent. over 1905. The number of patents for anti-skid devices have decreased.

Although it was generally believed that no show would be held in Brussels the coming winter, the Belgian Automobile Manufacturers' Association has now decided that it will hold a show in World's Fair Building, January 16-25. The best stands, on both sides of the main aisle, are to be reserved for Belgian makers, and there will probably be a special section devoted to body work.

NEW VEHICLES AND PARTS

A New Napier Carburetor.

For their new 80 horse power, six cylinder car the Napier firm of England have designed a new carburetor, in which the area of the spray nozzle outlet is varied in accordance with the power required of the motor.

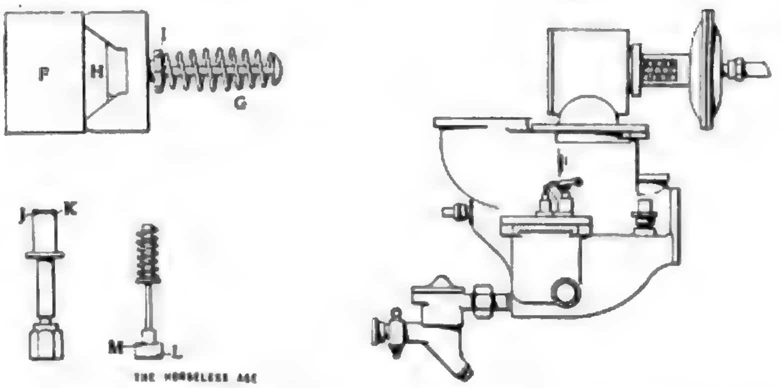
The outlet at the top of the jet has a curved slot J, and a short distance from it a small hole K. On the top of the jet a movable baffle cap L is fitted, ground to its seat, having a curved opening M in it corresponding to the slot in the jet. The cap is placed over the jet, held down to it by the spring shown, and is capable of being partly rotated.

The flow of gasoline is regulated by the amount of exposure given to the slot in the jet, by turning the baffle. Up to 20 miles an hour the little hole, termed the pilot, in the jet is the only aperture exposed; turning the baffle further gradually exposes the curved slot to its fullest opening when the maximum power of the engine is required. The movement of the baffle is made to coincide exactly by mechanical means with the gas and air throttle by the lever on the steering wheel under the control of the driver.

Simultaneously with the opening of the throttle and the exposure of the jet aperture, air is automatically admitted, firstly, from the usual air inlet; secondly, as the speed of the engine rises, the water pressure acts on the hydraulic regulator, the extra air is admitted, and the mixture adjusted to suit the varying speed of the engine. The amount of gasoline allowed to flow is no more than is actually required for the speed of the engine.

One of the special features of the carburetor is that it has an electro-deposited copper water jacket. The air throttle worked by the hydraulic air regulator is shown in the illustration marked 2. F is the sleeve showing one of its three triangular apertures in which the plunger slides; the air is taken in the front end and its supply to the carburetor is automatically regulated by the speed of the engine increasing or decreasing the pressure of water, which, in its turn, presses on a diaphragm. The diaphragm moves the plunger rod G, to which is attached the plunger H. In the view shown it is half open, and in accordance with the speed of the engine this plunger slides in and out, opens and shuts the three ports, and automatically adjusts itself to admit the amount of air necessary for the rate at which the engine is turning.

The spring shown on the plunger rod is provided to control the pressure of the water, and the nut I is for the purpose of adjusting the spring to its requisite tension, so that the opening and shutting of the valve occurs at the correct moment.



New Six Cylinder Napier Controllable Carburetor.

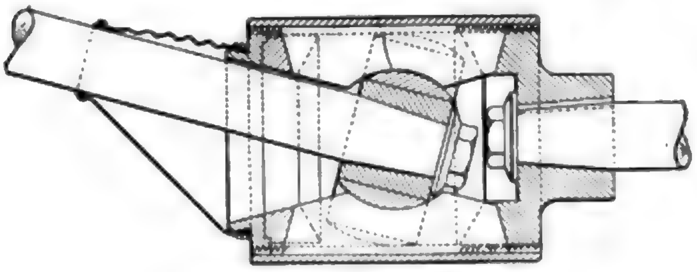
The Style H Blood Brothers' Universal Joint.

The Blood Brothers Machine Company, of Kalamazoo, Mich., have recently brought out a new design of universal joint known as Style H. The joint is made either slip or non-slip, as desired. The slip joint consists of two sections, the rigid or bearing section and the slip section. In the rigid section a collar is fastened to the shaft by means of a key or spline; to this collar is attached a circular shell, open at the opposite end. Within this shell are fitted two bearing plates placed opposite to each other in keyways cut in the shell and retained in place by means of an annular ring and lock-nut screwed into the open end. The collar and bearing plates are correspondingly beveled, as are the annular ring and opposite ends of the bearing plates, thus insuring a rigid set.

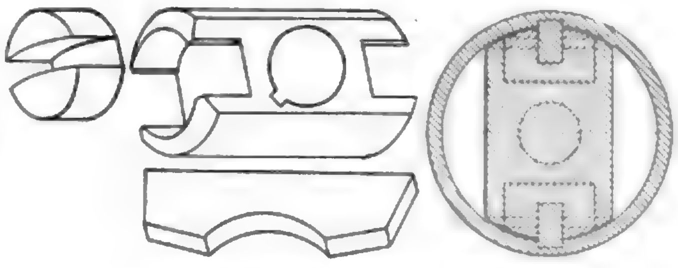
The propeller shaft is coned at its end, and is provided with a cylindrical collar, which is keyed within the pivot bearing head. This latter is approximately circular in section and is provided with two lugs at each end. These lugs enclose the straight bearing plates, pivot bearings being placed in the grooves thus formed, providing a working fit between the bearings and the plates, and also allowing a limited angular movement of the bearing head relative to the axis of the joint. The grooves formed in the pivot bearings have circular bottoms, thus allowing an angular movement of the head (and shaft) at right angles to the former movement. The faces of the annular ring and lock-nut are beveled to allow of these angular movements. A leather collar is attached to the propeller shaft and to the shell at either end, rendering the joint dust proof and retaining the lubricant therein.

The non-slip joint is provided with an exactly similar bearing head and pivot bearings, but the shell is shorter. In place of the straight bearing plates of the slip type, the bearing plates are formed with a circular portion corresponding with the bottom of the groove in the pivot bearing, thus allowing a relative angular movement. Endwise movement of the shaft is prevented by these plates, which are retained in place by an annular ring and lock-nut. A dust cover is fitted as in the slip type.

The bearing plates are of tool steel, hardened and ground to size. They are made interchangeable, so that they may be reversed to have the wear come on opposite sides. The shell is of seamless steel tubing, and the collars and pivot bearing heads are of steel, the latter being hardened for wear. Ample room for lubricant is provided by the large space within the joint itself. The joints are designed to be fitted on the drive shaft by keying on to the tapered ends of the shaft, a nut and lock washer preventing the joint from leaving the shaft. The wear in these joints occurs only between the bearings and bearing plates, there being none whatever upon the shell or other structural parts.



Blood Universal Joint Assembled.



Parts of Blood Universal Joint.

Success Chemical Fire Extinguisher.

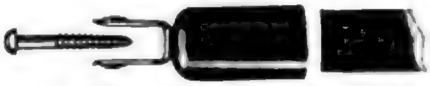
The H. W. Johns-Manville Company, 100 William street, New York, have recently put on the market the Success portable fire extinguisher. It is made of extra heavy Lake Superior cold rolled copper, securely riveted and reinforced by heavy shoulders of solder, and tested to withstand a pressure of 350 pounds to the square inch, or four times the required strength. The joint where the cover is attached is ordinarily the weakest part, but the method of attaching the dome to the body of the shell is said to make that joint the strongest part in this extinguisher. The large wheel at the top of the machine is a convenience in opening and closing it, and at the same time serves as a base on which to rest it when reversed, as in use for playing on a fire. The framework, or bottle holder, containing the supply of sulphuric acid, is cast brass. The bottle for holding the acid is obtainable anywhere, in case of accidental fracture from any cause. The hose, tested to 400 pounds to the square inch, can only be detached with a wrench, being joined to the body by a swivel ground joint.

To put the apparatus in action, it is simply turned bottom up, and the resultant mixture of sulphuric acid in the three gallons of water charged with bicarbonate of soda develops instantly force enough to throw a chemical stream 50 feet, it is claimed. This chemical stream acts as a blanket and smothers fire which water cannot reach. By means of a loosely fitting lead stopper the flow of sulphuric acid is regulated so as to generate the correct amount of gas at all times, making explosion impossible, the company states. As this extinguisher neutralizes the acid before it leaves the machine, the stream will not injure material with which it may come in contact. This extinguisher is approved by the National Board of Fire Underwriters

SUCCESS FIRE EXTINGUISHER.

The Connecticut Ignition Terminals.

A new form of quick detachable terminal for use on primary and secondary circuits has recently been put upon the market by the Connecticut Telephone and Electric Company, of Meriden, Conn. The ball and socket construction allows the connector to swivel or turn in any direction. The spring clip contact is said to be sufficiently strong to prevent jarring loose, and to be always positive and reliable.



CONNECTICUT TERMINAL.

The Connecticut terminal is made up in two types, suitable for use as primary or secondary connectors respectively. The secondary connector is fitted with a rubber collar or sleeve, which covers the end of the wire, making a neat finish, and avoiding danger of shock in handling. In order to attach the connector the wire is cut off straight, the rubber sleeve pushed on, the wood screw passed through the hole in the stud and screwed down tight. The screw makes contact with the stranded wire, and at the same time swells the insulation slightly, making it bind the inside of the rubber cap.

The secondary terminals are made to fit three sizes of wire, one-half inch, three-eighth inch and five-sixteenth inch in diameter. The primary terminal is connected by cutting off the wire straight, slipping it into the hole in the stud carrying the spring, then placing the screw in position (as indicated in the illustration) and screwing down tight.

Both the primary and secondary terminals are furnished with an adapter, as shown. These adapters will fit any plug or terminal (not over three-sixteenth inch in diameter) by removing the thumb nut, slipping on the adapter and then placing the thumb nut back on the screw. Hexagon ball nuts are made in various thread sizes, so that they can be screwed onto a spark plug or on a timer connection in place of the nuts with which they are usually fitted. This form makes a neater job, inasmuch as it allows the terminal to swivel in any direction, which is not the case where the adapter is used.

G. E. Tungsten Automobile Lamps.

The General Electric Company has brought out a new line of high efficiency incandescent lamps of low candle power, including miniature and battery types of tungsten lamps. These latter are made in standard and miniature bulbs, and can be supplied in any voltage from 1½ to 20 volts and from fractional candle powers up to 24 candle power. These lamps are intended for use with electrical novelties, portable devices, pocket lamps, etc., and are particularly applicable for use in automobile service as a substitute for oil and acetylene lamps. The filaments are short, and consequently sufficiently strong to withstand the shocks of automobile service. They can be operated from the regular ignition storage batteries. The efficiency of these lamps is 1¼ watts per candle, and this is claimed to be combined with excellent life and superior quality of light. Tungsten, by reason of the high efficiency it secures, is peculiarly adapted to the battery type of lamps, where low energy consumption is a prime requisite.

The "Autogas" Tank Box.

The Avery Portable Lighting Company, Milwaukee, Wis., have brought out a pressed steel box, finely enameled, for carrying one of their "Autogas" tanks on the running boards. The box protects the tank from mud and corrosion and holds it securely. The tank can be replaced in half a minute, it is claimed.

Slight Decrease in New York Registrations.

The report for the first half of 1908 of Secretary of (New York) State Whalen shows a decrease of $900 in the receipts from automobile certificates. Eight thousand two hundred and forty-five owners of autos were registered, as compared with 8,519 for the same period in 1907. Five thousand two hundred and forty-seven licenses of chauffeurs, however, were issued, as against 5,191 in 1907 till July 1. It is thought that the increase in chauffeur licenses is due to the supposed fact that depression in manufacture caused employees to become chauffeurs.

There is a decrease also in the number of new companies organized in the State. The fees, though, aggregate about $27,000. Most of the companies organized are, of course, located in the larger towns. In the same way the larger cities rank highest in the number of auto owners registered in the following order: Greater New York, Buffalo, Syracuse and Rochester, Utica and Albany.

At present the automobile is not named in the tariff schedule, and automobiles imported are liable to duty as manufactures of iron at the rate of 45 per cent. ad valorem. When the tariff is next revised, which it is likely to be next winter, automobiles will undoubtedly be classed separately. There appears to be some apprehension among manufacturers that the tariff on motor cars may be materially reduced. Two Buffalo manufacturers are reported to have filed a protest against any reduction in the present tariff rate with the Buffalo Chamber of Commerce, to be forwarded to Washington.

During the fiscal year 1906-7 104 automobiles were imported into Hawaii, valued at $162,770.

COMMUNICATIONS

Women Drivers.

Editor Horseless Age:

Why is it that any man who drives a car, either as an owner or chauffeur, says when the subject of women driving is brought up: "I always give them all the road and run my own car into the ditch, or anywhere to get out of their way"? I think this statement is a timely one and deserves some attention from automobilists in general. I believe the reason why they, as a rule, pay so little attention to the rules of the road, or even to the common courtesies of the public highways; which really are the rules of the road, is that women of the class who drive automobiles have been brought up to believe that men should always say or act "after you." This, of course, is true ordinarily, but when a woman has in her hands the control of a powerful machine on a public thoroughfare she must do as the law—either written or unwritten—provides, and forget that anybody ever showed her any more consideration than he would a man.

I have been in the automobile "game" more than four years, and by some very narrow escapes have learned not to try to teach women the rules of driving, but for the safety of my own passengers and car give them all the room possible. This is not right, but I have not the moral courage or the nerve—whatever it is—to hold the fair users of automobiles up on the road and explain to them how both our cars would have been wrecks had I done as they did.

There is no reason why they should not learn to use the roads properly, as some few have, and we men will be glad to see them at the wheels of their cars when we can depend upon them to do as men under similar circumstances would do; but at present some of my friends and myself take no chances with life or limb or car when we see a lady at the wheel.

One Who Likes Ladies in the Tonneau.

Cold Curing Compound.

Editor Horseless Age:

Will you kindly publish, for the benefit of subscribers, the formula for a fluid for vulcanizing patches upon inner tubes? I have had good success with this, but have lost the formula. J. S. Greene.

[You probably refer to the compound used for "cold curing." The cold curing fluid consists of a solution of 2 per cent. of proto-chloride of sulphur in 98 per cent. of sulphide of carbon. First the surfaces to be united are given several coats of rubber cement, each coating being given time to dry before the next is applied. Then the cold curing fluid is brushed over the cement and the surfaces are pressed together immediately. Rapidity in applying the patch after the fluid is brushed over the cement is essential to success.—Ed.]

Brake Lining Materials Not Affected by Oil.

Editor Horseless Age:

In the July 1 issue of your paper I notice an inquiry for a brake lining not affected by oil, after which you note that the only brake material that is claimed not to be affected in its frictional qualities by oil is cork. We take the liberty of informing you that Raybestos, which we have been advertising to a large extent for several weeks in your paper, is claimed by us to be not affected by oil. To be frank, we are somewhat surprised that you have not made yourself sufficiently familiar with the advertising columns in your own paper to be aware of our claims in this direction.

Royal Equipment Company,
A. H. Raymond.

[We have also been reminded by the Trenton Rubber Manufacturing Company that the Thermoid brake lining manufactured by them is not affected by oil.—Ed.]

Cleaning the Circulating System of Lime Deposits.

Editor Horseless Age:

Will you kindly publish directions for using sulphuric acid to remove lime from the water jackets and the radiator of my automobile motor? I have tried boiler compound, without results.

The radiator is of half inch brass tubing, and the water tank is made of galvanized iron.

I have noticed several communications in The Horseless Age in regard to using graphite in the crank case. I have used flake graphite on several occasions lately in my motor, and have not noted that it short circuited the spark plugs, and I have put on as much as two teaspoonfuls. The motor is a two cylinder double opposed.

C. A. Kinsey.

[The use of sulphuric acid is not to be recommended for removing lime from the cooling system. The following method of removing the scale is taken from "Operation, Care and Repair of Automobiles," by Albert L. Clough:

"The whole of the water in the circulating system must be run out and measured, taking care that no water is left which would have the effect of diluting the solution which is to take the place of the water. The solution must be made by dissolving 2½ pounds of solid caustic soda so that it makes 1 gallon of solution. If, say, 5 gallons is the capacity of the whole system, it will clearly be necessary to dissolve 12½ pounds of the soda. Considerable heat is generated when the soda is dissolved, and frequent stirring is necessary, unless the soda is hung in an iron basket just under the surface of the liquid. When the liquid is cooled it may be introduced to the circulating system until this is entirely filled. The soda is allowed to remain in the system all night, and is run out in the morning. It must be borne in mind that caustic soda will corrode aluminum or zinc, and must not be used if the system should have, for instance, an aluminum pump cover. It acts to some extent upon rubber and brass, but is not likely to seriously damage such fittings in one night. After running out the soda a hose pipe and water supply should be connected to the system, and a good stream of water driven through at fair pressure for some time—say five minutes. The solution of the caustic soda may be carried out in an iron bucket."—Ed.]

Graphite Lubrication.

Editor Horseless Age:

In your issue of June 24 there is a letter from Robert B. Caverly, regarding "Deflocculated Graphite in the Cylinder." I have used this graphite with great success in the crank case only, but do not use as much graphite as the Acheson Company directs. I mix about half a teaspoonful with a gallon of oil. S. L. Schoenfield.

Patent Query.

Editor Horseless Age:

Would you kindly inform me through your paper if there is a patent on the use of piano wire as a flexible shaft? Thanking you in advance, I am, yours truly,

G. R. D.

[So far as we know there is no patent on the use of piano wire as a flexible shaft. In fact the use of a certain device cannot be patented.—Ed.]

Wants Tire Valve Stems Shortened.

Editor Horseless Age:

For years I have read your valuable magazine, and noted your readiness to advocate improvements, and have often wondered why you never criticise the Schrader valve stem. Why is it made so long as to be a nuisance? Many a time I have had to make an excuse to get ladies out of hearing while I replaced a punctured inner tube. I knew I would invite Schrader to places they would not want to hear about.

I find my friends who run autos talk about Schrader in the same way, but none of us talk to him. You can do this so he can hear. The plunger of that valve is the same as used on the bicycle, and why should the stem be made so long as to cause so much profanity? And the worst of it is as the tires get large he lengthens the stems, and to a man putting on a new stiff tire it's just like a safety valve to a steam boiler—he must swear or burst.

John Gardiner.

[It may be in order to explain that Mr. Gardiner writes from Tucson, Arizona.—Ed.]

From Kansas City to Denver on a Steamer.

Editor Horseless Age:

I am thinking of making a trip to Denver in my 5 horse power Stanley. Do you know of anyone who has made a trip to Denver in a Stanley? If so, will you please advise me what luck they had with the water; also what route? P. L. M.

[We should like to hear from any readers who may have made the above trip as to road conditions, watering facilities and route followed.—Ed.]

Gear Muffling Lubricant.

Editor Horseless Age:

We have noted the request of Greenwood Brothers & Co. as to who furnishes gear muffling grease.

The Joseph Dixon Crucible Company, Jersey City, N. J., manufacture and sell a special graphited wood fibre preparation known to the automobile trade as No. 688, to be used in all enclosed gears except where there are small oil holes leading to the bearings.

This grease, as the name implies, has incorporated in it a small percentage of graphited wood fibre, flake graphite, and the whole being thoroughly incorporated in a high grade petrolatum grease. The fibre is obtained from kiln dried, straight grain cedar fibre (which has been selected after careful test). The object of this cedar wood fibre is to form a cushion for the gears to mesh with, and instead of having actual metallic contact they are separated by a thin, elastic cushion, making almost noiseless running.

The graphite used is Dixon's Ticonderoga pure flake lubricating graphite, the function of which is to eliminate the minute irregularities existing in the metal surfaces by filling in the low spots and forming over all a thin, tough, veneer-like coating of great smoothness and durability.

When this grease is used in the transmission gear box and the gears are shifted, danger of chipping is eliminated by the cushioning effect of the fibre and the veneer of flake graphite on the gear teeth: because of the spongelike nature of the fibre there is no dripping or throwing of the lubricant out of the gear box.

At the automobile shows we have had sets of gears running at high speeds with the covers removed, and there was no grease thrown. It has been observed that after this grease has been used for a short time it takes on the consistency of a soft vaseline.

Joseph Dixon Crucible Company.

[We have also received letters from Lewis C. Travers, C. R. Coward and Charles E. Duryea calling our attention to the fact that the Joseph Dixon Crucible Company made the grease referred to by our correspondent.—Ed.]

Editor Horseless Age:

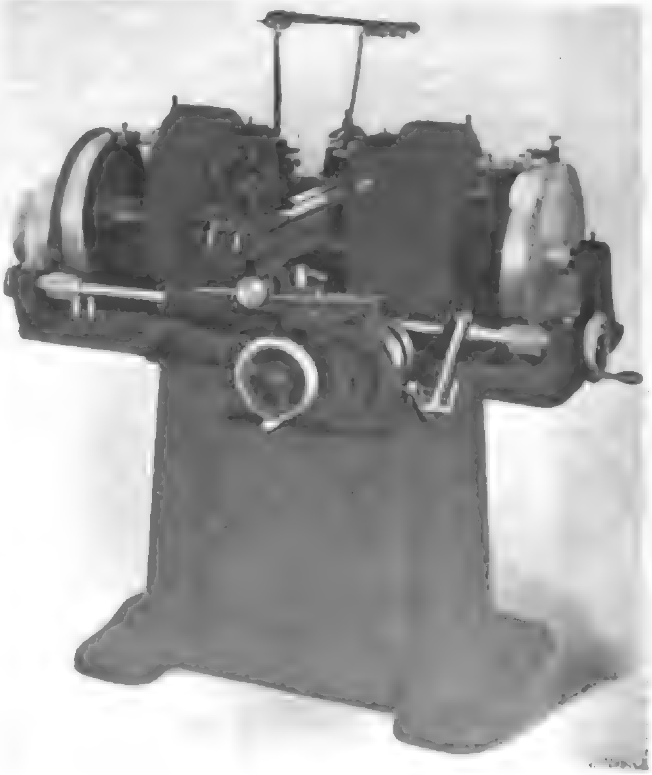
Geo. A. Haws, 72 Pine street, New York, makes a cork filled grease. This is what is referred to by Greenwood Brothers & Co., page 52, July 8. E. W. Roberts.

The Pratt & Whitney Spline Milling Machine.

Pratt & Whitney Company, of Hartford, Conn., are bringing out a new milling machine, known as the spline milling machine, designed to avoid the necessity of broaching or hand milling for cutting keyways with closed ends and of tang slots. This miller is claimed to perform these operations in a rapid and economical manner, and the operator may care for two or more machines at the same time.

The machine, which is here illustrated, consists of a frame with two cutter heads cast integral therewith, and has a work carrying slide capable of traversing back and forth between the two cutter spindles, which automatically feed toward each other at the end of each stroke. The cutter spindles are of steel, hardened and ground, and run in bronze bearings, the front bearing sliding with the spindle, a cable and weight arrangement holding back the spindles so that their outer ends are kept in contact with the large face cams seen in the illustration. These cams are adjustable along their shafts and are graduated to indicate depth of cut, etc. A three step cone drives the cutter spindles through gearing within the frame, an easily adjustable arrangement allowing of either spindle being operated independently or both together. The work table is exactly similar to the company's bench lathe bed, and is fitted in exactly the same way.

The table is automatically traversed in both directions by a constant cam, seen at the front of the machine, which operates a rocker arm to which is connected a long link. This link is also connected to the under side of the table at the further end. The rocker arm face is provided with a T slot, in which slides the connection with the link operating the table, any desired travel up to 4 inches being obtainable by adjusting the relation of the link connection to the rocker arm axis, a knob allowing this to be made without using a wrench. This knob is connected to a quick pitch lead screw engaging the connecting block. A lever and "tommy" retain the connection in place. The table may also be adjusted for position without altering the stroke by moving two knurled adjusting nuts on the link connecting block, a small adjustment up to 1¼ inches being then possible without releasing the work holding device. Changes in the rate of feed are accomplished by a sliding key change gear giving five speeds. The hand wheel allows the table to be traversed rapidly, as in ordinary milling practice, a hinged grip knob setting the power feed. The index pin and dial are placed directly in the rear of the right hand cutter spindle in a horizontal position. The contour of the table cam is such as to cause the table to stop at each end of its stroke, the cutter spindles being fed forward by the large face cams. These have gear teeth cut entirely around their periphery, which mesh with pinions upon the long cross shaft, which enables the face cams to be rotated by the hand wheel. The automatic feed for these cams is operated by the slotted link and crank motion visible in the illustration. Lubrication is by pump and cocks, with a large tank fastened to the door inside the frame to insure coolness, freedom from injury, ease of access, etc. Specially formed cutters with two or more lips (fish tail cutters) are designed for use in slot milling in this machine, although the regular end mill works satisfactorily at moderate speeds.



Spline Milling Machine

According to the last Belgian automobile census there were in that country on December 31, 1907, 3,262 automobiles, or 311 more than one year before. There were also 4,002 motorcycles, 213 less than the year before.

Commercial Applications.

Motor Fire Engines for Los Angeles.

The day of the horse in the fire department of Los Angeles, Cal., has passed. The board of fire commissioners has voted to buy no more animals for the department, and by September 15 the entire business district will be patrolled by motor trucks, while six months later the entire department will have been reorganized and the motive power changed from horses to gasoline motors.

The inefficiency of the horses on the long and steep grades that abound in the city was one of the main reasons for the change. A few months ago three dwellings on the summit of the Downey avenue hill were destroyed without salvage, because the horses pulling the fire engines were exhausted when they reached the foot of the grade and failed to drag the heavy apparatus up the hill to the fire. If motor trucks had been in use at least two of the houses, and in all probability even the third one, would have been saved. Every month the number of expensive residences built on the summits and slopes of the numerous hills is growing, and with their increase the danger of loss is growing.

A clean sweep is to be made. Every station within the city will sell its horses, the drivers will become pipemen and truckmen, and capable drivers and mechanics for the operation and maintenance of the motor trucks are to be obtained through civil service examinations. No reduction in the number of employees is contemplated, but it is possible that the number of stations in the outlying districts will be reduced, as one motor truck can cover the territory of two horse drawn fire engines, and can cover it better. The men and the apparatus thus released will be used for the better protection of the business district, with its valuable skyscrapers and stores.

For the men the change will be a decided advantage. In the first place, the odor emanating from the quarters of the horses in the fire stations, where the firemen have to sleep and eat, will be eliminated, since the runs to fires can be made in a shorter time, more conflagrations will be extinguished before they have gained headway, thus saving the men much time and exposure to danger.

Fire Chief Walter Lips has been granted an appropriation of $400 to inspect the automobile fire fighting facilities wherever they have been installed in the larger Eastern cities, and during the trip he will visit every factory manufacturing the trucks. The cost of the change is to be paid out of current funds without resorting to bond issues, and the city council has agreed to make an initial appropriation of $150,000.

Commercial Notes.

Twenty Atlas two cycle, 22 horse power taxicabs have been delivered to the Boston Taxicab Company during the past week.

The Akron, Ohio, Board of Safety has given a contract to the Webb Motor Fire Apparatus Company, of Vincennes, Ohio, for three combination motor fire engines and hose wagons at an aggregate cost of $13,500.

The Spencerville Auto Transit Company is to be incorporated to run an automobile line between Lima, Lafayette and Ada, Ohio, making four trips daily. One car has already been purchased and will be placed in commission immediately.

It is reported that L. H. Baker & Co., Birmingham, Ala., are in the market for two motor milk wagons. The vehicle must be capable of traveling 50 miles per day with a constant load of 2,000 pounds. The wheels must be shod with solid tires and a speed of 12 miles per hour must be attainable.

Prior to asking for bids for the contract of transporting the mails in the city of Pittsburg during the coming year Postmaster W. H. Davis is making some experiments with a touring car furnished by the Bellefield Motor Company. In the specifications for the vehicles to be used motor cars will be included.

An attempt to standardize taxicab rates in Paris has failed. The municipal council, which had the subject under advisement, reports that it would be impossible to unify the rates, owing to the difference in size and power of the cabs in service. It is, however, proposed to do away with the extra charge for going outside the city limits.

The United States Post Office Department has received an offer from a Detroit manufacturer to furnish automobiles of the $600 package car type to collect the mails in Washington, D. C. The company offers to furnish ten automobiles for eight hours a day, with drivers, and two emergency vehicles. The department will probably accept the offer.

Motor trucks have been purchased by the Shank Furniture and Storage Company and the Central Supply Company in Indianapolis, making the total number of such vehicles in that city sixty. The former company conducts a second hand furniture store, storage and household moving business, and is the first firm in Indiana of its kind to employ motor trucks.

The automobile line between Greensburg and Clarksburg, Ind., was opened on July 6. The cars will connect with all trains and traction cars at Greensburg. Cars have also been ordered for a line between Greensburg, Napoleon, Osgood and Versailles. This line will connect two county seats, one of them an inland town 6 miles from a railroad, and have a total mileage of 25. Rapid cars will be used for both lines.

The Taximeter Cab Company, which recently began operations in Los Angeles, Cal., is experiencing difficulties because it failed to secure a permit for cab stations from the police commission at the time the ordinance regarding such stations was passed by the city council. It is claimed that the independent automobile rental companies and horse cab owners immediately took possession of all of the cab stands provided by the ordinance.

California Reliability Run.

Fourteen of the twenty-one cars entered in the reliability run of the Southern California Automobile Dealers' Association finished the four days' contest July 6 with perfect scores, after negotiating a distance of 380 miles over roads that ascended a number of stiff grades in the mountainous region traversed. Two of the machines finishing with perfect scores were driven the entire distance by women; Mrs. W. J. Burt drove a Tourist roadster and Miss Gladys Moore went over the course in a single cylinder Cadillac. The run began Friday morning, July 3, from Los Angeles. On Saturday the confetti car guided the contestants into San Diego, whence the return to Los Angeles was made after a trip to the San Bernardino valley in the interior, touching the towns of Riverside, Redlands and San Bernardino on the way. No attempt at high speed was made. The cars proceeded at a comfortable pace and every mile in excess of the scheduled speed was penalized. One of the entries did not finish because the driver was arrested in a small town on a charge of having caused the death of a horse that ran away when the car passed the team. A broken spring and several punctured tires, together with the missing of the right road, accounted for the penalization of the other six cars.

The Arrowhead Hill Climb.

Last Saturday a hill climb was held in New York city on the Depot Lane hill, extending from the Boulevard Lafayette to Fort Washington avenue. The hill is about one-third of a mile in length, and has an average grade of nearly 15 per cent., while three sharp turns tend to reduce the speed that can be made on it. Following are the summaries:

Gasoline Cars at $850 or Less—Won by a 15 h. p. Ford in 30 2-5s.

Electric Vehicles—Won by a Babcock in 41 2-5s.

Gasoline Cars at $1,250 and Less—Won by a 15 h. p. Ford in 30 2-5s.

Gasoline Cars at $2,000 or Less—Won by a P. & S. in 29 4-5s.

Gasoline Selling at $3,000 or Less—Won by a 30 h. p. Knox in 24 4-5s.

Gasoline Cars at $4,000 or Less—Won by a Knox in 24 4-5s.

Gasoline Cars at More Than $4,000—Won by a Knox in 24 3-5s.

Taxicabs Carrying Four Passengers—Won by an 18 h. p. Franklin in 35 3-5s.

Free for All—Won by a Knox in 23 2-5s.

A Correction.

In an advertisement of the Stevens-Duryea Model X in our issue of July 8 the price of the complete car, which is $2,750, was erroneously given as $2,850.

The Glidden Tour.

(Continued from page 74.)

foreign matter in the roads, and the tires of the contesting cars gathered them all in. A puncture is not such a serious proposition this year as it has been in previous contests, owing to the fact that most of the cars are equipped with quick detachable rims and air tanks. The air pressure tank carried on the side of the cars, which is capable of pumping up half a dozen or more tires, is a time saver of the greatest value. It is particularly useful in contests such as this tour, where a few minutes' time may mean the destroying of a perfect score.

The hard climb up the mountain roads, which necessitated a great deal of low gear work, resulted in the overheating of a number of the engines, and for the first time since the cars left Buffalo there were a number of steaming and boiling radiators to be seen. The Gyroscope car had a particularly strenuous time of it in keeping its engine cool.

The little Franklin runabout, No. 106, took advantage of the committee's ruling at Bedford Springs to the effect that raw materials could be used in repairing broken parts, and a few miles out on the road the car pulled up at a blacksmith shop and the driver and mechanic proceeded to get busy repairing the spring broken on the run to the Springs.

The big six cylinder Franklin, No. 12, which broke a spring on the run to Pittsburg and welded the same, was held up again this day by the spring breaking, and was obliged to stop and make repairs. Considerable time was lost in so doing. The Selden car is also suffering with a broken spring, which has been patched up, but which threatens to give way at any minute.

The Garford car driven by Hurlburt has the rear hanger of one of its front springs broken, a result of a mad dash over the mountains on the run to Bedford Springs to make up time lost in repairs to a driving member of its floating rear axle.

Car No. 35 came very near being wrecked on the run to Harrisburg. About 5 miles out of Shippensburg it attempted to pass Franklin No. 14 at high speed without sounding its horn or giving any warning. Mr. Bates, driving the Franklin car, had no notice that the Olds wanted to pass until it dashed up alongside of him. He was driving on the left of the road to avoid the sink holes which were thick on the right side. The Olds was forced into the ditch and obliged to take a deep gully. The passengers were nearly thrown out of the tonneau, and the car careened as if it was about to upset. The machine righted itself in some miraculous way, and what might have been a fatal accident was avoided by an uncomfortably narrow margin. It was simply a case of reckless driving on the part of the man handling Car 35.

EXPERT DRIVERS.

In this connection it is timely to note the fact that although high speeds are maintained every day there have been no accidents up to this time. This is due to more than mere luck, and may be attributed to the fact that, although high speed men, the greater part of the drivers are skillful factory men who have had thousands of miles of road experience. Among the well known drivers handling cars are Tom Fetch, who drove the first transcontinental run, and who pilots the independent press car in this event; M. S. Bates, who drove with Whitman in the Franklin car that established the fifteen day San Francisco to New York record; Hurlburt, an old graduate of the Cadillac Company, who drove in the New York-St. Louis tour; Frank Nutt, of the Haynes Company, who has driven in almost every endurance contest held in this country; Teddy Day, of the Pierce Arrow, and a number of others. It is almost impossible to realize what perfect control these men have over their machines, and despite high and at times reckless speeds there is no doubt of the fact that they know what they are doing every minute of the time. That is the keynote of the situation in regard to these tours, as to why these so called daredevil drivers don't have accidents. They know how to drive. What would be a foolhardy and accident inviting speed for others is safe for them.

There are a number of specialty cars in the run which are attracting more or less attention along the run. Foremost among these is the Oldsmobile entered by the Gabriel horn people, and equipped with a musical horn on which it is possible to play any desired tune. This car carries some of the press men, and as it goes through the towns rendering the latest popular airs it receives a great ovation.

The Studebaker car driven by Bob Yerger is the same one used by Speaker Cannon when he made his run from Washington to the Chicago convention, and also carried the Government war message to Fort Leavenworth, Kan.

The Premier press car is endeavoring to make 100 miles a day for 100 days, and is now on its forty-second century.

A THRILLING EXPERIENCE.

The occupants of Pierce Great Arrow No. 100 had a rather thrilling experience on the run to Harrisburg, and had it not been for the bravery of mechanic Keller a man and his wife and their little baby would have been seriously if not fatally injured. The big Pierce car was coming over the road at a fair rate of speed and was just outside of Green Village when a long bridge over a stream was approached. A man was driving on to the bridge in a runabout in which his wife and child were seated. As the front wheels of the Pierce struck the bridge the horse began to cut up; the driver seemed to be able to hold him, but when the automobile was within 10 feet of the horse the horse suddenly reared and began to back. Standing on its hind legs, the animal was striking out wildly with its front feet, and then began to back. It looked for a minute as if the runabout would be forced off the bridge by the frightened brute, and the occupants of the rig hurled into the stream 15 feet below. Mechanic Keller took in the situation at a glance, and, jumping out of the machine, rushed to the horse. The animal reared and tried to strike him with its front feet, but Keller, at the risk of his life, jumped up and seized the bridle, and by main strength forced the horse down to its feet. He then led the animal past the automobile and safely off the bridge. He received the heartfelt thanks of the frightened occupants of the runabout.

A pleasing incident occurred in the town of Chambersburg. A number of young ladies dressed in white halted Chairman Hower's car and presented him with a beautiful flag, wishing the tourists Godspeed. Chairman Hower responded appropriately and assured the young ladies that the flag would be carried on his car to the end of the tour, and later hung in the rooms of the association with a proper inscription.

SOME MECHANICAL TROUBLES.

The driver of Franklin, No. 12, which was penalized at Harrisburg as a result of time lost in making repairs on a broken rear spring, stated that this spring had been weakened by hard usage in the West, the car having been driven over 10,000 miles before entering the tour, and on the run to Cambridge Springs he was forced into a ditch by a car passing him at Silver Creek. He and his mechanic welded the spring, but this weld gave way under the hard usage on the trip from Bedford Springs. The spring was rewelded, but it was the opinion of those in the car that the new weld will not last and that further trouble may be expected.

No. 102, the Moline car entered for the Hower Trophy, was penalized for having come in late as a result of delays occasioned by continued engine trouble. The ignition system on the car went wrong and the machine limped into Harrisburg with but two cylinders working.

No. 32, Selden, which broke a spring on the run to Bedford Springs, had blocked it up, but had further trouble when the spring let go again. They were late reaching Harrisburg. Their dust pan was also wrecked by striking a high stone in the road, and was dragging when they drove up to the finish line, and made a great racket.

The cars were parked in the open at Harrisburg, being lined up in Market square, where they were roped off and guarded by special police as well as by the A. A. A. official watchmen. Large crowds gathered to look at the cars, and it was evident that the arrival of the tourists had incited great interest.

James A. Bell, manager of the Harrisburg Board of Trade, drove out to Carlisle, Pa., in a machine to meet the tourists and welcome them to the city. He was unfortunate on the return trip to lose his coat out of the machine. He believes that it dropped out near Hogestown. The coat contained a valuable gold watch, a wallet containing money and papers and some letters. Mr. Bell's trip of welcome will no doubt prove a costly one.

ENTERTAINMENT AT PHILADELPHIA.

It was announced at Harrisburg that the tourists would be given free gasoline at Philadelphia with the compliments of the Philadelphia *Press*, and would also be furnished with a luncheon by the same paper. The Quaker City Motor Club will tender the tourists a smoker at the Hotel Walton in the evening. Word was also received from Boston to the effect that elaborate preparations were being made for the reception of the tourists there and their entertainment. They will be treated to a clam bake on Saturday, and on Sunday will be taken out en masse on a steamer for a long sail.

At Harrisburg.

The 13th of July proved to be the hoodoo day for the Gliddenites, and for the Hower Trophy contestants as well, and perfect scores were chopped down. The hard racking given the cars in the first three days began to have its effect, and the culmination came in the run to Harrisburg. Two of the perfect score teams in the Glidden contest came to grief and three of the perfect score Hower runabouts fell by the wayside. This was the killing of the day, and the teams that were penalized did not feel particularly jubilant. Up to this day the contest had been an apparently easy one, but the indications are that from now on the teams will have to fight harder to maintain their perfect scores, and the cars that have lost points are just as anxious as ever not to be further penalized, for they feel that it is still anybody's run and that the prospects may change many times between here and the finish line at Saratoga.

The Syracuse A. C. came to its penalty as the result of the Franklin entry, No. 12, having further trouble with the rear spring broken near Fredonia on the first day's run, and which was welded in record time. The spring gave way again, and the car was penalized 60 points for reporting late at the night control, which means a penalty of 20 points to this team, which up to this time had a perfect score.

THE DAY'S PENALIZATIONS.

The Rochester Club suffered a penalization as a result of the Selden car's breaking a spring on the run to Bedford Springs. It had been impossible to make repairs to this spring before starting for Harrisburg, and the result was the delay en route. This leaves seven perfect score teams in the Glidden contest, these being the two Buffalo teams, the first team of the Chicago Motor Club, the Rochester team, the Bay State A. C. and the Columbus A. C.

Among the three cars which were penalized in the Hower contest was No. 102, the Moline, which was late reaching the control, being delayed 3 miles out of Harrisburg by engine trouble. It was penalized 51 points on time, the difficulty with the motor being one of adjustment only and not calling for the use of any parts. No. 106, Franklin runabout, was delayed in making repairs to its rear spring, which broke on the run to Bedford Springs. The driver made a temporary repair when about 3 miles out of the control, and when about 20 miles out the last leaf of the spring gave way. A wooden block was used to brace it up and an old inner tube cut up to act as a buffer. The car was penalized 181 points for time. The Overland roadster No. 110 broke its frame and went to a blacksmith shop to make repairs. This was the first accident of this sort to any of the cars. The car will be penalized for time lost but not for parts used, as under the rules any raw material may be used to make or repair parts without penalization.

WOMAN DRIVER TO QUIT.

Overland No. 108, driven by Mrs. Shirley, will quit the run tonight. Mrs. Shirley withdraws owing to the fact that her mechanic's father is dangerously ill and he is obliged to go home. She was penalized an additional 10 points this day, reaching the control ten minutes late.

No. 109, Stoddard-Dayton, which had a fire in its carburetor on Saturday, had a similar occurrence this day. The blaze was confined to the bonnet and was extinguished before any damage was done.

No. 111, the Overland that broke its axle on the run from Pittsburg and made repairs, rejoining the run at Bedford Springs, reached Harrisburg in good shape. It runs as a non-contestant.

The perfect score cars in the Hower contest now number six, these being the two Pierce cars, a Reo, a Premier and two Stoddard-Daytons. The Reo cars have been experiencing considerable battery trouble, both cars having been slightly delayed this day from that cause. R. M. Owen was unable to start as a result of this trouble in the morning until his batteries were replenished, and Lockwood, driving in the Hower contest, had the same trouble with his car. It was necessary to secure new batteries for both, which under the rules may be put in without penalization.

Monday, 11 p. m.—Franklin No. 12 was withdrawn from the Glidden contest Monday night. It will put in a new rear spring and continue as a non-contestant. The Syracuse Club is penalized 333⅓ points, and now has a score of 666⅔ points. The Selden car No. 32 was also withdrawn as a Glidden Trophy contestant on account of a broken spring. It will put in a new spring and continue as a non-contestant. The Rochester Club was penalized 333⅓ points, and now has a score of 666⅔ points.

The entertainment at Harrisburg proved to be all that could have been expected. The Harrisburg Motor Club entertained the tourists at a smoker at the New Metropolitan Hotel. Oscar C. Robinson, vice president of the club, welcomed the guests. Speeches were made by Governor E. S. Stuart, Mayor E. S. Meals, Charles J. Glidden and others.

David Beecroft and R. J. Johnston, who assisted the local club in their endurance run in May last, were presented with handsome gold fobs, suitably engraved, with the compliments of the Harrisburg Motor Club. All of the tourists were presented with handsome souvenir steins.

It was announced by the committee at Harrisburg that the one point penalty imposed on Frank Nutt, driving one of the Haynes cars, would be expunged. The penalization had been imposed because of the fact that Nutt opened his extra part bag and used a spring shackle pin. It was

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Charles J. Glidden, the "round the world tourist" and the donor of the Glidden Trophy, in response to the request of THE HORSELESS AGE representative issued the following personal opinion of the value of the present tour:

A PERSONAL IDEA.

BY CHAS. J. GLIDDEN.

The fifth annual tour of the American Automobile Association for the Glidden and Hower trophies, and the most important the association has ever held, has progressed far enough to warrant calling it the severest test to which the automobile has ever been put, and I doubt if a single car completes the long tour in a perfect condition. Millions of people are witnessing this great demonstration of American automobile manufacturers, and millions more are watching the movement daily as chronicled in long telegraphic despatches sent to the leading newspapers of the United States by a staff of thirty two special correspondents accompanying the tour. During my driving of the automobile I have witnessed several important endurance contests in different parts of the world, but have seen none requiring such skill, care and judgment of drivers as the one now under way. Rumors are afloat that the winner will be challenged to a contest by some foreign and domestic manufacturers under the rules of 1907 (why not under the rules of 1908?). Any manufacturer whose car arrives at Saratoga with or without a perfect score will be in a position to challenge the world, and win any kind of a contest under the rules of 1908, which require the careful scrutiny of observers appointed by a competing manufacturer.

CHARLES J. GLIDDEN.

The following explanation of A. L. Kull's disqualification has been issued on behalf of Mr. Kull:

"Mr. Kull took the car from Detroit to Buffalo on the night before the start of the tour, and left with the Gliddenites without having had time to specially test the car. Although it had been driven hard in and about Detroit, it had not been driven over mountain roads such as were encountered in the tour. Mr. Kull found that the car was fitted with brakes which held well in running down hill, but which were inefficient in the case of the car backing up. Consequently, he refused to take risks such as were taken with cars with double acting brakes, and took a penalization instead during the run from Cambridge Springs to Pittsburg, which practically put him out of the Hower Trophy contest, for which the car was entered. For putting on a sprag on the road from Pittsburg to Bedford Springs the Gyroscope car was disqualified under the rules."

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shown that this was a part of the regular equipment, and that the bag had been opened by mistake. Consequently the penalty was expunged and the Chicago M. C. team No. 1 was returned to the perfect score class.

Mrs. Shirley, driving Overland No. 108, officially withdrew from the contest on Tuesday morning at Harrisburg. This leaves Mrs. Cuneo as the only woman driver. Mrs. Cuneo is in mourning at this time, owing to the fact that her pet cat, Glidden, Jr., passed away as a result of the rather strenuous trip over the mountain.

A number of the contestants took advantage of the opportunity to purchase tubes of fire extinguishing powder at Harrisburg. E. F. Day, driving 106 Franklin, withdrew at Harrisburg from the Hower Trophy contest, as a result of a broken rear spring. A new spring was put in and he will continue as a non-contestant.

H. D. Savage, driving a Peerless, and Paul Gaeth, of the Gaeth car, had a very narrow escape from coming into collision on the run to Harrisburg. The Gaeth car tried to pass the Peerless on a rough road, and was forced into the ditch. By clever driving Mr. Gaeth held the car straight, however, until he could get back on the road again.

At the evening meeting at Harrisburg Dr. Overpeck, of the Quaker City Motor Club, addressed the tourists and invited them all to attend a smoker to be given there Tuesday evening. The tourists were warned to drive slowly at Middletown, Mt. Joy, Marietta, Rohrestown, Lancaster, Ephrata, Reading and Pottstown, word having been received that speed traps had been placed at these points and arrests would be made. Free gasoline will be supplied the tourists at the finish line at Philadelphia.

Harrisburg to Philadelphia.

It was the same old story of late to bed and early to rise with the tourists at Harrisburg, and long before 7 o'clock they were ready to check out for the run of 133.5 miles to Philadelphia. The roads for this run were in excellent condition, and the trip was a pleasant one as far as road conditions were concerned, except for the jouncing occasioned by the innumerable water bars. Pennsylvania has a most pernicious habit of banking up its roads at distressingly frequent intervals, and as a result the tourists were spanked by the seat cushions almost all day. The entire distance was practically over macadamized roads, which were in fair condition. A little clay was met with between Reading and Philadelphia.

Monday night's rain had downed the dust in good shape, and as a result the tourists were able to enjoy their ride to Philadelphia. The roads were very wet, however, and there were numerous skids that threatened at times to result in serious accidents. The day's run was 133.5 miles, and the schedule time was seven hours, which meant an average speed close on to 20 miles an hour. As there were numerous speed traps along the route the tourists were obliged to average at least 30 miles an hour on every part of the road on which it was possible to do so. The drivers entered in the contest are beginning to get familiar with the ever present water bars with which the Pennsylvanians dot their roads, and they can now negotiate them at high speed without breaking springs or tossing their passengers up into the limbs of trees. Apart from the water bars the roads were excellent for the entire trip, being of good macadam, and many of the big cars reached a mile a minute speed. The Garford entries, which have been notorious for their speeding, were in their element, and Hurlburt burned up the roads at express train speed. It was said at Philadelphia that the observers were going to make a protest against riding in the Garford cars, as they felt that they were risking their lives. A number of the men who ride in tonneaus have secured rope and tied it across the seats to hold themselves in by. They term this device a life line, and, judging from the way some of them go over the roads, it is absolutely necessary.

MECHANIC SPILLED.

The Garford car No. 31, driven by Hurlburt, lost two hours and seven minutes repairing tires, and, besides, was late as a result of the necessity of soldering the radiator, which had been leaking badly. While Hurlburt was speeding along at a fast pace endeavoring to make up lost time, his mechanic, Benjamin Smith, who was sitting up on the top of the back seat and waving to people along the line, suddenly lost his balance and was thrown to the road as the car ran into a particularly vicious water bar. The machine was stopped at once and the driver and other passengers rushed back to help the mechanic. He was just picking himself up as they reached him. He was badly shaken up and was bruised around the face and shoulders, but was able to continue in the car to Philadelphia, where his wounds were properly cared for by Dr. Hogue.

The day's run was rather uneventful, all of the cars making good time over the roads. The chairman's car was met at Reading by a delegation from the automobile club of that city, who welcomed him and the other tourists. The Reading motorists had posted a man with a flag on every corner in the city, and kept the roads clear for the tourists. They had also enlisted the services of the local police to keep the curious crowds out of harm's way.

Previous to this time the advance guard of the tour had been held up by the police of Steelton, who warned them against speeding. Chairman Hower was also welcomed at Norristown by the automobile club there. On reaching Philadelphia Mr. Hower held up the tour until at least twenty of the cars had arrived. The vanguard reached the Quaker City at 12:40, and at 1:20 the chairman started the column in motion and the run of 4 miles down Broad street to the checking in point at the Hotel Walton was made.

The entire ride to Philadelphia proved to be most interesting, the scenery being varied and charming. Banners had been hung along the road at various points warning the tourists of speed traps. The tourists were interested in the quaint costumes of the Shaker women who lined the route. These simple folk cheered the cars loudly, and seemed to be very much interested in them. A few miles outside of Philadelphia the tourists were met by representatives of the Philadelphia press, who presented each car with two flags and also gave each man in every car a lunch and a glass of beer. Members of the Quaker City Motor Club escorted the tourists into the city. A large crowd had gathered at the Hotel Walton and cheered the drivers as they drove up.

TROUBLES EN ROUTE.

The Gyroscope car had its troubles again this day, and was laid up along the road several times. It seems to be difficult to keep the engine properly oiled and to keep it cool. The machine reached Philadelphia late.

Monday's tire troubles were repeated this day, and a number of the machines were delayed as a result. The Studebaker war car, carrying newspaper men, had three blow-outs, and the press men, despairing of getting into Philadelphia at a seasonable hour, left the car and came in by train.

STATISTICS OF THE TOUR.

Statistics are always more or less interesting. Charles J. Glidden has figured out that the aggregate mileage of all of the cars in the tour is equal to 100,000 miles covered by one car, or over 8,000 miles a day for one car for the twelve actual running days of the tour. Averaging the gasoline consumption at 10 miles to the gallon, the cars in the tour will burn up 1,000 gallons of gasoline. The aggregate value of the cars in the tour is close on to $175,000.

As a comparison between the Glidden tour of this year and last the following is interesting:

Entries Glidden Contest—1907, 46; 1908, 30.
Hower Trophy—1907, 13; 1908, 14.
Glidden Certificates—1907, 4; 1908, 2.
Non-Contestants—1907, 6; 1908, 10.
Official—1907, 5; 1908, 4.
Totals—1907, 74; 1908, 60.

Comparing this year's Glidden contest statistics with those of previous contests we get the following interesting figures:

1904, New York-St. Louis tour, 77 entries, 66 finishers.

1905, first contest for Glidden Trophy, 34 entries, 27 finishers, Percy Pierce winner.

1906, 74 entries, 55 starters, 8 non-contestants, 30 finishers.

1907, 82 entries, 47 Glidden, 14 Hower, 16 non-contestants; 74 starters, 28 finished.

1908, 60 entries, 30 Glidden, 14 Hower, 2 Glidden certificates, 10 non-contestants, 4 official.

Cars 99, 31, 22, 103, 24, 18, 26, 16, 15 and 104 all experienced tire troubles of more or less importance.

No. 10, the Thomas, was delayed on the route by slight engine trouble. Moline, No. 102, entered for the Hower Trophy, which came into Harrisburg late on Monday, was reported as having a cracked cylinder. It had not reached Philadelphia at 6 p. m. Tuesday. No. 28, Oakland, bent its front axle on the run to Philadelphia by dropping into a hole on the road. The car was taken to a blacksmith shop and the axle taken out, heated, straightened and put into the car again in fifty-two minutes. The machine reached Philadelphia ahead of time and suffered no penalization.

The tourists were the guests of the Quaker City Motor Club at a stag smoker given Tuesday evening at the Horticultural Hall. The guests were welcomed by Mayor Reyburn and the club officials. A number of prominent men addressed them. Charles J. Glidden made a speech, as usual.

The run Wednesday is from Philadelphia to Milford, Pa., 132 miles. The schedule is six and three quarter hours.

SCORES AT PHILADELPHIA.

GLIDDEN CONTEST.

	Points.
A. C. of Buffalo, Team No. 1	1,000
A. C. of Buffalo, Team No. 2	1,000
Chicago M. C., Team No. 1	1,000
Chicago M. C., Team No. 2	997 2-3
Rochester A. C., Team No. 1	666 2-3
Rochester A. C., Team No. 2	1,000
Bay State A. A.	1,000
Cleveland A. C.	664
Columbus A. C.	1,000
A. C. of Syracuse	666 2-3

HOWER CONTEST.

No.	Points.
100—Great Arrow	1,000
101—Reo	1,000
102—Moline	949
103—Great Arrow	1,000
104—Premier	1,000
105—Gearless	Out.
106—Franklin	Out (non-con.)
107—Stoddard-Dayton	1,000
108—Overland	Out.
109—Stoddard-Dayton	832
110—Overland	608
111—Overland	Out.
112—Stoddard-Dayton	1,000
113—Blomstrom	Out.

The Glidden Checking System.

In a contest of the size and scope of the Glidden tour there is necessarily a great deal of detail work and the system necessary to keep track of the various entries, their performance and penalizations is rather complex. Each night the official observers for each car are given their assignments, and each day they change to a different machine. They are obliged to carry and fill in a report card handed to them for each day's run. The official starter at the morning control and the checker at the night control also fill in a card. Each driver is given a card on which his time is recorded, and this is handed in each night. In addition to this, Mr. Jervis, the official press representative, keeps a large bulletin posted, giving the club team scores each day. It keeps the officials busy in keeping the records straight, and their duties in addition to this require them to answer hundreds of questions from tourists and press representatives. They generally shift the burden of this responsibility to Chairman Hower, who, after all, is the man who runs things. He gives decisions on all questions, and his word is final. Mr. Hower believes in one man control, and he has it. To his credit be it said that this year's tour is going off very smoothly, and the hotel and other arrangements, although not altogether satisfactory, are at least fair and impartial.

One of the passengers in Haynes car No. 20 has attracted considerable attention among the tourists, he being T. Ninagawa, a Japanese employed by the Speedwell Motor Car Company, Dayton, Ohio. The report had been circulated among the tourists that Mr. Ninagawa had been sent to America by the Mikado of Japan to look into the automobile industry in this country. Mr. Ninagawa, when approached by a HORSELESS AGE representative, had no hesitation in talking about his mission here. He speaks excellent English, and stated that he was in no way connected with the Japanese Government, having come to this country on his own volition to look into the automobile industry here and study American methods. He remarked that the Japanese were always anxious to learn, and recognized that America is a great country for hustle and activity. It is his intention later to return to Japan and engage in the automobile business there.

Magnalium.

Magnalium is an alloy of aluminum and magnesium (90 to 98 per cent. aluminum) manufactured in Germany. For the following interesting notes on its characteristics we are indebted to Morris R. Machol, 32 Park place, New York, who is the American agent of the Magnalium Syndicate, of Berlin, Germany.

The alloy is imported in pigs or ingots for castings or forgings and can be handled by the ordinary foundryman or blacksmith. It forges about like Swedish steel. It can be delivered in plates, bars, rods, wire, tubing, etc., and in any form it shows a far greater strength than aluminum, yet it is lighter, its specific gravity being about 2.5, while that of pure aluminum is 2.64.

It shows the following tensile strength in pounds per square inch: Castings, 19,000 to 42,000; forgings, 30,000; annealed and hard rolled plates, 42,000 to 52,000 respectively; drawn rods, 60,000; wire, 42,000 to 52,000; tubing, 74,000.

The various other claims made for it are given below. It can be worked or machined about like brass, giving a smooth surface of silver color. Clean sharp holes can be bored and perfect screw threads can be cut in the metal. The finest files can be used on it successfully. The tool speed is about twice that of aluminum. It attains and maintains a high polish, resists oxidization, is unaffected by dry or damp air, water, gaseous ammonia, carbonic acid, sulphurate of hydrogen and most organic acids. It is very slightly affected by saltpetre or sulphuric acid and more rapidly by alkalies or strong alkaline solutions. It is slightly attacked by salt water, and should be lacquered where it is exposed to sea water.

It is very close grained and can be polished, etched, engraved, pickled, etc., without any trouble. It is very ductile and can be forged, rolled, annealed, drawn, etc.

Magnalium, unlike aluminum, can be soldered by any ordinary workman with Magnalium solder after a little practice. Its electric and thermal conductivity is 56 per cent. of that of pure copper. The melting point is 1,185° to 1,250° Fahr., the specific heat 0.2185.

Road Building Activity in Southern California.

The board of supervisors of Los Angeles County, Cal., has called a special election for July 30 to vote on a proposed bond issue to the amount of $3,500,000, the proceeds to be spent in creating asphalt base roads over 300 miles in length on the principal highways of the county outside of the incorporated cities. The agitation for better roads is directly due to the work of the automobile owners. Los Angeles city is perhaps the largest automobile centre west of the Rocky Mountains, and for years the automobile dealers and owners have demanded that the roads be put into shape in order to attract still more wealthy tourists, who would be able to explore the beauties of the country in their machines every day in the year. The Los Angeles Chamber of Commerce is conducting the campaign for the election; mass meetings have been arranged; the assistance of the stereopticon will be employed to give the voters a visual idea of the condition of some of the roads, and a personal canvass is to be made in several doubtful districts.

Other counties in southern California will shortly follow the example of Los Angeles. San Bernardino County intends to supplement its already existing excellent system of oiled roads by selling bonds to the amount of $500,000, and the city of San Bernardino is preparing to spend $110,000 on its main thoroughfares in connection with the improvement of the county roads, while Santa Barbara County will raise $1,000,000 for the same purpose.

The French automobile exports during the first five months of the year were valued at 53,691,000 francs, as compared with 71,000,000 francs for the first five months of 1907. Only Russia, Turkey and Algiers increased their imports during this period, all other countries showing a decline. The decline in the total exports for May amounted to about 7,000,000 francs.

OUR FOREIGN EXCHANGES

German Motorists' Liability Law.

The much dreaded liability law has now been introduced in the German Bundesrat. The first paragraph establishes the principle that "if a person is killed, the body or health of a person injured, or property damaged by an automobile in operation, the keeper of the automobile must repay the injured party the injury so done." To this very broad proposition there are, however, numerous exceptions. Thus there is no liability if the damage was not due to any fault of the keeper of the automobile or of a person ordered and authorized by him to drive the car, nor to faulty operation or breakdowns. If the vehicle is operated by another person without the knowledge and consent of the keeper, this person becomes liable. There is also no liability under the above provision of law if the injured party or property was in the vehicle at the time of the injury or if the injured party was engaged in the operation of the vehicle; also if the accident is caused by a vehicle which is unable to exceed a certain speed on the level (to be fixed by an Imperial order under approval of the Bundesrat), and the keeper has an official certificate attesting this. If a person is killed by an automobile the party liable for the accident must pay for any medical attendance and the funeral expenses, and if the killed person was responsible for the maintenance of others, and the right to maintenance of the third parties lapses with the death of the victim, the person liable must pay to the third parties damages equivalent to the amount of maintenance moneys which the killed person would have been required to pay during his probable duration of life.

German Manufacturers' Meeting.

The German Automobile Manufacturers' Association held a general meeting at Frankfort-on-Main on June 19. It is announced that the members of that association unanimously stand by their agreement not to take part in any automobile show in Germany before the fall of 1909, and as all the big firms are members of the association there can be no show in that country for one year and three months from the date of the meeting. With regard to the construction of an automobile driving and testing track, the association takes the view that such a track would be of great benefit to its members. The majority of the members seemed to prefer the Taunus Circuit to the Eifel Circuit, and a committee of nine members was appointed to investigate the different plans. In the meantime the secretary of the association, Dr. Haefelin, will call on all the important manufacturers to find out how many shares of the enterprise they are willing to take up. A committee was also appointed to work out a uniform sales and warranty contract for the German automobile, motorcycle and vehicle body industries. The association set aside the amount of 7,000 marks for the Emperor William II fund for chauffeurs. For a better representation of the automobile and parts industry the association decided to appoint a committee to make an agreement with one of the existing large trade papers, or to found a new publication to represent it.

A French Decision on the Liability of Motorists.

A decision has just been handed down by the Court of Appeals at Rouen, France, which will be read with interest by motorists in this country. The Whitney brothers, Payne and Harry Payne, last year bought two 45 horse power Renault cars in Paris, and had them taken to London by road by two chauffeurs, Pouget and Fritz. On the road to Dieppe they encountered a number of vehicles, which Pouget, who was leading, passed safely, while Fritz had a collision with a pushcart, as a result of which both he and the pushcart man were killed. Pouget was charged with involuntary homicide, and sentenced to one month's imprisonment, it being held by the court that there was a direct relationship between the two vehicles which had been dispatched from Paris together on a common errand, and that Pouget was criminally responsible for the death of the two men. An appeal was taken to the Court at Rouen, which reversed the decision, holding that if Pouget avoided the pushcart and Fritz did not, the latter was responsible for the accident, and though Pouget was guilty of moral complicity on account of illegal speeding, he was not criminally responsible for the accident. Harry Payne Whitney was absolved from civil responsibility.

The Spyker Automobile Company, of Trompenburg, near Amsterdam, Holland, which failed recently, has made a proposition to settle with its creditors on a 25 per cent. basis.

Belgium continues to increase her automobile exports in spite of the general depression. During the first five months of 1908 she exported cars to the value of 2,305,283 francs, as compared with 1,912,151 francs for the first five months of 1907, and 1,864,455 francs in 1906.

The next Paris Show will be held in the Grand Palais in December next. Following the example set in the Berlin Show last fall, there will be two consecutive shows, viz., one for touring and town cars November 28-December 13, and one for commercial vehicles and machine tools December 22-29. The regulations, which will be published shortly, are said to be much like those of last year.

Legal Notes.

Manager Tybolt, of the Bellevue-Stratford Garage, Philadelphia, states that he was arrested for speeding at Elwood, N. J., recently by Justice Carver, who imposed a fine of $10 and costs, amounting in all to $13.50, but that when he told the justice that he had only $8.50 in his pocket, the latter accepted this amount, and handed over a receipt for full amount of fine and costs, whereupon he allowed the party to proceed.

The Oakland (Cal.) City Council has passed an ordinance providing that all automobiles, motorcycles, etc., must keep to the right of the street, travel not more than 18 miles per hour, and not more than 10 miles per hour in certain downtown districts and in turning corners. Cars must stop in the street not more than 2 feet from the curb. Violations of the ordinance will be punished with a fine of $300 or 150 days' imprisonment.

In compliance with the request of Jerome Bradley, a trustee of the village of Dobbs Ferry, N. Y., the Automobile Club of America has arranged to post two men at the outskirts of Dobbs Ferry to request automobilists to observe the speed limits of the village. The men were posted July 5, and will be on duty every Saturday and Sunday for a few weeks to co-operate with the Dobbs Ferry authorities in suppressing reckless and fast driving in that district.

New Incorporations.

Jamaica Motor Car Co., Hillside Branch, N. Y. —Increased capital from $1,000 to $10,000.

Revolving Cylinder Motor Co.—Title amended to Fulton Motor Car Company, New York city.

Turbine Motor Car Co., Los Angeles, Cal.—Capital, $150,000. Incorporators, John A. Pirtle, W. H. Faust and J. J. Jenkins.

Orange City Garage, Los Angeles, Cal.—Capital, $25,000. Directors, Otto Kolberg, S. A. Erwin, W. L. Erwin, H. R. Gardner and H. F. Gardner.

Universal Automobile Co., Chicago, Ill.—Capital, $20,000. Incorporators, C. Aured, R. P. Bates and William H. Emrich. To manufacture and deal in automobiles and appliances.

Motor Taximeter Cab Co., New York.—Capital, $150,000. To take over the taxicab service heretofore operated by Renault Frères. The company has offices at 214 West Sixty-fifth street.

Safety Electric Operating Co., Jersey City.—Capital, $500,000. Incorporators, H. W. Andrews, G. E. Osborne and Charles D. Montague. To manufacture, operate, buy and sell motor vehicles.

Velie Motor Vehicle Co., Moline, Ill.—Capital, $100,000. Incorporators, Willard L. Velie, Otto E. Mansur and Stuart Harper. To manufacture and deal in motor vehicles, gasoline, electric or steam.

Bell Speedometer Co., Chicago, Ill.—Capital, $50,000. To manufacture speedometers and other automobile and bicycle supplies. Incorporators, D. B. Carmichael, John F. Fowler and J. S. McInerny.

Knight Carriage and Automobile Co., Salt Lake City, Utah.—Capital, $50,000. To take over the stock of the Deseret Carriage and Wagon Shops, 245 East Fifth street. The officers of the company are: President, John A. Knight; vice president, John M. Knight; secretary-treasurer, William A. Knight; directors, Charles L. Knight and Isora M. Knight.

MINOR MENTION

The Ellicott Motor Car Company, Buffalo, N. Y., has recently been granted a discharge in bankruptcy.

The Jacobson-Brandow Company, Pittsfield, Mass., have leased the top floor of the Gamwell Block, on Columbus avenue.

Col. J. H. Sprague, of Norwalk, Ohio, gave his customary annual reception to his friends at his office on the afternoon of July 4.

The Grabowsky Power Wagon Company, Detroit, Mich., has been admitted to membership in the American Motor Car Manufacturers' Association.

The Tennant Motor Company, Ltd., 1449 Michigan avenue, Chicago, agents for Peerless cars, have increased their capital stock from $7,500 to $60,000.

We are informed that the Garford Motor Car Company, Elyria, Ohio, on June 15 put on a night force of 300 men in addition to their regular day force of 600 men.

Piggins Brothers, Racine, Wis., are constructing a gasoline motor which is claimed to be smokeless and so noiseless that it cannot be heard 6 feet distant when in operation.

S. A. Campbell has taken the New England agency for the new Ennis tire, which is manufactured in Newark, N. J. He has established headquarters at 893 Boylston street, Boston.

The total number of registrations in New Jersey under the new law up to July 1 was 11,400, and the sum of $83,850 was received for license fees. Last year only 8,521 cars were registered to July 1.

The La Crosse, Wis., Board of Public Works has placed signs on the country roads leading into the city, reading: "City limits; auto speed limit 12 miles per hour." It is hoped that this will stop speeding.

On July 8 there were 1,104 automobiles and motorcycles in Indianapolis, according to the official report of the Indiana Secretary of State. This shows an increase of 320 automobiles in the city since January 1, considered a remarkable showing.

The Bureau of Manufactures, Washington, D. C., has received a request from a business man in a city of western Europe who desires to be put in touch with American manufacturers or exporters of 6, 8 or 10 horse power automobiles. The merchant states that he will furnish satisfactory references. In writing refer to No. 2,411.

Vice Chancellor Howell, of the New Jersey Court of Chancery, has issued an order directing the receivers for the Pope Manufacturing Company to apply to the Superior Court of Connecticut for the transfer to the jurisdiction of the New Jersey court of sufficient funds to pay another dividend of 25 per cent. to the creditors of the company. The receivers have been authorized to manufacture 700 Pope-Hartford cars of the 1909 model.

The registrations in Maine during the first six months of the year have been as follows: January, 8; February, 6; March, 46; April, 129; May, 169; June, 297, making a total of 555. There were also issued 604 drivers' licenses.

It is reported that the strike involving the buffing and polishing departments at the Badger Brass Works, Kenosha, Wis., has resulted from the action of the company ordering a reduction in prices for piece work of 12½ per cent. The striking employees are still out while their places have been filled by others.

The Triumph Automobile Tire Company, Wheeling, W. Va., has recently been incorporated with a capital stock of $1,000,000, of which $200 is paid in. The incorporators are Henry E. Pease, Charles O'Deer, W. E. Johnson, Homestead, Pa.; C. K. O'Hara, Akron, Ohio, and K. P. Stewart, Wheeling. The company will start work at 40 Zane street, Wheeling.

The Southern Motor Car Company, E. M. Pavey manager, is building a number of experimental cars in Houston, Tex., in a shop located at Capitol and Caroline streets. The company expects to turn out a car under the name of the Dixie Flyer, and is at present negotiating with the Business Men's League of Houston regarding inducements to locate there.

At the recent stockholders' meeting of the Motz Cushion Clincher Tire Company, Akron, Ohio, the following directors were elected: Chas. Motz, Gus Burkhardt, William Wolf, E. J. Alderfer, Nick Seil, Howard Haupt and Paul E. Bertsch. Charles Motz was elected president, Gus Burkhardt vice president and Nick Seil secretary and treasurer. It was reported that the company had had a good year.

The Maxwell-Briscoe Motor Company, Tarrytown, N. Y., have issued a $2,500 challenge to the winner in the Glidden tour to an endurance run across the continent from New York to San Francisco under 1907 Glidden tour rules. The company expresses itself as dissatisfied with the provision of this year's rules which requires high priced cars to make a higher average speed than low priced cars.

The Capital Auto Company and the Buick-Losey Company, Indianapolis, have exchanged locations, the former company taking the third floor of the building at 415 Massachusetts avenue, where it will manufacture automobile tops exclusively. The Buick-Losey Company has moved into the three story building at 130-132 East New York street, built by the Capital Auto Company a little more than a year ago.

The automobile records of the State of Missouri show that during the year that the new law has been in force there have been registered 3,233 owners, 101 dealers and 917 drivers of automobiles. Of the owners registered 1,500 are from St. Louis, 600 from Kansas City and 125 from St. Joseph. There is a sum of $18,833 in the State Treasury to the credit of the good roads fund, which represents the income from the automobile registration law for one year.

Club Notes.

The Cleveland A. C. will have its annual run this year to Saratoga, N. Y., by way of Buffalo, starting on Friday, July 17.

The Leavenworth (Kan.) Automobile and Good Roads Association has protested against the new city ordinance establishing an annual tax of $5 on automobiles.

The Salt Lake A. C. on July 2 filed articles of incorporation with the county clerk at Salt Lake City, Utah, the object stated being to conduct a social and protective organization for motor vehicle owners.

Secretary W. E. Macarton, of the Salt Lake A. C., recently visited Ogden, Utah, for the purpose of interesting local business men in the construction of a speedway for automobiles between Ogden and Salt Lake City.

The Oklahoma State A. A. has been chartered by the State authorities, the headquarters of the association being at El Reno. The incorporators are: F. H. Wright, R. C. Trulock, E. E. Blake, Geo. W. Compton, Herman Harms, E. D. Humphrey and George Bellamy.

The Chicago M. C. has fixed the date for its demountable rim contest for August 6. The contest is open only to touring cars equipped with wheels of 34 inch diameter or more, all fitted with demountable rims. All of these rims must be changed during the contest, one at a time.

The associated automobile clubs of New Jersey have retained ex-Governor John W. Griggs for the purpose of testing the constitutionality of the Frelinghuysen automobile law. Chas. T. Terry, chairman of the A. A. A. legislative committee, will be associated with Mr. Griggs.

The Motor League of Rhode Island was incorporated on July 1, the incorporators being Henry Grimwood, Fred C. Lawton, Dr. Henry Rolfe Brown and George H. Huddy, Jr., all of Providence; J. L. Ellis White, of Pawtucket; W. Herbert Caswell, of Narragansett, and Stanley G. Smith, of Woonsocket.

The Huntsville (Ala.) A. C. has been organized with a membership of twenty-six. The following officers were elected: President, Dr. J. C. Burman; vice president, Sterling P. Metcalfe; second vice president, Miss Mary Turner Clanton; secretary, Mrs. R. E. Smith; Mrs. R. T. Baugh, treasurer, and Rev. Francis Tappey, chaplain.

The A. C. A. has issued a statement giving reasons why it organized the grand prize race to be held at Savannah on Thanksgiving Day. In this statement there is given a letter from the A. A. A. under date of September 23, 1907, acknowledging the receipt of the rules adopted by the International Recognized Clubs at Ostend. This is probably intended as a reply to the contention made by the A. A. A. delegates at Dieppe recently, that the A. A. A. had never been properly notified of the Ostend rules.

Business Troubles.

F. E. Churchill & Co., automobile dealers in Brockton, Mass., have made a voluntary assignment. The stock in trade consists of one car, a gasoline pump and office furniture. The assets and liabilities are said to be about $500 each.

The sheriff of Lehigh County on July 6 levied on the property of the Bethlehem Auto Company at Canastova and Prospect avenues, West Bethlehem, Pa., on an execution of $10,964.05. The creditors are represented by A. S. Stine.

A foreclosure suit has been brought against the Monarch Motor Car Company, Chicago, Ill., by J. C. Gibson & Co., H. B. Dodge & Co. and N. Max Dannina, who hold promissory notes aggregating $15,000 against the company, on which the interest has not been paid.

Edmund Sprung, formerly president of the Huber Automobile Company, Detroit, Mich., has brought suit in the Circuit Court at Detroit for an accounting and for the appointment of a receiver for the company, which he claims owes him on a note for $700 and other accounts which it failed to reveal in its last statement.

The visible assets of the Earl Motor Car Company, a Milwaukee concern doing business at Kenosha, Wis., have been seized by the sheriff on a claim filed against the company by the Automatic Screw Company, of Cincinnati, Ohio, amounting to $90. The company is planning reorganization, and it is said that new capital will be secured from Escanaba, Mich. Charles Rhode, of Milwaukee, was the principal promoter of the company, and Thomas H. Booth, of Chicago, was actively engaged in the management. Mr. Booth has resigned from the company, but will retain his stock.

Garage Notes.

Procter Brevard has opened a garage in Weatherford, Tex.

Ira O. Wetmore has erected a garage in Carrizozo, N. M.

A. Osbun, Redlands, Cal., is planning to build a one story brick addition to his garage.

Edward Buroff is erecting a fireproof two story garage on North Third street, Watertown, Wis.

A. Adams, Paradise, Ariz., has purchased the lot adjoining his harness shop, and will erect a garage.

The Barger Automobile Co., agents for Cadillac cars, have opened a salesroom at 1839 Euclid avenue, Cleveland, Ohio.

A garage 40x60 feet will be erected on the corner of Fifth street and Beaumont avenue, Beaumont, Cal., by George Mayer.

The White Co. has established an agency for Riverside and San Bernardino, Cal., with the Auto Transfer Co., of Riverside.

Harvey Smith, formerly with the Crescent Auto and Machine Co., Fond du Lac, Wis., will open a garage at 20 East Second street.

J. P. Egensperger, who has an office in the Scofield Building, Cleveland, has secured the agency for the Northern cars, which have never been represented in Cleveland before.

O. L. Nick and A. Partridge, Miles City, Mont., have opened a garage on Park street.

The Akron Auto Clearing House has been opened at 51 South Main street, Akron, Ohio, with B. Warman as manager.

Ed and Arthur Foust, Bluffton, Ind., have rented a part of the Baumgardner livery barn, and will conduct a garage business.

The Bates-Odenbrett Motor Car Co., Milwaukee, Wis., agents for the Buick, have established a radiator and lamp repair department.

A corrugated iron garage with concrete floor is being constructed for W. R. Ellis at 2236 Grove street, Berkeley, Cal., at a cost of $2,500.

The Grimes Foundry Co., Bluffton, Ind., have rented the old Reformed Church, and will open a garage. Walter Grove will be in charge.

Edward Buroff is building a garage on North Third street, Watertown, Wis. The building is two stories high, and of fireproof construction.

Emil H. Ott, Milwaukee, Wis., has awarded contracts for the erection of a $4,000 brick veneered garage at Summit avenue and Windsor place.

The White Company have opened a Minneapolis branch at 220 Fifth street S., in charge of J. F. Toole, who formerly had charge of their Chicago branch.

George F. Ream, Elkhart, Ind., has opened a garage back of the Odd Fellows' Block on South Main street. A brick barn has been remodeled for use as a repair shop.

Hubert Levy, Louisville, Ky., has opened a garage at 650 Fourth street under the name of the Hubert Levy Automobile Co. The company has the agency for the Franklin and Buick.

The Stanford Auto and Manufacturing Co. has purchased the Corbaley & Thorp Garage, of Palo Alto, San Mateo County, Cal., and will add additional space and equipment to the combined premises.

The Ocean Park Garage Co., Ocean Park, Cal., will open a garage on Pier avenue. Dr. W. R. Mail is president of the company, Dr. W. H. Kiger vice president, and Lewis E. Bradt secretary and treasurer.

The garage of the South Tacoma Livery and Garage Co., 5241 South Washington street, Tacoma, Wash., was on June 15 destroyed by fire, which originated from an oil torch. The loss is estimated at $14,000.

A garage to be known as the Square Garage is being erected on North Main street, near West Gardner square, Gardner, Mass. The building will be one story, 40x70 feet, and will be ready for occupancy about July 15.

D. L. Ormsby has established the "Audubon Auto and Machine Works, Dorman L. Ormsby, proprietor," 415 West 150th street, New York city. He is no longer connected with the Washington Heights Automobile Garage.

The Clinton Automobile and Supply Co., Clinton, Ia., succeeded the Lamb Automobile Co. on July 1. The business is now conducted by Mr. Peironnet and M. J. Dannatt. They will handle the Peerless, Cadillac, Buick, Pope-Hartford and Pierce cars.

Henry Workman, Buffton, Ind., will erect a cement block garage, which he will rent to Charles Zehrung. The garage will probably be opened about August 1. Zehrung intends to engage in the livery business in addition to the regular garage business.

The garage owned by F. S. Johnson on Highland avenue, San Rafael, Cal., was burned to the ground on June 21. Johnson, who had returned from a pleasure trip, left the oil lamps lighted, and it is thought that the gauge on the gasoline tank exploded.

Fire destroyed the interior of the garage of the Goshen Auto Supply Co. at Goshen, Ind., a few days ago. Four automobiles were destroyed, and the loss is estimated at $10,000, with $6,000 insurance. The business is owned by Putt & Teegarden, and the garage will be rebuilt immediately.

The partnership formerly existing between H. A. Rowan and William A. Blair under the name of H. A. Rowan, Jr., & Co., Philadelphia, has been dissolved. The Aldine garage at 2028 Samson street, conducted by the firm, will be continued by Mr. Rowan, who will represent the Dietrich, Carter and Allen-Kingston cars.

The Square Auto and Garage Co. will be conducted in Gardner, Mass., by a partnership consisting of Guy A. Skinner, Geo. M. Clements and a local business man whose name is kept in the background. The same parties recently incorporated the Gardner Auto Co. in Maine, but later changed their plans and formed a partnership instead of a stock company. The garage will be located at 135 North Main street.

Trade Personals.

Wm. Stegeman has accepted the position of chief engineer with the Palmer & Singer Manufacturing Company, New York city.

W. Tischbein, a director of the Continental Caoutchouc Company, of Hanover, Germany, is on a short business trip in this country at present.

C. S. Mantell has been appointed temporary manager of the Studebaker Company branch at Seattle, Wash., succeeding C. J. Zintheo, who recently resigned.

Alfred Kunz, for many years connected with the Pope agency in Milwaukee, Wis., has severed his connection with the company and joined the forces of the Solliday Motor Co. as head of the repair department.

R. F. Thompson, formerly San Francisco agent of the Fisk Tire Co., has been appointed Pacific Coast representative of the Michelin Tire Co., which recently established a factory branch in San Francisco.

Mason B. Hatch, sales manager of the E. R. Thomas Motor Company, of Buffalo, N. Y., has resigned his position to go into the retail field. He will handle the Chalmers-Detroit line exclusively in Buffalo and surrounding territory.

F. H. Sanders, who has been a Franklin demonstrator and salesman for Adams & Hart, Grand Rapids, Mich., for a number of years, has been employed as field salesman by the H. H. Franklin Manufacturing Company. Mr. Sanders will take a 1909 model into the Northwestern territory, and instruct dealers in selling and demonstrating the new model.

Trade Literature Received.

Norton Co., Worcester, Mass.—"Helps-Dont's For All Who Grind."

Charles E. Duryea, Reading, Pa.—Circular of the Duryea carburetor.

Packard Motor Car Co., Detroit, Mich.—Catalogue of 1909 Packard cars.

Thomas Spring Works, Canisteo, N. Y.—Circular of the Thomas coil auto springs.

Pratt & Whitney Co., Hartford, Conn.—Catalogue of the Spline milling machine.

Western Electric Co., New York.—Catalogue of spark coils for automobiles and motor boats.

Donegan & Swift, 6 Murray Street, New York.—Catalogue of the Swift two cycle marine motors.

New Agencies.

Antigo, Wis.—Lewis-Leykom Co., Kissel Kar.

It is claimed that most aluminum solders disintegrate after a few years. The following composition is being recommended by *Brass World:* Tin, 29 ounces; zinc, 11 ounces; aluminum, 1 ounce; 5 per cent. phosphor tin, 1 ounce. The solder may be applied with a soldering iron or blowpipe.

The Horseless Age

First Automobile Journal in the English Language

VOLUME XXII NEW YORK, JULY 22, 1908 NUMBER 4

Cylinder Lubrication in Air Cooled Engines.

The average user seems to have only a vague and hazy idea of the manner in which an engine cylinder is lubricated. His impression seems to be that if he feeds a definite quantity of oil to a cylinder during a day's run the object is accomplished and the cylinder is well lubricated. As a matter of fact, quantity counts for very little; what is necessary is to get a little oil to the place where it is required at very frequent intervals or continuously. Little or no accurate work has been done toward determining the friction of the pistons of a high speed gasoline engine, but it is probable that under the best conditions it is not less than 5 per cent. of the brake horse power. From this value it may increase until it equals the power delivered by the fuel; in other words, till it stops the engine. If pistons and cylinders are properly fitted and have reasonably smooth surfaces their friction will not be great enough to stop the engine unless very little oil or none at all is being furnished them. Slowing down, due to poor lubrication, is not often noticed in automobiles unless the cylinders have practically run dry; but in small boats, where the engines are less carefully lubricated and carry a heavier average load, it is not uncommon to see an engine slowed down to half speed owing to lack of oil. In such a case an increase in the rate of feed will cause the engine to speed up to normal in a very few seconds.

It is easy to see from the above that a dollar saved in oil may result in an increase of $5 in the gasoline bill, to say nothing of increased wear. Over-lubrication is easy to guard against, for the sense of smell and the condition of spark plugs are sure to give warning of the presence of too much oil, at some points at least, though even then some parts of the piston may be running nearly dry. Cylinders and pistons are about the most costly bearing parts on a motor car, and it pays to keep them in the best possible condition.

A consideration of the subject of good lubrication leads to the following queries: When and where do we need lubricant? How much and what quality do we need? How shall we get it there?

Fig. 1 shows a diagram of the action of a four cycle engine. Suppose the piston to be lubricated and to be starting downward on the expansion stroke. In doing so it leaves the exposed wall of the cylinder above it covered with a layer of oil, exposed to the action of the intensely hot burning gas. So far as I know nothing has been done to prove whether the oil left on the walls is burned during this stroke or not. It certainly gets hot enough to burn, and whether it does flash or not is simply a question of how much oxygen is present. I regard it as probable that as a rule the oil is only partially burned, for unless there was some oil left on the cylinder wall it would seem impossible to run an engine with some of the splash systems that are successfully used, for the cylinder wall would be left dry the next up stroke, precisely when lubricant is needed most.

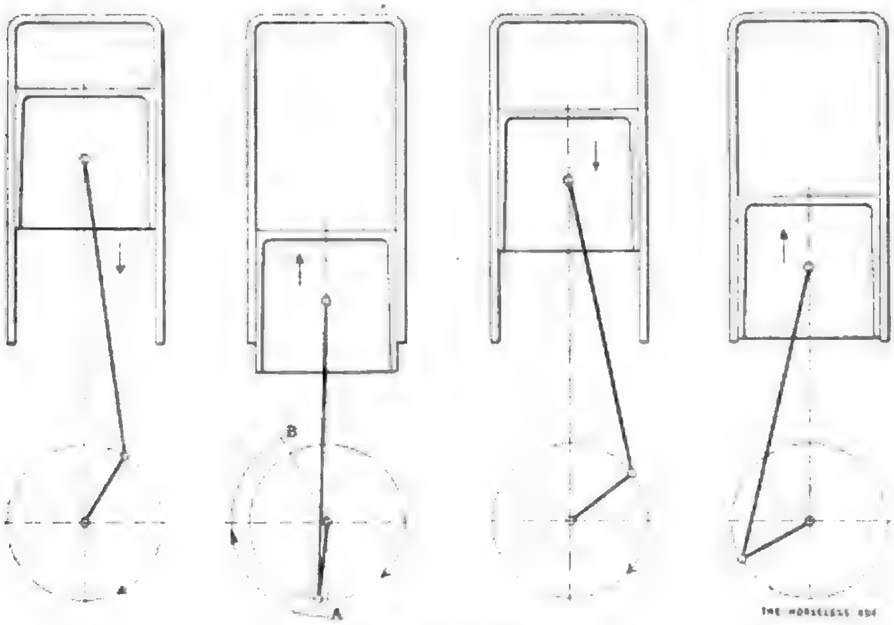


FIG. 1.—FOUR CYCLE DIAGRAM.

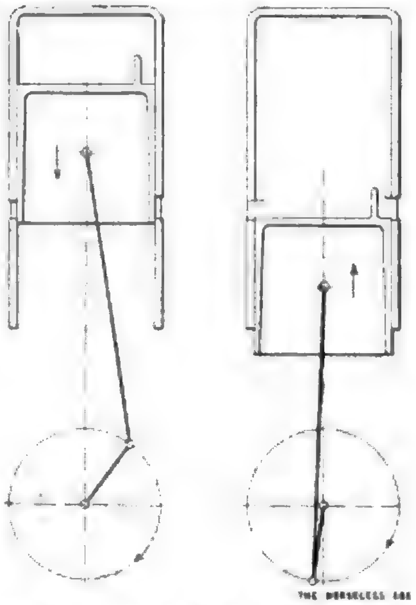


FIG. 2.—TWO CYCLE DIAGRAM.

That being the exhaust stroke, the cylinder is still filled with gases, which are quite hot, and it has not had time to give off the heat imparted to it from the explosion. During this stroke the most oil is needed and the least is present. It is probably during that portion of the stroke, from A to about B, that most of the cutting occurs; above B the side pressure of the piston is less and the speed is slow, so that lubricant is not so badly needed. Then, too, although this is the hottest part of the cylinder, it has a longer time to cool before the piston reaches it.

During the next suction and compression strokes the walls are probably cool enough to retain the lubricant, so this prepares them for the hard work of the next expansion stroke.

In the two cycle engine, diagrammatically shown in Fig. 2, each down stroke serves for an expansion, and for the first half of exhaust and intake. At the beginning of the up stroke conditions are somewhat the same as in the four cycle engine, in that the oil is more or less completely burned from the cylinder wall. The cylinder is, however, partially filled with a cooling fresh charge. Particular attention should be called to one part of the cylinder, namely, the bridge across the exhaust port. This is highly heated, and hot gas is still passing around

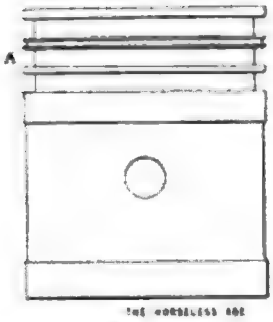


Fig. 3.

it when the top piston ring begins to scrape up across it. So difficult to lubricate is this point that one designer, who devoted many of his best years to two cycle design, recently told me that he was tempted to give up the two cycle engine because he could not be absolutely certain of preventing cutting on the bridges. This is at present one of the principal obstacles with which the designer of an air cooled two cycle engine must contend.

The effect of piston rings upon the lubrication must be rather complicated. Considering only one stroke, oil is trapped between the rings, which in this way serve to distribute oil. But the rear ring must act as a scraper and remove part at least of the oil it has helped to distribute. As the rings must be free in their grooves they have an action somewhat like the valves of a pump, and as they move from side to side of the groove a part of the oil, which always fills the free space in the groove, passes from the side of the ring on which the oil is most plentiful to the dryer side.

Let us now consider the action of the different systems. In the splash system the cylinder is oiled by the spray thrown from the rod end after dipping in the oil pool in the bottom of the crank case. When the piston is at the top of its stroke this spray can reach the cylinder wall up to the bottom of the piston, and if the piston is shorter than the stroke it is evident that the oil will be distributed over the entire length of the piston during its down stroke. How much oil will get to the upper ring depends, of course, on the ring design. Evidently it is all that is needed to prevent cutting on the exhaust stroke, for motors are very successfully lubricated in this manner. During the suction stroke a considerable amount of oil passes the piston, especially if the engine is a large one and is run closely throttled. There seems to be a great difference between engines in regard to the amount of oil they get from splash. Some engines get too much, and baffle plates must be resorted to, leaving only a small slot for the connecting rod to work in. Others do not get enough, and resort is had to oil pockets on the cylinder or piston, such as are shown in Figs. 5 and 6. Splash lubrication does not seem well adapted to the usual forms of small two cycle engines, and is seldom used.

The second method of lubrication is that in which oil is fed to the side of the cylinder from a positive pump; usually a shallow groove is turned in the cylinder and the pump pressure distributes the oil entirely around. The piston is made long enough to cover this groove all the time. As the groove registers with the upper ring when the piston is at the bottom of its stroke the system makes sure of getting oil where it is wanted every time. A somewhat similar scheme is used on large stationary engines, but not on automobile motors, so far as I am aware. It is shown in Fig. 4. Oil is supplied to the annular chamber A under pressure, and is fed to grooves in the piston through numerous holes.

In cases where the piston pin is positively lubricated by pressure through an oil tube in the connecting rod a groove is sometimes turned in the piston at the pin centre, and this groove, being, of course, filled with oil, serves to lubricate the cylinder walls.

Sometimes an oil groove is turned in the land between two upper rings, as shown in Fig. 3. This groove, in conjunction with pressure feed to an oil groove in the cylinder, gives particularly good lubrication to the upper end of the piston.

For two cycle engines the most popular method of lubrication is to feed the oil into the inlet pipe near the carburetor. This gives ideal distribution, to the cylinders at least, for the oil fed is strictly proportional to the fuel burned, as it should be. Another method which seems to be growing in popularity is to mix the oil with the gasoline in the tank. Some makers seem to be getting good results with this method, while others say that they have experienced trouble owing to the oil separating from the gasoline in the tank, and because of the different surface tensions of gasoline and oil in the carburetor. Whether these divergencies in the results are due to differences in the kind of oil used or to differences in the shape of the tanks, causing the oil to be stirred more or less by road vibrations, I am unable to say at present. It is certain that if the oil will remain admixed with the gasoline this is the ideal method of lubrication, for as long as there is any fuel to run the engine there is also oil to lubricate the cylinder.

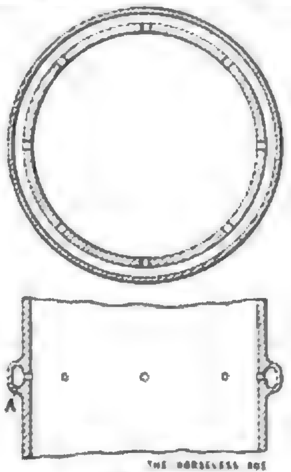
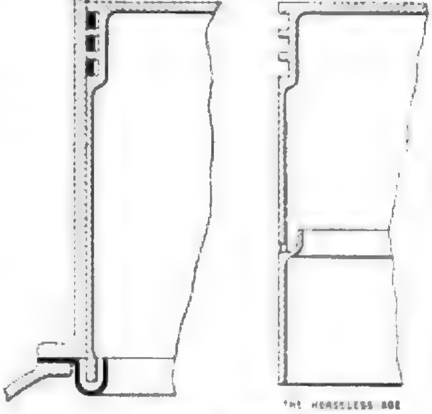


Fig. 4.

All of the foregoing applies equally well to the air or water cooled engines, the only difference between them in this respect being that an air cooled engine will cut quicker if lubrication fails, owing to higher wall temperatures and usually less even expansion of the cylinders.

With regard to the kind of oil to use little can be said that has not already appeared in these columns many times. A high fire test, purely mineral oil should, of course, be used. The experience of the manufacturers of the engine in question is the best guide as to the brand of oil to use and the amount to feed. But in a new type of engine, where the amount must be determined by experiment, the best way to start is to use enough; just as much should be used at first as can be consumed without sooting the plugs too fast. After the cylinders and pistons get polished this amount may be decreased. The heavier oils are usually best for air cooled engines.

A small amount of graphite is a very useful addition to the oil, for it serves to fill the pores of the cylinder and piston walls. In this way we get a composite surface of graphite and iron that will run for some little time without cutting, even if it is fed no oil. Such a surface is particularly valuable on the older splash lubricated cars, where there is no way of telling when the oil level is getting too low. The graphite will often prevent cutting if the oil runs out, and so save the user the cost of refinishing, or even getting new cylinders, pistons and rings. It is important, however, not to use too much graphite; less than 1 per cent. of the bulk of oil is enough. If the graphite is of the flake variety care should be taken to get the finest flakes, although they are somewhat more expensive. Quite recently a new form of graphite has appeared on the market under the trade name of "Deflocculated." It has a very fine grain, and is sold mixed with oil in the form of a thin paste. So fine is the graphite that the grains cannot be seen with the naked eye. The peculiar property claimed for this paste is that it will mix thoroughly with cylinder oil, and that it will not settle to the bottom. Apparently this claim is justified, for the writer has kept a mixture of the required proportions in a clean bottle for thirty-six hours without any signs of settling, the bottle remaining stationary all the time. This mixture should prove useful wherever force feed lubrication is employed.



Figs. 5 and 6.

The Construction and Use of an Aluminum Rectifier for Charging Ignition Batteries.

By Albert L. Clough.

A considerable number of motorists reside where direct current, suitable for charging storage batteries, is not supplied, and where considerable trouble and delay is involved in carrying batteries to a garage where a mercury rectifier or direct current generator has been installed. Such owners who have access to an alternating current supply may be interested in the following description of a small electrolytic rectifier, which can be built easily and cheaply, and operated reliably at fair economy. This rectifier is of the aluminum-carbon-sodium phosphate type, and is essentially a double "electric valve arrangement." Fig. 1 shows the arrangement diagrammatically. A is a single wound coil or auto transformer, with a laminated core. Its terminals are connected, through the switch K, to the 110 volts alternating current circuit. The middle point of its winding is brought out at I, and a number of taps are taken off the winding at points on each side of I and at equal numbers of turns therefrom. Between these taps and I alternating voltages ranging from 15 to 40 volts may be taken.

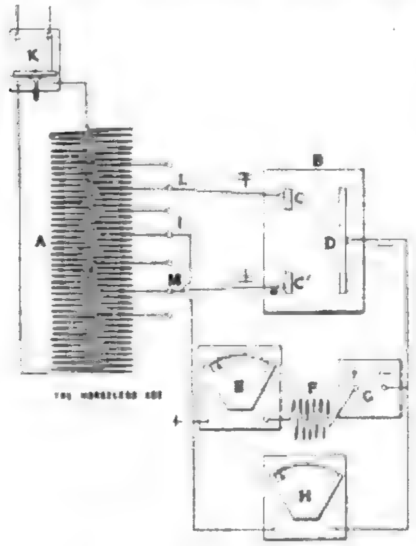


Fig. 1.

DESCRIPTION OF CELL.

At B is shown the rectifying cell, in which C and C_1 are aluminum plates and D is a carbon plate, all three being immersed in a solution of sodium phosphate rendered conductive by the addition of sulphuric acid. E and H are direct current ammeter and voltmeter respectively, which should be of the magnetic field type; F is a regulating resistance and G is the storage cell to be charged. The centre point of the auto transformer winding is connected directly to the positive terminal of the ammeter, through the adjustable regulating resistance F to the positive side of the storage battery. The negative terminal of the battery is connected to the carbon plate of the rectifying cell.

The aluminum plates of the rectifying cell possess the property of preventing the passage of current when they are negative to the carbon. During one wave of each period plate C is positive and passes current to the carbon plate D, and during the other wave of each period it is negative and passes no current; during this latter time, however, aluminum plate C_1 is positive and passes current to D. The current flowing between D and I is therefore continuous in direction, but pulsating between zero and a maximum, and a battery placed in this part of the circuit will be charged. For the containing cell B a hard rubber or glass jar should be used, but it should not be very much larger than required to hold the elements. The writer used the rubber jar of an Exide vehicle cell, which had been broken near the upper edge. This part was sawed off, leaving the jar 6½ inches high and 5x4 inches in its other dimensions. The aluminum plates were sawed out of one-eighth inch sheet, and were 6 inches long and 1 inch wide. The carbon plate was sawed out of one-quarter inch sheet battery carbon, and was 3¼ inches wide and 6 inches long. All three plates were drilled near the top, and a binding post, taken from a discarded dry cell, was inserted in the hole in each plate. The upper end of each plate was cut so as to form a shoulder, as shown in the figure, in order to hold a rubber jar cover. These plate dimensions were taken from an article by Wilmar F. Lent, published in the *Scientific American* of August 24, 1907. Before immersing in the liquid the end of the carbon element should be soaked thoroughly in melted paraffine.

Two separators cut out of one-quarter inch hard rubber were used to keep the elements apart, and the plates and separators were held together by means of a bunch of rubber bands near the top and one near the bottom. The cover was cut out of thin hard rubber to the dimensions of the inside of the jar; slots were cut to take the lugs of the plates, and a small ventilating hole was drilled to allow the gas to escape. Fig. 2, in which C represents an aluminum plate, D the carbon plate and E a separator, will make this construction plain. In this figure F represents the plates assembled, viewed in plan.

The jar is to be filled with a saturated solution of phosphate of soda, and its saturation is essential. All the soda which can be dissolved in the amount of water required should be used. The jar should not be filled closer than within three quarters of an inch of the cover, as acid has to be added.

THE AUTO-TRANSFORMER.

For the auto-transformer the writer used apparatus which happened to be at hand, as no special regard was had for economy of current. Two reactance coils from general electric alternating current, 110 volt multiple arc lamps were used. These were ring coils of 1x1½ inch rectangular iron section wound with twelve coils each of twenty-five turns of No. 14 wire (Fig. 3). The points where adjacent coils were made together gave numerous points at which different voltages could be taken off. These two reactances were connected in series across the alternating current lighting circuit, and the connection between them was made point I (Fig. 1), one of the direct current terminals. Each of the small coils gave about five volts, and the wires L, M (Fig. 1) were connected so as to bridge five coils, counting from the point where the two reactances were connected together, about twenty-four volts thus being impressed between the aluminums and the carbon plate. It makes very little difference, so far as results are concerned, just how the alternating voltage is cut down, but it should not exceed thirty or forty volts. Any form of transformer capable of taking 115 volts at its terminals, and of carrying five amperes continuously without dangerous heating, will do. A regular transformer with a secondary capable of giving fifty volts and with a central terminal and a number of taps will be preferable to the auto-transformer or reactive coil in some respects. If a special auto-transformer has to be built a cylindrical core of small soft iron wires should be built up, 1¼ inches in diameter and 10 inches long. On this core, which should be wrapped with insulating paper, should be slipped ten coils, wound on a wooden form, each three-quarters inch wide and consisting of eighty turns of No. 14 single cotton covered wire connected in series. Connection I should be taken from the middle point of the winding, and connections L and M from the ends of such coils as are found to give the necessary voltage. The outside ends of the two end

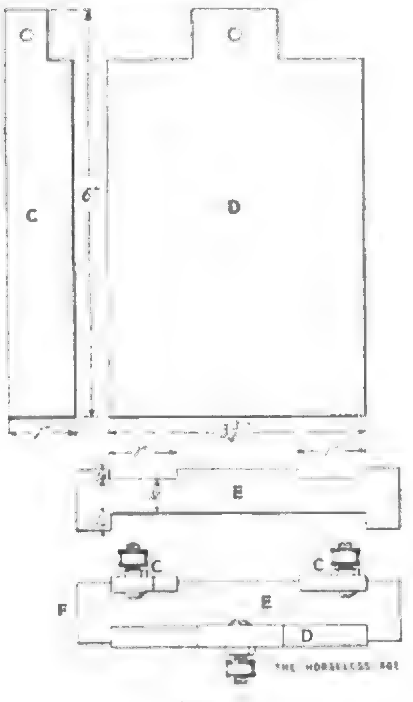


Fig. 2.

coils should be connected to the line which it is assumed to carry an alternating current of 60 cycles and 110 volts approximately. A larger number of coils of fewer turns each may be used, but a total of 800 turns should be employed.

FORMING THE RECTIFIER.

In preparing the rectifier for use twenty-five volts or thereabouts should be applied between the aluminum plates and the carbon plate. The cell to be charged should not be included in the circuit at first, the resistance F (Fig. 1) and the instruments only being connected. The resistance may be made by winding No. 16 bare German silver wire into a close spiral on a one-half inch mandrel. The spires are slightly separated by pulling on the ends of the coil. Three or four feet of such a resistance may be made and permanently connected to the negative side of the ammeter. By forcing the end of the wire from the carbon plate between two adjacent spires of the coil a sufficiently good contact may be had, and an easy means of adjustment secured by including more or less of the coil in circuit. When the alternating voltage is first applied to the cell little or no current will pass, as the sodium phosphate solution has a high resistance. As soon as pure sulphuric acid is added to the solution current will begin to flow, and will begin to show itself at the direct current instruments. The acid should be added very gradually, not over a drachm at a time, until about four amperes passes at a pressure of at least ten or twelve volts. The amount of acid added is a somewhat particular matter, and the solution should be thoroughly stirred after each addition. Before the best results are obtained the aluminum plates must "form" themselves, and this requires that the apparatus be run on the dead resistance for several hours. As the electrical energy expended in the solution causes it to heat rapidly, and, as this heating materially reduces the efficiency of rectification, means must be provided for cooling the cell. The easiest way in which this can be accomplished is to set the cell in an ordinary sink and allow faucet water to circulate around it. A small standpipe of about 5 inches in height can be inserted in the sink waste, and this will maintain the water level in the sink somewhat below the top of the cell. The cold water faucet can be left open slightly to insure a constant current of cool water.

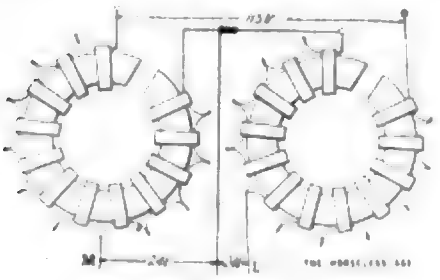


FIG. 3.

CONNECTING UP BATTERIES.

After the plates are formed it may be necessary to add a little more acid to the solution, and this should be done if it is found, by experiment, that it raises the reading of the voltmeter, with a given direct current flowing. A pressure of ten or twelve volts and a current of three amperes will be found sufficient for charging a three cell battery. One end of a short wire should be attached to the + pole of the battery, and its other end connected to the German silver resistance by inserting its end between two adjacent turns. The — pole of the battery is connected to the wire coming from the carbon plate of the cell. The alternating current is then switched on to the coil, and the ammeter should show a direct current in the same direction as when the dead resistance alone was used. If not the battery has overpowered the rectifier and a higher voltage is required. In all probability the ammeter will show a current in the right direction, and the battery is then charging. The charging current can be regulated by cutting out or in more or less of the German silver resistance. It is absolutely necessary that an ammeter and voltmeter of the magnetic field type should be used in order to show the direction of the charging current. When the apparatus is first used it is well to watch the auto-transformer carefully to see that no part of it heats beyond a temperature comfortably bearable by the hand, as it is possible that a misconnection between the coils, the use of bad iron for the core or some other mistake may cause it to pass too much current. Should it heat excessively, even when the connections are found to be all right, more turns of wire should be added.

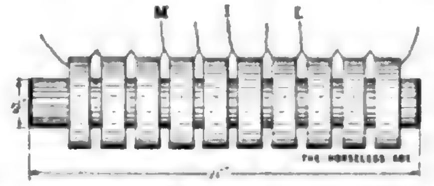


FIG. 4.

MAINTENANCE OF RECTIFIER.

After considerable use the solution in the cell will be found somewhat reduced by spraying, and the loss should be made up by adding phosphate solution and possibly a little acid. Some scale will be formed on the aluminum plates after a time, and this should be scraped off. After long service the aluminum plates become somewhat worn away and finally have to be replaced, and it may be well to make four aluminum plates instead of two in the beginning, thus allowing for a renewal.

EFFICIENCY

This form of rectifier is not highly efficient electrically; the output in direct current will ordinarily not be found to be over 20 per cent. that of the alternating current input to the coil. It is, however, a more efficient means of charging a single three cell battery than is the direct current lighting circuit with lamp resistance, which is so largely resorted to. When once properly adjusted it is quite dependable, and as it is simple and cheap to build one may forgive its lack of high electrical efficiency. The pulsating direct current which it delivers is well adapted for charging purposes.

Empirical Carburetors.

By WARREN NOBLE.

If from a chemist's burette a quantity of gasoline of known density were admitted to a gas holder, and a saturated vapor secured, mixing the vapor with a certain quantity of air would result in the production of an explosive gas whose value as an explosive agent would depend upon the density of the mixture and would vary with the density both at atmospheric pressure and at pressures many times atmospheric. It must, however, be remembered by the serious student of carburetion that although the explosive force is increased by compression, the maximum explosive effort exerted by a quantity of trapped gas depends primarily upon the density of the mixture at normal pressure, this fundamental density differing with the pressure to which it is desired to eventually compress the mixture under observation.

This difference in density of gasoline vapor gas is important, for it can be readily shown that the explosive efficiency of such gas is very easily changed by the most delicate changes in the quality of the mixture, although firing is possible through a wide range of mixture qualities. Those of my readers who can remember the early days of surface and bubbling carburetors will recollect this delicacy under very practical conditions, and will also remember the ingenuity many of us expended in securing means of crudely but timely adjusting our "mixture taps" for hill climbing and speed purposes. Moreover, at the present time certain modern machines utilizing surface carburetors or an equivalent type are notoriously sensitive in this direction, although quite conducive to steady running when once set correctly.

In a conventional gasoline engine the compression is constantly fluctuating, owing to the variations of throttle opening demanded by road conditions and the many auxiliary influences which are imposed.

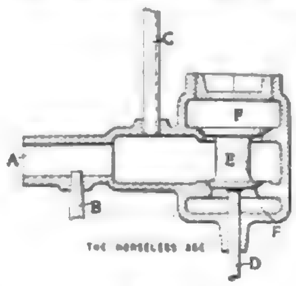


FIG. 1.

A, fixed air inlet; B, nozzle; C, straight tube giving automaticity; D, control rod; E, throttle valve; F, F, ports to induction passages.

MIXTURE PROPORTIONS SHOULD VARY.

I think it is generally accepted now that the best results are secured from an internal combustion automobile engine when the mixture proportions vary widely at different speeds. It was formerly generally believed, even among experts, that vapor and air should be mixed in inflexible proportions, and much work was done in an endeavor to secure devices which should satisfy this condition. Much was written during those days concerning the accuracy of this theory, and I was particularly strenuous in upholding it. It was not until I had thoroughly investigated the matter, in company with the late Ivan de Haviland, some time chief engineer of the English Daimler Company, that I was converted to the variable mixture theory. Later we substituted empirical devices for the so called automatic arrangements, which we tried out exhaustively.

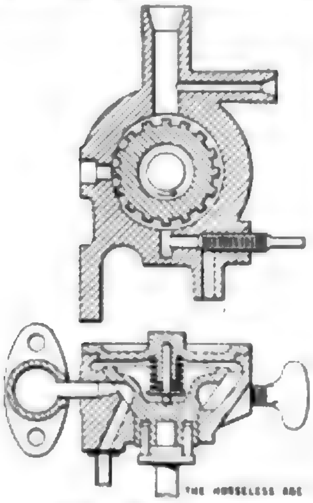


Fig. 2.—Gobron-Brillie Measuring Carburetor.

At this juncture it may not be out of place to mention the device which gave us the best general results of all those tried. The experiments were carried out on a four cylinder engine, 4⅞ inches bore by 5½ inches stroke, ball bearing throughout, with 62.9 pounds cold compression taken isothermally. The connecting rods were 16 inches long, low tension ignition by make and break compensating plugs was used, and the valves were set in the head at an angle of 30 degrees from the horizontal, and operated by tension rods with a spring take-up to each, the same shaft being exposed. Six cam shafts were used with each device, the cams being cut solid with the shafts, each representing a different valve setting. We secured the best results from the Krebs carburetor—used to this day by the Panhard firm, who were responsible for it in the first place—and from a carburetor similar to the Krebs as to mixing chamber, but with a straight tube of one-quarter of an inch bore by 39 inches in length leading directly into the mixing chamber. The air passage past the jet was circular, .55 inch in diameter, the jet orifice being .0302 inch in diameter at the nozzle and the level of the gasoline .115 inch below the nozzle of the jet.

This combination gave us remarkable results at less than normal speeds, and average results at high rates of revolution, but the load curves fell off before the normal was reached and regained a little just above the normal. We tried various tube diameters and lengths, but found the dimensions given the most satisfactory. The automatic action (?) was, of course, due to the variation in resistance to the air flow through the small tube. It was this device that convinced us of the necessity of varying the proportion of gasoline to air.

SOME CONCLUSIONS ARRIVED AT.

At this time, too, we found out that it was impossible to secure by needle valves any measurable adjustment of gasoline flow; that suction controlled devices in any of the then known forms were so unreliable as to be well nigh useless; that the form and dimensions of inlet passages made considerable difference in the flexibility range; that with almost any known system except surface carburetion the engine took its gasoline almost entirely in liquid form, vaporizing it during the compression stroke; that complete scavenging was not essential to flexibility; that some back pressure on the exhaust line was desirable at low speeds, and that simultaneously throttling on the carburetor supply and the output was desirable.

The investigation furnished convincing evidence that combustion is entirely without law—in other words, that it is an empirical phenomenon and to be treated as such. The supplementary mechanisms were also found to be entirely of an empirical nature and so unreliable that their calibration could not be depended upon for long.

MEASURING CARBURETORS.

The measuring carburetors of the past are now well nigh forgotten. Those who are working on the problem of fuel injection know only too well the difficulties encountered in securing force feed mechanisms to handle efficiently and accurately such minute quantities of liquid, and for small engines such devices are almost invariably unsatisfactory. Yet, for many years the Gobron-Brillié firm employed a measuring system which when unworn was most satisfactory, and when properly proportioned was excellent in many ways. It consisted, as some may remember, of a ratchet fed plug rotating within a casing having teeth or recesses cut in its periphery, the volume of liquid taken up by these teeth being fed into the induction passages, where the inrushing air evaporated it and carried it into the cylinders.

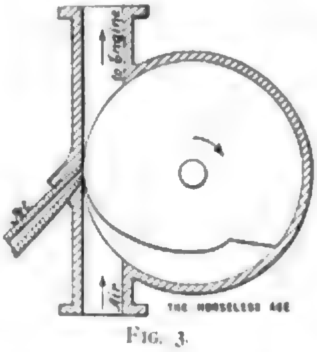


Fig. 3.

THE WICK CARBURETOR.

The wick carburetor in an improved form might well be termed a measuring carburetor, although, perhaps, a more fitting denomination for it would be "selective" carburetor, since such a type refuses heavier spirits and water, only using the low density components of the gasoline supplied to it. The puddle type of carburetor, now in quite general use, is a step forward, and is more constant in action between certain limits. In all these types there must be provision for subsequent proportioning with an additional air supply, and the fallibility of this additional air inlet is the weakest point. From an extensive experience with a certain type of wick carburetor it has always appeared to me that, aside from its unwieldiness, it is a satisfactory device, and an investigation of such a carburetor would well repay anyone in search of a basis for empirical carburetor construction, for, inasmuch as saturated vapor can be derived from it with ease, the problem becomes one of the correct mixture of air and vapor, which is much simpler than the problems to be solved in connection with a satisfactory device of the jet type.

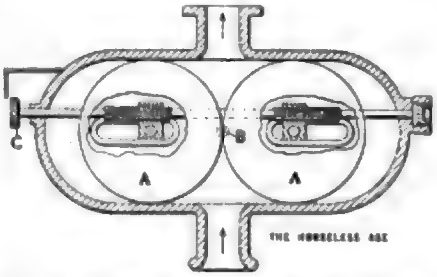


Fig. 4.—Experimental Device for Finding Carburetor Cam Curves.

A, A, dummy shutters; B, location of jet orifice; C, screw for adjusting distance between shutters.

AN EXPERIMENTAL DEVICE.

Before discussing this type further I wish to refer to a previous article of mine in The Horseless Age, in which I gave a description of an empirical carburetor and the mode of calibrating it in an experimental stage for future manufacture for any given engine. This consisted primarily of a flat chamber which received a circular shutter or cam the axis of which lay in the same plane as the orifice which acted as the jet from a float chamber of ordinary pattern.

Were the shutter entirely circular it would in any position cut off communication between the intake and outlet of the chamber along the line of the jet orifice, but being cut as a cam it admitted a greater or smaller quantity of air as the profile receded from or approached toward the opposed wall of the chamber. Thus air was permitted to pass through a variable rectangular orifice, one dimension of which was constant and known, so that any variation in the air opening could be read off directly.

In order to secure automatic action the shutter was coupled to a calibrated suction device, the curve of action of which had been previously fixed. In calibrating the carburetor itself a typical engine was coupled up with an electric brake. Two shutters were used with the carburetor. They were not cut as cams, but so arranged that they could be moved apart symmetrically about the jet by a fine screw of differential but known pitch. Readings were taken simultaneously of the brake results, the air opening past the jet and the engine revolution. In this way a speed power curve at constant ignition was obtained for each opening. This was combined with the calibration curve of the suction device, the amplitude of motion of the shutter from its influence being known, with the result that it became possible to determine the exact profile necessary for the engine type under observation.

Occasionally these devices were fitted with a suction device and a throttling device in addition. Later almost equally good results were secured by positively connecting the cam with the control and dispensing with the throttle, the throttling being done in this case at the carburetor supply by the cam itself.

In the illustrations I show a few of the possible arrangements. Such a carburetor may have one, two or four shutters, the proper number to use depending upon the location of the float chamber.

CONTROLLABLE SPRAY NOZZLES.

Since this initial work I have happened upon a form of jet which lends itself to simultaneous adjustment with the shutter revolution, and this suitably linked by a differential calibration, so that adjustment of jet with air openings may be made and accurately observed, should give almost perfect results, excepting as regards vaporization.

In this form of jet the gasoline orifice is also formed rectangularly, by simply making a saw slot in the side of a closed tube in communication with the source of fuel supply. The width of the saw slot does not matter, as long as it is sufficiently narrow, as this becomes the fixed dimension of the rectangle, and adjustments need only be counted vertically. A glance at the diagrammatic section will show the system and explain the action more clearly than verbal explanation. The friction of the necessary gland is a drawback, but such drawbacks are common to any known form, except, of course, where positive operation from the control is resorted to.

Apropos of positive control, I would be a strong advocate of its adoption were it not for the seeming impossibility of securing uniform intelligence of drivers. With a positive control connection the driver must be entirely in sympathy with his engine, whereas with an automatic device he may open the throttle and leave it open without reference to the car's performance under load, since the automaticity will take care of the carburetor openings.

As regards devices for providing this same automaticity and depending upon engine speed, their number is legion, but the difficulty of securing an even reasonably efficient one is extraordinary.

HYDRAULIC CONTROL OF MIXTURE PROPORTION.

After much thought on the subject and after observing the "fading" of many devices depending upon springs and diaphragms and even dead weight connections, I am convinced that an hydraulic system is the most efficient, both as regards constancy and power. The power factor of such an automatic system is exceedingly important, and the hydraulic system—positively actuated by the engine—affords a much greater actuating force than suction.

Hydraulic systems are gaining ground abroad, but personally I would prefer to make the automatic system self contained, instead of utilizing the cooling system of the motor, which, to my mind, is by far too replete with variables to be valuable in this direction. An adjustable by-pass on the system will provide for all the variables of friction of the carbureting device, and once set will remain effective for an indefinite period. Moreover, should it be deemed desirable, the same hydraulic system can be separately coupled to act as an engine governor.

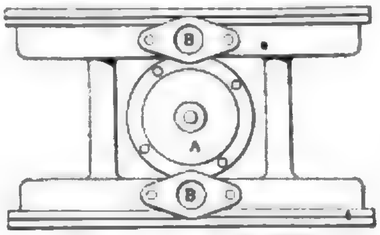


Fig. 5.—Quadruple Shutter Type.

A, float chamber; B, B, induction passages.

In research work with the object of solving the problem of carburetion by empirical means, I would start again with the surface type of carburetor and would investigate the possibility of securing a flow of vapor for some arbitrary standard of density from a chamber filled with some form of absorbent brick. It is a matter of conjecture whether such an substance would give as good results as a wick, since it would be non-selective, but it would be less bulky, which would be a point in its favor for automobile use. Whether a vapor approaching saturation could be constantly supplied from such a chamber is a matter for experiment. Coupled with a hydraulically controlled mixture valve, the device should give good results and would be well worth trying.

Some Experiences With Deflocculated Graphite.

In view of the interest which has been manifested by our readers in this new lubricant, the inference drawn from some little personal experience with it may be worth printing. First, as to its remaining mixed with or "suspended" in oil. A mixture of "Oildag" and medium grade Panhard cylinder oil remains practically perfectly uniform for quite a long time. After it has remained in a bottle on a shelf for about two weeks there is a slight deposit on the bottom of the bottle, but this can be removed by shaking the bottle a little. In a tank on a moving car there would be no settling whatever. In a mixture of graphitized oil and gasoline, in the proper proportions for two cycle engines, the graphite remains "suspended" even better than in the oil-graphite mixture. Only a very small deposit is formed after a long time, and this deposit does not in the least adhere to the containing vessel, or, if it does, the gasoline so quickly washes it away that the adherence cannot be noticed.

Owing to the well known properties of graphite, and the peculiar smoothness of this particular kind, it seems well adapted to the lubrication of almost every part of an automobile. It seems to be the best lubricant for running in new engines by driving them by belt, as it smoothens the parts out very nicely and prevents any sign of cutting.

There is no doubt of the great value of deflocculated graphite as a cylinder lubricant, especially for motors which are run hot; nevertheless, it cannot be recommended for use in all types of engines, for, unfortunately, besides being a lubricant, the graphite is an excellent conductor of electricity, and has a tendency to short circuit spark plugs. Hence, in engines where it is necessary to supply so much oil that considerable gets to the spark plugs, graphite should not be used. Where force feed lubrication to the cylinders is employed, the graphite can generally be used without any trouble. In engines which employ splash lubrication it can be used to advantage only where the engine is so designed that an excess of oil does not get above the pistons. For two cycle engines, where the cylinder is lubricated from oil carried in the entering charge, graphite should generally be used only when the plugs are pocketed so that shooting flame ignition is secured.

The salient point is to prevent the accumulation of too much graphite on the plugs; a small amount does little, if any, harm, especially if there are gas currents which will clean it off again. It might be laid down as a general rule that in any engine lubricated with ordinary oil, which will run for a long time without sooting its plugs, graphite may be used to advantage, and the plugs will soot little, if any, quicker. But where plugs must be cleaned often with common lubricating methods, they will generally need much more frequent cleaning if the graphite is used. Possibly in some cases so much oil will be needed as to more than compensate for the presence of the graphite.

But wherever the graphite can successfully be used it offers great advantages, such as decrease in friction, wear, and chance of damage if the oil flow should cease. Possibly it also is more efficient than oil in preventing cutting.

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Entering the Automobile Industry.

Certain other industries have been affected by the business depression more than the automobile industry, and some concerns in these "hard hit" industries are looking for new fields of enterprise. The automobile industry, probably largely on account of the booming it has received in the newspapers, has attracted the attention of these parties, and every now and then we hear of a carriage or machinery firm about to take up the manufacture of automobiles. Many of these concerns undoubtedly have been deceived by the stories of "rushing business" and "fine prospects" in the automobile industry that appear in the columns of the leading dailies, and it may not be amiss to sound a word of warning to all these would be automobile manufacturers.

The automobile industry is an industry of rapid development. Until now it has been swayed by fashion, and the public demand has changed more or less from year to year. The manufacturers on their part have sought to develop first those particular fields which offered the greatest immediate profit, and other lines have been more or less neglected. Of course the newcomers' only chance is in these relatively neglected lines, but when it is considered that the old established manufacturers are rapidly turning to these lines as the demand for the first developed types is letting up, it will be seen that here, too, there is comparatively little chance for the newcomer.

Many firms have started in the last few years to build automobiles for farmers and residents of small country towns—extremely simple machines, with all the frills and polish dictated by fashion left out. But aside from the fact that these cars are not required to travel as fast as the average modern car is capable of, they represent quite as difficult mechanical problems. They must travel over bad roads driven by persons of no special mechanical training, and are not likely to receive much care in use. The cars must stand up under these conditions, for unless they do the market among farmers and the moderately well to do residents of country towns will soon be exhausted. In fact the problem of building a car that will give satisfactory service to a farmer is an extremely difficult one, and a great many of those who attempt its solution are doomed to failure. The experience of the old manufacturers will, of course, stand them in good stead in taking up this branch of the business. Those who attempt the task of building such machines without any previous experience in automobile work have a very small chance of success.

Aside from the moderate priced vehicle for country use, there is the commercial branch of the industry, which also seems to have been neglected by the manufacturers. But if the use of motor trucks and delivery wagons has made less progress than the manufacture of pleasure vehicles, it is certainly not for want of attempts to engage in this branch of the industry. The crux of the situation is that the problem of the economical, dependable commercial motor wagon has not yet been fully solved, and until it is the application of such vehicles can make but slow progress. There is great opportunity for experimenting in the line of commercial vehicles, but the opportunities for immediate returns on investments in this branch are not great.

Cranking Dangers.

Less has been heard in recent years of accidents in cranking automobile motors, and it was thought that the use of smaller individual cylinders, the frequent provision of compression relieves and the possibility of starting a multi-cylinder motor "on the spark" after all short stops had together largely eliminated this source of personal injury. That this impression is entirely erroneous is proven by a report made by the chairman of the automobile hazard committee of the International Association of Accident Underwriters at a convention in Atlantic City, N. J., last week, according to which no less than 49.2 per cent. of all automobile accidents are caused by back kicks in cranking. Only 14.8 per cent. of the accidents are caused by persons being thrown from automobiles, and 13.1 per cent. by collisions. When one considers how frequently accidents of the two last mentioned kinds figure in the newspapers, it appears that in the course of a year a great number of persons must be injured by the starting crank, and the means of avoiding such accidents become of great practical importance.

Some of the causes of injury by the starting crank are that the operator has neglected to retard the spark before cranking, that the timing gear has been improperly connected up after having been taken apart, that the ratchet slips off owing to its teeth being worn, and that the ratchet sticks. The fact that it is often attempted to start the motor in a cramped position, between the spring horns and the garage wall, may also be responsible for some accidents of this kind.

The automatic interlock preventing the insertion of the starting crank unless the spark had first been retarded came into somewhat extensive use at the era of big single cylinder cars, but seems to have been almost entirely abandoned since, although it could be fitted as readily to a four cylinder car in which the motor is started from the front as to a single cylinder car with the motor started from the side. On the other hand, a somewhat different automatic device, by which the compression relief cocks are opened by the act of inserting the starting handle, has been adopted on a number of cars. Such an arrangement would seem to be specially advantageous on large cars whose motors are very hard to crank unless the compression is relieved. In some cars the compression is relieved by pulling on a rod near the starting crank, but the automatic feature is desirable because it leaves both hands free for cranking.

We understand that some manufacturers still send out starting ratchet cranks with ratchet teeth left unhardened, although this would seem hardly believable at this late day. Any owners who may be bothered with the teeth of such ratchets bending back and the crank refusing to hold are advised to have a blacksmith forge out the teeth again to approximately their original shape and then harden them in cyanide.

A Neglected Point in Carburetor Connections.

While there has been considerable improvement in carburetor design and construction during the past few years, the construction of inlet manifolds has not received the attention which it deserves. The introduction of the six cylinder engine has, however, compelled a diligent study of the forms of these manifolds, for it has proven to be no small problem to get equal charges into each of the cylinders. Our present object is to call attention to one of the "little things" which are too often neglected, namely, the pocketing of gasoline in the intake system.

The piping from the carburetor to the inlet ports should be so designed that if gasoline were poured in at the engine end all of it would run out through the air opening of the carburetor. Otherwise little pools of gasoline are bound to collect in the pipes, for cooling of the pipes by the evaporation of the fuel will condense a part of it under some conditions, and too much flushing of the carburetor while starting will often cause a surplus supply. These little pools of gasoline, while they last, act as surface carburetors and cause the mixture to become too rich at irregular intervals. This makes the engine miss explosions, and gives all the indications of poor carburetion.

It is quite common at present to connect the carburetor to its manifold by a threaded coupling, such as a pipe nipple. Where such a nipple is placed in a horizontal position there is sure to be a pocket for gasoline at the end nearest the engine.

If the purchaser of a car, especially one of the older models, experiences trouble with irregular mixture, he will do well to look over the inlet connections before placing the blame upon the carburetor. If he finds that there are pockets the difficulty may sometimes be remedied by drilling a small hole to drain each pocket. These holes will, of course, admit air into the inlet manifold, but if they are small and few in number this air leak will be so nearly constant that it can be provided for by adjusting the carburetor to feed a little more fuel. This expedient, however, cannot be recommended unless the amount of fuel lost is small; otherwise, it is a source of danger and may cause a serious fire.

Ball Bearing Crank Shafts.

Some time ago considerable discussion was carried on in these columns regarding the advantages and disadvantages of ball bearings applied to the crank shafts of automobile engines. Many points that seemed of value, at least theoretically, were brought out during this discussion. Since that time these bearings have been used quite extensively on automobile engines of all sizes. As a result of the practical experience thus obtained some of the best foreign makers have discontinued their use, but we do not recall any American manufacturer who has done so. Quite recently the advent of the "bloc" motor has caused a renewal of interest in this application of ball bearings, and for the comparatively small motors usually made of this type we find ball bearings very generally employed.

The questions raised in the mind of the designer by this state of affairs may be summed up as follows: If it is an advantage to use bearings of this type, why are they not more generally employed on cars of the highest grade? Higher first cost would not be considered there if the bearings were any better than plain ones. They must certainly reduce engine friction, and if of proper size and well mounted should wear well. The only objection which has been made against them, so far as we are aware, is that they are more noisy than plain bearings. This is probably true, but it is likely that the slight metallic sound which some have objected to may be overcome or muffled.

We regard the subject as important to engine designers, and it would be extremely interesting if someone who has had sufficient practical experience with the use of ball bearings on crank shafts to speak with authority on the subject would let the public know wherein they have "made good" and wherein they have failed.

The Design of Bevel Pinions.

In a bevel gear drive it is often desirable to use a pinion with a small number of teeth. This is generally the case where a large reduction ratio is desired and where considerable power is to be transmitted so that teeth of quite large circular pitch must be used. In such cases, unless the pinion has about as few teeth as advisable, the gear is so large that its housing is unwieldy. Thirteen teeth are about the smallest number that should ever be used in a bevel pinion, if the teeth are of the ordinary form. But some manufacturers are using eleven, and we believe that as few as ten have been used occasionally. There are two objections to the use of pinions with a small number of teeth. First, it concentrates the wear on a few teeth, so that the wear of each tooth is large and frequent adjustment is necessary. Second, the teeth are undercut so much that their strength is greatly reduced. This latter objection has been overcome in a few instances by changing the relation of the pinion teeth to their pitch cone. This is done by moving the pitch cone, whose position is purely arbitrary, in on the teeth so that the teeth have very short flanks and long faces; when this is done there is no undercutting whatever, no matter how few teeth are used. Designers who find themselves obliged to use small bevel pinions would do well to look into this matter of moving the pitch cone, for it not only gives stronger teeth but also improves the contact conditions and seems to be good practice from every point of view.

In some respects it is regrettable that so many tables of tooth parts, pitch diameters, etc., have been prepared and are in general use. While they serve excellent purposes in the shop as time savers, they certainly tend to discourage the common study of the theory and practice of gear tooth action, and we believe that they have been the indirect cause that many of the present generation of designers are lacking in knowledge regarding this most important branch of the mechanic arts.

Coming Events.

August 14—Algonquin, Ill., Hill Climb of the Chicago Motor Club.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

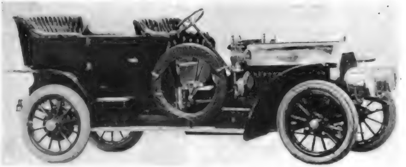
September 14—Annual Economy Run, Chicago Motor Club.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show, American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show, Association of Licensed Automobile Manufacturers.

NEW VEHICLES AND PARTS



The 1909 Meteor Car.

The 1909 Meteor Car.

The Meteor Motor Car Company, of Bettendorf, Ia., after three years of experimental work, are preparing to turn out a considerable number of cars for the season of 1909. Their new model is a five passenger touring car, with sufficient room in the tonneau for two extra seats. The manufacturers state that it has been their aim to produce a strictly high grade car, and that they have been particularly careful in the selection of material. There is not a malleable iron part in the whole car, and all of the steel parts are made from solid stock. The gray iron castings for the cylinders are imported from England.

The motor is of the four cylinder, vertical, water cooled type, of 5 inch bore by 5½ inch stroke. The cylinders are separately cast of a hard, close grained iron. The valves are mechanically operated, and are located on opposite sides. The pistons are cast of the same material as that used in the cylinders; they are ground and fitted with four rings, three at the top and one at the bottom. Two oil grooves are cut in the piston to ensure an even lubrication of the walls of the cylinder. The crank shaft is of specially treated chrome-nickel steel cut from the solid block, and runs in five large bearings, which are ground to 1-3000th of an inch. The connecting rods are all drop forged. The lower ends are fitted with split bushings and babbitt bearings. The cam shafts are enclosed within the motor crank case, fully protected from foreign matter, and always certain of lubrication. The cams are drop forgings, and are all keyed to the shaft. The oiler, magneto and pump gears run in an oil tight compartment in front of the crank case. The oiler and magneto are located immediately beneath the toe board under the dash, and are accessible by merely raising the board up, thereby obviating the necessity of raising the hood when it is necessary to fill the oiler or inspect the magneto.

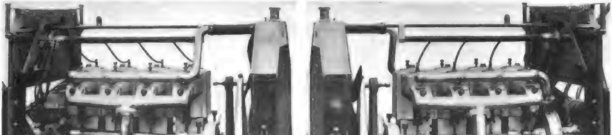
Ignition is by a dual system consisting of an imported Eisemann low tension magneto and batteries. All wiring is concealed by black fibre tubes extending from the magneto up along the dash and over the cylinders to the spark plugs, which are Eisemann magneto plugs located directly over the intake valves. The switch is the only piece of mechanism on the dash, with the exception of the compression release valve, which when opened releases 60 per cent. of the compression of motor. All the piping of the motor, including the water pipes, inlet manifold and carburetor pipes, are of buffed aluminum. The buffed aluminum fan pulley is mounted on an eccentric for ready adjustment of the belt tension. The pump and water pipes are of relatively large size, and the total water capacity of the car is 6 gallons.

The clutch is of the large multiple disc type, located in the flywheel, and runs in oil. Any play may be taken up by the means of four lock nuts projecting through the rear half of the wheel. It is claimed that on account of the size of the clutch and the oil it runs in it is impossible to make it "grip," but that it is extremely sensitive.

The change gear is of the selective type, giving three speeds forward and one reverse, with direct drive and all gears idle on the high. The power is transmitted to the rear axle by a shaft drive, with a driving angle of about 2½ degrees when the car is loaded. The rear axle is of chrome-nickel steel, of the floating type, with external and internl brakes. Both sets of brakes are equalized by means of balance levers. The front axle is of I beam section, also of chrome-nickel steel. Both axles are fully equipped with Timken roller bearings, including the steering pivot of the front axle. The frame is of pressed steel, with a drop in the rear for clearance of the rear axle, and also to give a low centre of gravity. All of the springs are 40 inch, semi-elliptic being used in front and platform in the rear. The wheel base is 120 inches, with 34 inch wheels equipped with 4½ inch tires, both in front and rear. All exposed woodwork in the car, including the dash, is of Circassian walnut.

The 1909 Correja Car.

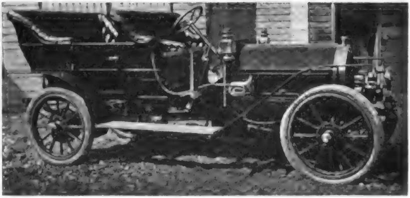
This car is made by Vandewater & Co., of Iselin, N. J., in one model of 39 horse power. Three styles of body are furnished, viz., touring car, runabout, with and without rumble seat, and with double rumble seats. The wheel base is 110 inches and tread 56 inches. The frame is straight, of pressed steel channel section, with an angle steel sub-frame, for supporting the engine, riveted to it. The frame is suspended on semi-elliptic springs front and rear, the



Two Views of the Meteor Motor.

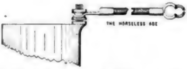
front springs being 38x2 inches and the rear 48x2 inches. The spring horns are of manganese bronze, riveted to the frame. The front axle is a steel forging of I beam section, dropped in the centre, with integral spring seats. The rear axle is of the full floating type of tubular construction, with the change gear case forming a part of it. The change gears, bevel gears and differential are housed in one casting, which is provided with ample openings for inspection and adjustment. It is pinned and brazed to seamless drawn steel tubes, which carry the springs and wheels. The spring seats are split brackets, which are secured to the axle by square dowel pins and clamping. The front and rear wheels are of the artillery type, have twelve spokes each, and are fitted with Marsh separable rims to accommodate 34x3½ inch tires in front and 34x4 inch tires at the rear, and run on annular ball bearings.

The engine is a four cylinder Waukesha of 4¾ inch bore by 5 inch stroke, and is rated at 39 horse power at 1,000 r. p. m. The power is transmitted through a cone clutch, with springs beneath the leather to permit of easy engagement; thence by Cardan shaft to the change speed gear case on the rear axle. The Cardan shaft is fitted with two universal joints and runs in a heavy steel tube, which entirely encloses it, and also acts as a torsion rod. The change speed gears provide three speeds forward and reverse, selectively. Final drive is through large bevel gears to the driving shafts, which are secured to the hubs of the driving wheels by jaw clutches. Chrome-nickel steel is used throughout the transmission, which is fitted with Standard annular ball bearings.



THE CORREJA CAR.

Water cooling by centrifugal pump is used, the pump being driven by shaft from the two to one gears. The pump shaft is extended beyond the pump to permit of coupling up a magneto. A honeycomb radiator is used, with fan just behind it. The cooling system holds about 5 gallons. High tension ignition is used, with dry cells and spark coils. A bed is cast on the crank case, however, to allow for installing a magneto which can be driven by the extension of the jump shaft. A fuel tank of 15 gallons capacity is located under the front seat, and the fuel feeds by gravity to the carburetor. Steering is by wheel through worm and sector gearing. The connections are steel tubing, with ball and socket joints, with the drag link in front of the axle, and with the steering pivots mounted on 1 inch ball bearings. Two sets of brakes, internal expanding and external constricting, are fitted, both operating on the rear wheels and equalized by cross bars connected at their centres to the pull rods. The two drums are separated by an air space to permit of better heat radiation.



BOLTON'S "SNAP ON" BATTERY SWITCH.

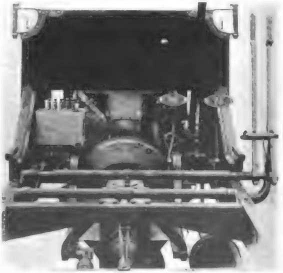
The Bolton "Snap On" Battery Connection.

Geo. W. Bolton, 260 Wreford street, Detroit, Mich., is marketing a new form of connector for dry batteries. It is made so that it pulls over the binding screws of the cells, and not only makes a firm contact with the screw but also prevents the screw from turning. As the connector could only be pushed off by pushing on the wire, which, however, is not sufficiently stiff, and as it cannot be pulled off, it would seem to be a sure method of connecting such cells. Mr. Bolton will shortly begin the manufacture of a similar connection for spark plugs.

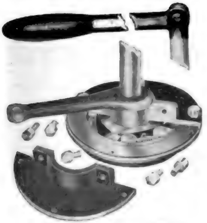
The Hewitt Integral Manifolds.

We show herewith two photographic views of a new integral manifold brought out by the Hewitt Motor Truck Company,

FRONT VIEW OF METEOR CAR.



CENTRAL PORTION OF CHASSIS.



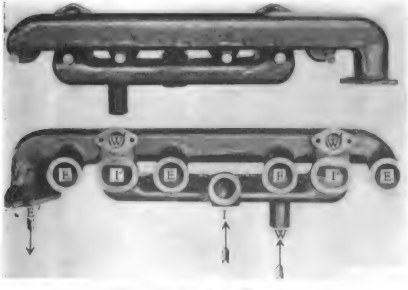
Blood Brothers Steering Gear.

10 East Thirty-seventh street, New York city. View A shows the side which is next to the cylinders and view B is looking toward the manifolds when they are in place on the engine.

These manifolds take care of the exhaust gases, the incoming charge and the incoming water, and the gases and water flow in the manifolds as follows: The gas from the carburetor enters at the point I, passes through the manifold and enters the cylinders through the ports I' and I'. The inlet water enters at W, flows through the manifolds and enters the water jackets at W' and W'. The exhaust gases from the cylinders enter the ports E E and leave the manifolds at E'.

The two important advantages of this new manifold are that it is compact, and that the charge inlet and the water inlet are integral, the warm water thus heating the incoming charge. This design is equivalent to some extent to the arrangement in taxicab motors, where the four cylinders and manifolds are all in one casting. This latter feature cannot be incorporated in large motors for the obvious reason that the castings would be too heavy. This has led the Hewitt Company to design manifolds which possess the features outlined above, in which the incoming charge is heated by the water circulation, thus doing away with entraining globules of imperfectly carbonized gasoline in the mixture. The importanee of this provision has been recognized for a long time by carburetor manufacturers, and a great many of them have adopted the plan of water jacketing the carburetor.

By having the water and inlet manifolds together the extra piping which a water jacketed carburetor necessitates is done away with. Another feature which appeals very strongly to the manufacturer of commercial vehicles is that these manifolds, being of cast iron and held in place by lugs, are very much cheaper than any other form of piping.

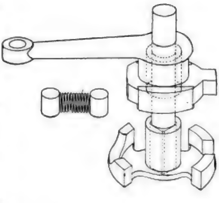


Hewitt One Piece Inlet Manifold.

The Blood Brothers Self Locking Lever Steering Gear.

Blood Brothers Machine Company, Kalamazoo, Mich., have brought out a new steering gear for motor buggies, electric vehicles and light cars generally, as illustrated herewith. The principle embodied is that of the roller ratchet, the lower portion of the gear being locked against movement by the roller mechanism, except when the latter is acted on by the steering tiller.

The working parts consist of two steel castings, a tiller shaft, with lower end squared to operate the lower casting to bunt the rollers out of lock and turn he crank, four hardened tool steel rollers working between the two tool steel cam pieces dovetailed in opposite sides of the crank casting, and the tool steel ring forced into the casing, and two coil springs to push the rollers into the wedge shaped places between the cams and ring. The tool steel parts are all hardened and ground to size.



The case is made of three castings which make an oil tight receptacle. Any of the cap screws that hold the cover on may be used to fasten to a bracket to secure the gear to the chassis frame. The gear is sent out with a short tiller shaft of 1 inch diameter, projecting above the case, to which the regular tiller shaft with lever can be attached.

The New York-Paris Race.

The latest report received in New York regarding the progress of the remaining contestants in this race is to the effect that the Protos car, in charge of Lieutenant Koeppen, reached St. Petersburg, Russia, at 7:45 p. m. on Monday, July 20. The whereabouts of the Thomas car at that time were not definitely known, but it was thought to be at Nishni Novgorod, a little over two days behind. By reaching St. Petersburg first Koeppen won a $1,000 prize offered by the Royal A. C. of Russia. The distance from St. Petersburg to Paris is 2,077 miles, and as from now on an average of 200 miles per day can probably be easily maintained, Koeppen may be expected to reach Paris by August 1. He made the last 300 miles to St. Petersburg in seventeen hours.

All through Siberia and Russia the German Protos and American Thomas car have been very nearly on even terms, both having led the way at different stages of the tour. Shortly after leaving Vladivostok both cars got stuck in the mud. The Protos at once took to the railroad, running on the ties, and thereby gained a considerable lead over the Thomas, which stuck to the roads. The Thomas also was delayed for five days by a break of the steering gear, which enabled the German car to pull first into Chita and capture the $1,000 prize offered by that town to the car which, coming from Vladivostok, reached there first. Having repaired its steering gear the Thomas car began to catch up on its rival, overtaking it near Tomsk, about 3,000 miles from Vladivostok. The Thomas held the lead until the Ural Mountains were passed, when it broke a gear.

The Glidden Tour—II.

By Harry B. Haines.

Philadelphia to Milford, Pa.

With one-half of the distance outlined for the Glidden tour completed, the dust covered caravan of over fifty automobiles carrying their 200 and more passengers rushed into Milford and stopped at the official headquarters, the Bluff House, the first car arriving before 1 o'clock. It had been a day of excellent macadam roads and delightful scenery surprises, and the trip will live long in the memory of the tourists.

The cars had been parked over night in the court yard of the City Hall at Philadelphia, and a large crowd was on hand to see them checked out. The first car was dispatched at 7 o'clock sharp, and the day's running time was 6 hours and 45 minutes. There were not 5 miles of bad road the whole distance, and the water bars, which had proved so racking on the previous days of the run, were missing, for which fact the tourists were duly grateful.

The first 50 miles traversed were over country varying from level to hilly, and the balance of the trip, which led through the scenically beautiful Delaware Water Gap, was over narrow roads intersected with steep hills and numerous sharp, dangerous turns. Despite this every car in the run came through at high speed. The little Moline runabout, No. 102, in the Hower contest, which had cracked a cylinder, did not reach Philadelphia until 10:30 Tuesday evening, and the driver announced that he would have repairs made and catch the tour at Albany.

The people of Easton, Allentown and Bethlehem turned out in force, and the tourists went through these towns between two lines of curious spectators. The reception all along the line was most enthusiastic, and the summer guests from Delaware Water Gap were intensely enthusiastic in their welcome. The occupants of the cars were given bouquets of flowers, as well as eatables and drinkables. There is no doubt but that this was the finest and most enjoyable day of the tour.

There were the usual number of lame ducks strewn along the roads, but none of these were in serious difficulty. No. 98, the Premier pilot car, went down and out a short distance out of Nazareth. The road is being repaired, and the car came along at high speed and dashed into some loose rock that had been piled in the centre of the road. The front axle was broken off short about an inch and a half inside the left spring seating. No one was hurt, and the car was dragged off the road and the front axle jacked up. Repairs will be made, and the machine will rejoin the tour tonight. Chairman Hower, who had lost his road once or twice and also suffered a puncture in one of the tires of his car, came along and took the confetti from the pilot car, continuing on with it to Milford.

No. 11, the Thomas six cylinder, was delayed as a result of a leaky radiator, time being taken to repair the same. There were the usual number of tire troubles, among the cars being laid up from this cause being Nos. 22, 26 and 111. Blowouts are becoming more frequent, and the tires are beginning to show the effects of the hard treatment they have received. It is pleasing to note the fact that despite the large amount of hill work done the cars entered are having no trouble with their brakes. It is evident that the manufacturers have fully awakened to the fact that well made and generous brakes are a necessity.

Just outside the town of Shawnee car No. 1, the Great Arrow, was stopped by a bevy of pretty women, who stood in the centre of the road waving a large American flag. Driver Day slowed up and brought the car to a standstill. The spokesman of the party presented the flag to Teddy Day, with the request that he carry it in the machine, and if it brought him victory, which they sincerely hoped it would, to carry it back to Buffalo with them. Mr. Day promised that he would, and went on his way again.

Cars Nos. 22 and 26 were particularly unfortunate with their tires, each having a puncture and a blowout. Altogether, the day was rather uneventful, but most thoroughly enjoyable.

The only really close escape from accident reported was when Pierce Car No. 1 was grazed by a large red touring car that dashed in from a side road at high speed. A colored man was at the wheel, and was coming at good speed. He saw the Pierce when it was too late to stop. Day swung his car into the gully, and the colored driver whirled his machine to the other side of the road. There was not an inch to spare between the two cars. It was a close call.

Lockwood's Reo, No. 101, in the Hower contest was penalized twelve points on time, being delayed as a result of losing two screws out of its transmission. No. 110, Overland, lost thirty-three points on time. No. 111, Overland, broke the truss rod on its rear axle, but reached the final line on time. All of the Glidden cars came in with perfect scores.

At Milford.

The tourists found Milford a very delightful spot, and spent a very pleasant afternoon and evening there. At 8 o'clock an open air meeting of the contestants was held, and the usual routine work disposed of. The tourists then enjoyed themselves in dancing and boating.

The start for Thursday's run to Albany was set for 7 a. m. as usual, and the trip gave promise of being a rather difficult one. It was figured out at Milford that with 42 per cent. of the entire distance of the tour run, 27 per cent. of the cars entered had suffered penalization.

Word was received at Milford on Wednesday evening that the Blomstrom car, No. 113, known as the Gyroscope, had come to grief about 5 miles out of Nazareth. This machine, which had been in more or less trouble since the run started, broke a steering knuckle it seems, and plunged off the road when going at a speed of about 20 miles per hour. The machine dashed ahead on into a tree and was wrecked. Bert Carey, of Detroit, Mich., the mechanic, jumped and escaped injury. Chris White, of New York city, the driver, stuck to his seat and was not injured. The car was said to be damaged beyond the possibility of immediate repair.

Milford, Pa., to Albany.

All of the 5:30 calls at the Bluff House were exhausted when the last of the tourists hied himself to bed on Wednesday evening, preparatory for early rising and prompt preparation for a 7 o'clock start on

On the Road from the Delaware Water Gap.

Passing Through the Woods—Delaware Water Gap.

the run to Albany, which was 158.5 miles, the longest day's run of the tour to date. The committee had announced that the running time would be 8 hours and 15 minutes, which was a little less than a 20 mile schedule. In the event of rain an hour and fifteen minutes longer was to be allowed. Thursday morning dawned bright and clear, however, as has every morning of the tour to date, and the weather man had evidently decided that he would still continue to be good.

Charles J. Glidden is always working up surprises for the newspaper men, and he called their attention to a bulletin posted on the front piazza of the hotel, which read to the effect that the 1909 tour would be held west of Chicago, and the event of 1910 would be held in Scotland, England and Wales, being over a course from Land's End to John o' Groat's. The entry list was to be limited to 100 cars, and the object of the tour to be definitely stated as a test of the durability of American cars. Mr. Glidden stated that this announcement was unofficial, but he believed that after next year the tour should be held abroad, as was originally intended when the cup was given.

The cars were sent away promptly at 7 o'clock, and made their way over roads that were excellent on the average. Some very high speeds were attained, and many a speedometer touched the mile a minute mark. Dai Lewis, the original pathfinder, had started out early with a paint pot and brush, and feeling rather facetious, he had daubed up signs along the roads at which the tourists had many a hearty laugh. On a tumbledown Italian shanty there was a large sign bearing the legend "Every room with a bath." The scenery was most attractive, and the tourists had some fine views of the Hudson River. The ride was a long one, though, and rather tiresome.

One perfect score was ruined by an accident to No. 9 Premier, which bent its right front steering knuckle as a result of a skid while coming out of Kingston, N. Y. The route suddenly turned off to the right, and Joseph Moore, the driver, swung his car around at a fairly high rate of speed in order to make the turn. The machine skidded and the steering knuckle was bent. An attempt will be made to have it straightened and to continue on the run.

No. 18, the Gabriel horn Oldsmobile, had a bad skid at the same place, taking the turn at about a 30 mile pace. The car skidded, and when it was straightened up it was found that the rear axle had been slightly bent. The axles on various other cars are also beginning to show signs of the strains they have undergone. Car No. 20, one of the Haynes entries, has a sprung rear axle. The Premier Pilot car, which broke its front axle on the run to Milford, secured a new one and put it in, and reached Milford late Thursday night, starting out as usual ahead of this day's run.

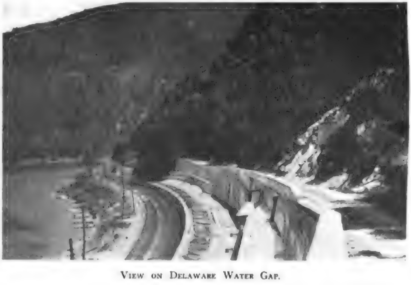
The Oakland entry, No. 28, which bent its axle in the early days of the run, stopped long enough this day at a country blacksmith shop and put on a truss reinforcement. They hope by this precaution to avoid future axle troubles.

The tires on the various cars have been given a terrible gruelling, and the tire men are right at hand asking entrants to change the shoes on their machines rather than wait until they have trouble on the road. The Rapid truck, which is carrying a 25 per cent. overload, and has been averaging 10 miles an hour for the whole trip, is carrying a lot of air pressure tanks. These tanks are furnished by the Firestone Tire and Rubber Company, and are offered free to any of the contestants, irrespective of what make of tires they are using. The contestants find these great time savers, and exchange their old tanks for new ones at each night stop.

Among those seen along the roadside this day with tire troubles were the following: No. 8, Premier; No. 11, Thomas; No. 12, Franklin; No. 15, Rainier; No. 15, Stevens-Duryea; No. 24, Studebaker; No. 26, Studebaker; No. 29, Garford; No. 30, Garford; No. 31, Garford; No. 35, Oldsmobile; No. 111, Overland.

That the tourists are still able to make quick repairs was demonstrated this day when Gus Buse, of Buffalo, decided to take the radiator off his big Thomas and repair it, having been troubled by its leaking for the past two days. The big car was stopped at Port Jervis and the radiator was taken off and soldered. The job was completed and the car ready to start again in forty-five minutes. It reached the night control in good time.

Most of the entrants are trying their best to beat their schedules each day in order to have time at the finish to adjust their cars. The running gears seem to be giving the most trouble, and there is a pleasing lack of ignition troubles. In fact these,



View on Delaware Water Gap.

THE RAPID TRUCK CARRYING FIRESTONE TIRES AND AIR BOTTLES.

instead of being the rule as in the past, are now the exception. Tires, springs, axles and steering gears are the bugaboo now.

The Premier car, No. 9, succeeded in straightening its bent steering knuckle and reached Albany after 10 o'clock Thursday night. The car will be penalized and will continue in the tour.

There was no entertainment provided for the tourists at Albany, and they were glad of it, and most of them turned in early in order to get a good sleep and be ready on the morrow for the longest day's run of the tour, which will be to Boston. The usual evening meeting was held, but only routine matters disposed of. The run from Albany to Boston is 194.2 miles.

Albany to Boston.

Friday was a day of anomalies in the Glidden tour; it was the longest day's run of the tour, but it led over roads that for the greater part were the finest macadam. One of the perfect score clubs dropped from grace when the Studebaker entry No. 25 broke its left rear wheel just outside of Warren, Mass., putting it out of the contest. Some days ago, in the hard runs over the mountains, the Studebaker car fractured three of the spokes in this rear wheel, and this day, while rounding a turn at high speed, the wheel collapsed. Ralph Esty, a newspaper man, representing the Chicago *Inter Ocean*, felt the car going down on one side and jumped. He injured the ligaments in his right ankle and had to be attended by a physician. He left the machine and came on by train. The driver of the car, W. Jones, stuck to his post, and the passengers, R. H. Wurster and Mr. Cox, remained in their seats and were not hurt. The car was gotten over to the side of the road out of the way of the other machines. As no spare wheels were listed among the parts carried by this machine it will, of course, be disqualified, and will continue the run as a non-contestant. It was penalized 1,000 points, which makes the penalization for the Rochester Club No. 2, with which it was affiliated, 333.3 points.

Garford car No. 29, which broke a wheel on the run to Bedford Springs and has since been running as a non-contestant, had a narrow escape from being wrecked just after leaving Worcester. Van Tine was driving at high speed, as usual, and on rounding a turn came suddenly upon a wagon heavily loaded. The driver of the rig could not turn out in time to avoid a crash, and Van Tine threw his steering wheel over to the right to its limit. The big machine leaped from the road and crashed into a fence, demolishing part of it, narrowly missed hitting a tree and finally turned around, tearing off the left front tire. None of the passengers were injured, but all of them were badly frightened. The tire was replaced and the car continued at high speed.

On Friday's run Hurlburt, driving a Garford car, took a turn to a bridge at high speed and struck the side rail, ripping it off. Beyond putting a dent in the body of the car no damage was done.

James McLean, an observer riding in Franklin car No. 114, met with a painful and serious accident at West Springfield. A young girl, standing on the curb, threw a green apple at the car as it came along. The apple struck McLean's goggles, shattering the glass and cutting his right eye severely. The wound was temporarily dressed by the occupants of the car, and at Springfield the injured man was taken to a physician's office, where two stitches were put in the cut. He had a very narrow escape from having the sight in this eye destroyed. This practice of throwing things at the occupants of cars is a most dangerous one, and the committee has asked all the newspaper men to publish notices requesting the spectators along the routes followed by the cars to refrain from throwing anything.

The Haynes car No. 19 broke a rear axle strut rod on the run from Albany, and stopped to make a new one; it succeeded in doing this, and still finishing on time and without penalization. Since Chairman Hower made his decision that any repairs

ENTERING CONTROL AT MILFORD.

"Parked at Milford."

could be made on cars, providing that only raw materials were used and the driver and mechanic did their own work, the rebuilding of machines is becoming more general.

No. 16, the Stevens-Duryea entry, which has been having trouble as a result of a leaky radiator, took the radiator off at Spencer and repaired it. The car finished in good time. The day's run was marked as usual with tire troubles, among the cars so afflicted being No. 4, Reo; No. 23, Marmon; No. 25, Studebaker; No. 29, Garford, and No. 32, Selden.

The day's route was a most picturesque one, the first 100 miles being through the heart of the Berkshire Hills, and including the descent of Jacob's Ladder, one of the famous hills of this section.

The people along the route were rather cold and distant, and the tourists missed the ovation that they have been accustomed to. At Springfield, Mass., the Fisk Tire Company, Knox Automobile Company and the Stevens-Duryea Company united in inviting the tourists to be their guests at a light luncheon. This was served at the gasoline station at Bridge street in Springfield from 11 o'clock until the last car had passed. It was a dainty little spread, and the tourists enjoyed it thoroughly.

The day's run was 194.2 miles, and the schedule time was ten hours, which required an average speed of 19.4 miles per hour. The roads were in good condition, although hilly, and many of the cars averaged 27 miles an hour, and even better for the entire trip. The day had dawned cloudy and threatening rain, but as usual it cleared off later and the weather was perfect. Jupiter Pluvius has indeed been good to the tour this year, and it is a record breaker inasmuch as there has not been a single rainy or unpleasant day. The famous Red Horse Tavern or Wayside Inn, immortalized by Longfellow, was one of the points of interest passed during the day. The tourists had been warned of speed traps at Springfield and Worcester, and all of them drove carefully. No arrests were made.

Upon arrival at Boston the tourists were received by a committee of the Bay State Motor Club and welcomed. They were served with punch and refreshments at the Hotel Somerset, and were advised that the club headquarters would be open to them during their stay in the city. On behalf of the club Mrs. Cuneo, when she drove up, was presented with a handsome bouquet of flowers. Mrs. Charles J. Glidden, wife of the donor of the trophy, was at the Hotel Somerset and welcomed the tourists as they drove up.

The official headquarters having been established at the Hotel Somerset, the usual evening meeting of contestants was held there. Mayor Hibbard, of Boston, addressed the tourists and welcomed them, at the same time extending the hospitality of the city.

On behalf of the Bay State Motor Club, J. F. Hovestadt, chairman of the reception committee, addressed the tourists and outlined a plan for their entertainment, stating that it was the purpose to make their stay in the city of beans so pleasant that everyone of them would be sorry when the time came to leave, and would feel that next to his own home town Boston was the finest city in the world.

The entertainment arrangements are interesting. On Saturday there will be a trip to Nantasket by boat, with a dinner at the Palm Garden at Paragon Park. On Sunday the tourists will be taken on a sail down Boston Harbor in a steamer specially chartered for the occasion. Those wishing to see some of the historic places in and around Boston on Saturday and Sunday mornings will have autos at their disposal. Altogether the Bay State people want to make the two days of rest as enjoyable as possible. The entertainment committee having the affair in charge is composed of the following gentlemen: Lewis R. Speare, C. R. Pierce, J. S. Hathaway, W. K. Farrington, G. W. McNear, Elliot C. Lee, Harlan W. Whipple, Harry W. Knights, J. Fortesque, A. P. Underhill and J. C. Kerrison.

It was announced on Friday evening that Monday's run of 154 miles from Boston to Poland Springs, Me., would have to be made in eight hours if the weather was fair. In the event of rain the running time will be extended to nine hours. The tourists have to date run 1,074.5 out of the total distance of 1,684.7 miles.

Car No. 9, the Premier, which broke its steering knuckle on the run to Albany, was officially declared out of the run, having withdrawn as a contestant on Friday. It will put in a new steering knuckle and continue as a non-contestant.

At Boston.

Saturday morning at Boston there remained only four perfect score teams in the Glidden Trophy contest. These are Buffalo A. C. team No. 1, composed of three Great Arrows; Chicago M. C. team No. 1, composed of two Hayneses and an Oldsmobile; the Bay State A. A. team, composed of three Marmons, and the Columbus A. C. team, composed of three Pearlesses. In the Hower Trophy contest the following are the only remaining perfect score cars: No. 100, Great Arrow; No. 103, Great Arrow; No.

One of the Stevens-Duryeas Crossing Rustic Bridge in Pennsylvania.

Peerless Team.

107, Stoddard-Dayton; No. 104, Premier; No. 112, Stoddard-Dayton. The two Stevens-Duryea cars, driven for Glidden certificates, both have perfect scores.

When the tourists had had a good night's rest and began to sit up and take notice on Saturday morning the nose count found many in the ranks of the missing. Tom Fetch, driving an independent Packard press car, had not put in an appearance. His car was ditched on Thursday while passing the Studebaker press car, and was badly damaged. The accident happened near Saugerties, N. Y. The Packard car blew out a tire while passing the Studebaker machine at high speed and ran into a deep ditch. None of the passengers were injured, but they did not report at Albany, and reached Boston on Saturday morning.

Car No. 25, the Studebaker, officially withdrew as a contestant on Saturday morning, as did No. 9, the Premier car, which suffered a broken steering knuckle. Both cars will go on as non-contestants.

No. 110, one of the Overlands, which broke its frame on the run to Harrisburg, and made temporary repairs, did not reach Boston Friday night, and was not in at 11 o'clock Saturday morning. It is stated that it is to withdraw from the contest.

At Boston an eleventh club team was formed in the Glidden contest, to be known as The Down and Out Team, and it has as its members all of the cars whose perfect scores have been ruined and which are running as non-contestants. The charter member was Van Tine, of the Garford, who broke a rear wheel on the run to Cambridge Springs. This was entry No. 29. Franklin No. 12 joined the club next with a broken spring. The other members to date, all of whose perfect scores have been impaired, are No. 28, Oakland, connecting rod replaced; No. 32, Selden, broken spring; No. 9, Premier, broken steering knuckle; Studebaker, No 25, broken wheel. To this list of Glidden contestants is added an annex from the Hower contestants, including Gearless, No. 105, which hit a telegraph pole; Moline, No. 102, which cracked a cylinder; Reo, No. 101, which had transmission trouble; Overland, No. 108, withdrawn as a result of dispute over rules; Stoddard-Dayton, No. 109, which broke a radius rod bracket; Overland, No. 110, which broke its frame on the run to Harrisburg; Overland, No. 11, with a rear axle truss rod broken, and Gyroscope, No. 113, which had delays and accidents every day, and wound up on the run to Milford by going over a precipice as a result of a broken steering gear and landing down the embankment against a tree.

One pretty episode occurred when Mrs. Walter Marmon, who has been driving with her husband in the Marmon car, was presented at the Hotel Somerset with a handsome bouquet of roses. Mrs. J. S. Hathaway made the presentation, and said that the flowers were a tribute from the Boston autoists to the game little woman who is sitting beside her husband in one of the three Marmon cars, all of which are still high up in the perfect score brigade.

Saturday morning a number of the tourists availed themselves of the courtesies of the Bay State Motor Club, and were taken out in automobiles to see the various points of historic interest in the Hub City. In the afternoon they were taken on a special trolley car to the steamer Myles Standish, which carried them to Nantasket Beach, where they enjoyed the various attractions, including ocean bathing. They were served with a dinner at 5 o'clock, and returned to the hotel late in the evening. The Boston automobilists have been uniformly courteous, and the tourists are well pleased with the treatment they have received. Chairman Hower and Mr. Glidden have deserted the official headquarters, and are spending the two days' rest down at a friend's home a few miles out of the city.

Sunday at Boston.

Sunday at Boston was a day that will long be remembered by the Glidden tourists, and they were all unanimous in the opinion that they had never been more royally entertained. The Bay State A. C. and its members did themselves proud and won the heartfelt thanks of the entire party. Automobiles were placed at the disposal of the tourists, and they were taken out to view the various points of historical interest around this famous city, which is so rich in Revolutionary lore. In the morning a number of the tourists availed themselves of the auto ride opportunity, and in the afternoon the majority of them were guests on the Boston municipal boat, which took them for a sail down the bay for a distance of 12 miles. A luncheon was served on board, and the day's outing proved to be most enjoyable.

At the invitation of E. Ralph Estep, of the Packard Motor Car Company, a number of the newspaper men on the tour, seventeen in all, were taken out for the day in three Packard cars. They were driven nearly 100 miles, viewing all points of historical interest in the vicinity of Boston, Salem, Lexington, Concord, Cambridge and other surrounding cities. They were given a dinner at the famous Fern-

Lunch Served at Springfield by Knox and Stevens-Duryea Companies.

croft Inn at Middletown, Mass., and returned to the hotel at 8 o'clock at night to turn in early and prepare for the run of 154 miles over the mountains to the Summit House at Poland Springs, Me.

The schedule had been announced as eight hours in fair weather and nine hours in the event of rain. There remain but 610.2 miles yet to be run in the Glidden and Hower Trophy contests, and all of the entrants and others interested are keen with excitement. Five o'clock calls were the rule at the official hotel, and everyone was glad that the two days' rest was past, and that they would soon be on the road again. The line up of cars outside the hotel was guarded night and day by a special detachment of four police sent from headquarters. Curious crowds came from miles around to view the machines, and there was no doubt of the fact that the tour has created the keenest interest. To date the tourists have enjoyed the most perfect weather, the rains having come at night instead of in the day time. Sunday was threatening, but the rain held off. The route of the run to Poland Springs takes the tourists up into the mountains. In the last four days of the home stretch they will have some very strenuous work, and will go through three States and the White and Green mountains will be crossed. Some of the most difficult roads on the entire trip will be encountered, and there is no doubt of the fact that some of the perfect scores will be jeopardized.

The question of the item of cost of the tour was discussed at Boston among a number of the entrants, and the general opinion seemed to be that, although the tour was a big expense and would cost some of the entrants a good many thousands of dollars, it was worth all it cost in the way of securing desirable advertising for the cars entered and in bringing the public attention to automobiles in general. They also felt that it gave an excellent opportunity for them to test out their cars and discover their weaknesses. The Packard Company have two of their 1909 machines in the independent class, which they are trying out. One is the independent press car, driven by Tom Fetch, and the other the Red Cross car.

The showing being made by the three Marmon cars, which are practically on their first big run, is occasioning much favorable comment. This is the first time this firm has entered water cooled cars in events of this sort.

Boston to Poland Springs.

A large crowd of Hub City motorists gathered at the Hotel Somerset on Monday morning to see the Glidden contest cars checked out. The confetti cars were sent off at 5 o'clock as usual, and at 6:30 Chairman Hower left. At 7 o'clock Starter Ferguson began to check out the contesting cars. The Moline runabout, entered in the Hower contest, which dropped out of the run at Harrisburg as a result of a cracked cylinder, had made repairs and reached Boston late on Saturday evening. It will continue the run as a non-contestant. No. 110, Overland, had not reported up to the starting time on Monday morning, and is now considered out of the contest.

Monday's run was 154 miles, and the route was interesting and picturesque, the scenery being most attractive. From Boston to Salisbury the road was fine pike, and from there to Portsmouth was of sand and gravel, intersected with the usual water bars. From this point to Portland, and, in fact, to Poland Springs the road was gravel and clay loam.

Morday dawned threatening, but with the usual good luck that has followed the tour the rain held off, and at the starting time there was every indication of a pleasant day. There was more than the usual rush to get away. Every one of the contestants was ready at the stroke of 7 when Starter Ferguson began to send the cars off.

WARNING OF SPEED TRAPS.

The run proved to be a delightful one. The tourists were warned before starting that a speed trap had been put in operation on the road between Newburyport and Portsmouth, and were advised not to exceed a speed of 8 miles an hour. A copy of the following letter received at Boston on Sunday night was given to each of the tourists as he checked out on Monday:

> YORK VILLAGE, Me., July 17, 1908.
>
> *Chairman Hower, Boston:*
>
> MY DEAR SIR—I wish to warn you and the other Glidden tourists of a speed trap now maintained regularly on the route for Monday next, the 20th inst. It is on the road between Newburyport and Portsmouth, about 8 or 9 miles from Newburyport, near a small place called Seabury. The Newburyport end or signal man is in or close to a blacksmith shop; the road is straightaway (nearly) and runs down a very slight grade between thick undergrowth and trees on both sides of the road. The route timed is one-quarter of a mile, and the "squire" is one-quarter of a mile further! They "got" me today, but it cost me only $6.75. I asked him if he was going after the Glidden tourists on Monday, and he replied ominously that they would "be treated like anybody else." I think the trap was only opened up today—looks as though they might be "laying" for you. Very truly yours,
>
> (Signed) JOHN L. EMERSON.

They were all on their guard, and no arrests were made. All along the route the cars were welcomed enthusiastically, and the day's run was one continuous ovation.

One thing was particularly noticeable, and that is the fact that as the contest draws to a close the entrants are becoming more cautious, and are not driving as hard and as recklessly as they did in the early days of the trip. With but three more stages left the drivers are sparing their springs and running gears, and are not trying to beat the schedule by an hour or two as in the past. They are satisfied if they can get in with a half hour's leeway. A number of the entrants are taking the precaution to drive a mile or two out of the starting control and then stop in some convenient spot and go over their cars. Adjustments on the engine are made, and most of the drivers have taken the precaution to adjust and tighten their spring clips, as well as to inspect their steering gears. The perfect score men are particularly careful and are driving so as to carefully guard their records. Unless something unexpected happens the cars that have gone thus far without penalization are likely to go into Saratoga on Thursday afternoon without any black marks against them. It had rained during the night and the dust on the roads had been laid, making the riding very pleasant. One or two slight showers were encountered. It is remarkable to note the fact that this was the first bit of rain encountered since the tourists left Buffalo. The Moline car, which rejoined the tour at Boston, continued on the run and reached the Summit Springs House in good time, as did the Overland, No. 110, which was also late getting to Boston, but is still in the running.

There was one narrow escape from accident when the big Pierce car No. 1, driven by A. J. Keller, nearly ran down a man on a bicycle at North Beverly. The bicyclist came out from a side street on his wheel just as the big car came along. He started to cross the street directly in front of the big machine. He did not see the car until the bystanders shouted to him, and Day called to him through a megaphone. He looked around and when he saw the car within 10 feet of him he became panic stricken, and, throwing up his hands, swerved his wheel and fell to the road with a crash directly in front of the big machine. Keller swerved the car and managed to miss the man, but it was a mighty close call. He was cheered by the crowd on the street, who rushed to the bicyclist's assistance. He was an old man, about sixty, but was not injured, although badly frightened and suffering from shock. He was taken into a nearby house and cared for.

There was only one other incident of the day worthy of mention, and this proved to be about the narrowest escape from serious injury that any of the tourists had experienced to date. M. S. Bates, the well known trans-continental driver, who pilots Franklin No. 14, and has a reputation for being one of the most careful and safest drivers on the run, was speeding along at a 30 mile an hour clip near Ipswich, and was nearing a sharp turn when suddenly a low hung, high powered runabout came speeding along. The driver first swerved to the right and then to the left, and evidently lost his nerve, as the runabout began to skid and headed directly toward the Franklin car. There was not much time to think, for it was all over in less time than it takes to tell it. It seemed as if nothing under the sun could prevent a smash-up, which would have meant serious injury or death to some of the occupants of the cars. The passengers in No. 14 braced themselves and waited for the crash to come. The observer prepared to jump, but was forcibly pushed into his seat by a newspaper man who sat beside him, and this quick act undoubtedly saved him from serious injury. Bates, the cool headed, calm driver that he is, took in the situation at a glance and with a miraculously quick decision threw his steering wheel over and forced the Franklin off the road. He did not have time to diminish the speed much, and his car keeled over until two of its wheels were off the ground, and it seemed that the machine must turn turtle. The big red runabout, driven by the badly frightened youngster, swerved over to the far side of the road and cleared the rear end of the Franklin by less than an inch. The passengers in the Franklin were not yet out of danger, however, for as the machine left the road it jumped over a 3 foot gully and ploughed straight through the long sea grass toward a deep swamp. Driver Bates applied his foot and emergency brakes, and did everything possible to check the car, and succeeded in bring it to a standstill just as the front wheels were hanging over a 10 foot embankment at the bottom of which were the deep stagnant waters of the swamp. Had the car gone 5 feet further it would have plunged down this embankment. All of the people in the car stuck to their seats, however, and assisted in getting the machine back on the road. It was necessary to dig the long sea grass from under the wheels, and the machine was then forced back to the road without outside help and continued the run to Poland Springs without further mishap, finishing an hour ahead of its schedule time. Mr. Bates and his passengers were congratulated by the tourists on the fortunate ending of what might have been a very disastrous accident.

Tire troubles were the bugaboo of the day as usual, and a number of cars were delayed by this cause. Some of the drivers whose tires are beginning to show signs of hard usage have taken the precaution to change them, and so hope to avoid trouble, believing that it is better to take the delay necessary to put on new tires in advance of trouble than to take a chance of tire trouble at an inopportune time. They are taking no chances of jeopardizing their perfect scores. Among the cars that experienced tire troubles and did tire work during the day were the following: No. 1, Pierce; No. 16, Stevens-Duryea; No. 19, Haynes; No. 21, Marmon; No. 22, Marmon; No. 25, Studebaker; No. 30, Garford; No. 31, Garford; No. 103, Pierce; No. 106, Franklin; No. 111, Overland.

With the completion of this day's run the tourists have but three more days to go and 456.2 miles to cover before they reach their goal at Saratoga.

THE SCORES AT POLAND SPRINGS.

No perfect scores were spoiled on the trip to Poland Springs, the four perfect score teams there being Buffalo Team No. 1, Columbus A. C. team, Bay State Club team and the Chicago Motor Club team No. 1. In the Hower Trophy the perfect scores are Nos. 100, Great Arrow; 103, Great Arrow; Premier, 104; Stoddard-Daytons, 107 and 112

At Poland.

At Poland Springs Charles J. Glidden, who is the statistician of the tour, figured out that 72 per cent. of the mileage of the tour had been run, and 63 per cent. of the cars entered for the Glidden Trophy still had perfect scores. Car No. 105, one of the runabouts, stopped at a blacksmith shop on the way to Poland and made repairs to its distance rod. During the time that repairs were being made a farmer nearby handed the mechanic a block of wood to assist in jacking up the car with. The observer reported this, and the driver refused to sign his report. Under the rules no outside assistance may be rendered to any cars, and in a strict interpretation of the rules the fact that this block of wood was handed to the mechanic and used by him would be ground for penalization. The matter was taken up with the committee, and they reserved decision after hearing all the facts.

One very regrettable feature of the conduct of the run by the committee is the fact that the reports of the official observers showing the work done on the various cars are not made public. These would be particularly valuable, both to the trade in general and to the public, but no news of these happenings is given out officially, and all that is printed is what the newspaper men happen to see along the line or glean themselves.

The observers have also been having their troubles when obliged to ride in the rumble seats of the runabouts. These rumble seats are not fit for a man to ride in on a long tour, and were originally intended only for town use, and it is doubtful if observers can be secured for another tour who will put up with the discomfort and danger of occupying them.

HOTEL ARRANGEMENTS GOOD.

The hotel arrangements for this year's tour were worked out to perfection, and great credit is due to Mr. Herr, the gentleman who had charge of this part of the work, for the excellent accommodations and service that the tourists received. The most advantageous rates had been arranged for all along the route, and there were no kicks to be heard as to overcharging.

FAKE PUBLICITY MATTER.

The publicity men on the tour this year have been "on the job" good and strong, but after the first day or so their stuff was absolutely unreliable, and they sought to make good advertising matter out of every mishap to a car. For instance, if a machine was damaged in any way as a result of being ditched or running off the road, or as the result of reckless driving, the word would be passed that it had been purposely run into the ditch in order to save some farmer's life or prevent some accident to a spectator along the road. One or two of these stories got through, but then they began to come too fast.

During the entire trip, however, the arrangements for the dissemination of news to the press representatives were most meagre and unsatisfactory. In this end of the work there was no system, and the old idea of suppressing everything in the way of news of real happenings to the cars was followed out. In a tour of this sort it should be incumbent upon the committee to issue an official bulletin to the press every night, giving a concise and accurate summary of the observers' report cards, showing exactly what work was done on the machines each day and what parts used or replaced. The idea of the run is to give the public a chance to see how automobiles stand up under strenuous touring conditions, but as usual the short sighted policy of trying to fool the public is followed. Every entrant wants the impression to go abroad that his car has gone through without mishap or adjustment. The ordinary man who is buying an automobile doesn't expect to get a car that will never need attention, and he would be interested to actually know what happens to a machine on a tour of this character.

(Continued on page 121.)

ENTERING BOSTON.

Why the Average Two Cycle Engine Does Not Give More Power.

By F. E. Watts.

Many people are unable to see why the average two cycle engine does not give twice as much power as a four cycle engine having the same bore and stroke. It can be run just as fast, and since it takes in and explodes a charge twice as often, it would seem from a casual examination of the problem that it should produce twice as much power. The fact is that many two cycle engines of the present day will not give any more power than a four cycle of the same size, and that even the best of the common two and three port types seldom give more than one and a half times as much.

There are three reasons why more power is not developed: First, power is lost in compressing the charge in the crank case; second, the inlet opening is insufficient to obtain a full charge at high speeds; third, the mixture is of poor quality.

The first of these causes of loss has been treated in these columns before. Some such loss is unavoidable with any form of two cycle engine, and it may vary from 2 to 15 per cent. of the indicated horse power according to the pressure used, size and freedom of passages, and timing of the ports.

Most two cycle engines do not have nearly large enough carburetors. With a three port engine most of the gas must be taken in while the piston is nearing the top of its stroke; that is, while the crank is moving through about 50 degrees, a period less than one-quarter as long as the time the inlet valve on a four cycle engine is usually open. During the latter part of the port opening the flow is usually rather slow. Although the gas flows under a much higher pressure and more rapidly than in the four cycle, the short time allowed makes a much larger passage necessary. The carburetor area should usually be twice as great as on a four cycle of the same bore and stroke. Where a disc valve is used, remaining open for 180 degrees, the difference is not so marked.

The third reason for lack of power is the most important one. Poor mixture is responsible for most of the troubles in two cycle engines. A poor mixture may be due to one or both of the following two causes: Either the carburetor may function improperly, or the cylinder may not be cleared of burnt gases in the short time available. The effects of these causes may be plainly seen by referring to an article by Mr. Clough on page 507 of Vol. 20. The indicator cards there shown are typical of a good many two cycle engines. The compression pressure is 80 pounds and the explosion pressure is only 180 pounds, giving a ratio of 1:2¾. This is far lower then is usually obtained under working conditions in the average four cycle engine. For instance, a four cycle engine with valves in the head and a compression of 60 pounds gave by manograms, taken in the same manner as that for the two cycle, an explosion pressure ranging from 220 to 200 pounds, with an average of about 234 pounds. This 234 pound maximum gave a M. E. P. of 64 pounds per square inch, while while the two cycle card in question gave a diagram pressure of 44 pounds per square inch.

From this, 6.8 pounds crank case pressure must be subtracted to get the M. E. P., which is thus 37.2 pounds. But the mean effective pressure in the working cylinder (44 pounds) is what should be considered, since no improvement in the mixture would change the crank case back pressure.

The ratio of 60 to 234 is about as 1:3.9, so it will be seen that poor mixture and the presence of poor gases may reduce the ratio as much as 42 per cent. Of course, it is well understood that a manogram gives only approximate results, since it does not take into account the angularity of the connecting rod, but such diagrams are at least roughly comparable among themselves.

The writer believes that the elimination of burnt gases from the cylinder before compression is the chief problem with which the two cycle designer must contend.

All engines are, of course, partially scavenged, but the average two cycle is worse off in this respect that any other type. The four cycle with valves in the head is quite free from burnt gases, as indicated by its explosion ratio of from 1:3.65 to 1:4.35. In one engine with valves on one side the explosion ratio runs from 1:2.8 to 1:3, being generally less at the higher speeds. We consider that part at least of this reduction in pressure is due to the retention of more burnt gas than in the former case.

Of course, the cards from only three engines do not offer a wide enough range for study to prove a case, but a significant illustration of the effect of getting rid of the burnt gases was furnished during the experiments with the engine with valves in the head. It is quite generally known that the six cycle engine is fully scavenged, and is a machine of high fluid efficiency. The engine just referred to "six cycled" a number of times, owing to missed ignitions. So the ensuing explosion after each miss took place when the cylinder was completely filled with fresh mixture. The average of such explosions reached the value of 275 pounds, which gave a pressure ratio of 1:4.6. The corresponding M. E. P. was 81 pounds. Once the explosion reached the value of 315 pounds, which gives a ratio of 1:5.25.

In view of this experimental data, I think that we may be justified in assuming that when a two cycle engine is successfully scavenged the result will be such an increase both in the maximum and the mean effective pressure that the necessarily greater pump or crank case loss will be far more than made up for; and we shall have a machine that will closely approach the four cycle engine in power delivered per cubic inch of mixture taken in. In other words, our engine will equal or exceed the best four cycle of the present type in fuel efficiency, and will give nearly twice as much power for a given bore and stroke.

Carburetor "Tickling" Devices.

Originally the carburetor was primed directly by the finger, and this method is still in use in the majority of cases. But as lifting the bonnet became irksome various means were devised to operate the float from either the frame or dashboard without the necessity of touching the bonnet in any way. These devices may be divided into two classes, the mechanical and the pneumatic, according to the method of operation.

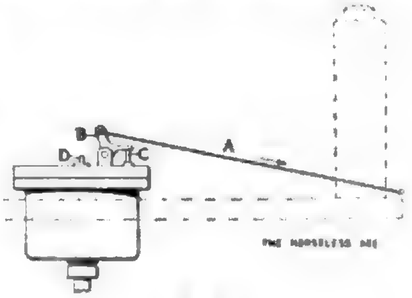


Fig. 1.

The mechanically operated devices may be subdivided into (a) the rod and wire and (b) the flexible mechanism classes. Examples of the first class are shown in Figs. 1 and 2. A (Fig. 1) is a wire or rod of small gauge projecting through the radiator at some point, terminating in a ball or handle. At its other extremity it is attached to the bell crank B on the carburetor. A pin C projects from the carburetor body, its lower extremity touching the float within the float chamber. If now the carburetor is to be "tickled" the wire A is pulled in the direction of the arrow, the bell crank is operated, depressing C and allowing the fuel to enter the float chamber. D is the projecting end of the needle valve.

Fig. 2 shows the bell crank B reversed so as to operate by a push on the rod A. This rod terminates in a button outside the radiator. The carburetor is "tickled" by pushing in the direction of the arrow, the action being the same as in Fig. 1.

The chief representative of the flexible mechanism class is the Bowden wire

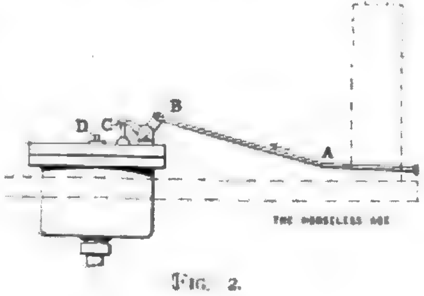


Fig. 2.

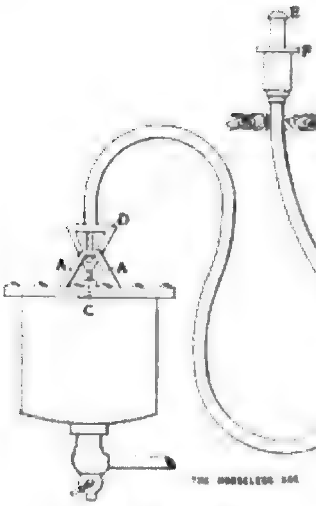


FIG. 3.

"tickler" shown in Fig. 3. Here the push is communicated directly to the needle valve, which opens downward. The Bowden wire mechanism consists of two members, one working within the other, the movement of either member being due to the reaction of the one upon the other. In this case the inner member has a button E at one end and is fastened to a tripod A upon the top of the float chamber at the other. The outer member is fastened to the nipple F at its operating end and to a yoke D attached to the priming pin C (in this case the needle valve stem). The mechanism is seen projecting through a hole in the frame convenient to the driver when in position for cranking. Taking hold of F with the fingers and pressing upon E with the thumb, the outer member gives a push to C through the yoke D, and thus tickles the carburetor. The Bowden mechanism is particularly adapted to such service, as it is capable of transmitting its power in any direction or a number of directions, and need be supported at one or two points only.

The pneumatic devices either actuate the priming pin by means of an induced current of air due to the movement of a piston or diaphragm, or the squeezing of a bulb, or by a jet of air being forced into the float chamber, and thus lowering the float directly. An example of the device using a piston is shown in Fig. 4. Here the cylinder is fitted with a piston A having a ball valve C within the piston head, the valve opening only on the outstroke as in an air pump. A cylinder K is screwed into the cover of the float chamber. This cylinder has likewise a piston P fitted to a long rod R. A length of tubing connects the two cylinders. When piston A is pushed inward by means of the knob, the air within the cylinder back of the piston is forced through the tube, and entering K forces P toward the bottom of the cylinder, when the priming pin R lowers float F and opens the needle valve. A light spring E withdraws R into the cylinder when the pressure is released, and A is forced to its outstroke. Fig. 5 shows an atomizer bulb used in place of the cylinder. The action would be similar with a diaphragm in place of piston P, the priming pin R being attached thereto. Where the jet of air is used for actuating the float a simple copper or brass nipple is screwed into the float chamber cover and the tubing is connected, when by squeezing the bulb or pushing the knob the jet of air entering the chamber forces down the float and thus accomplishes its purpose. The jet of air method is by no means as certain as that illustrated in Fig. 4, a number of impulses being usually necessary, whereas the pump need be operated but once.

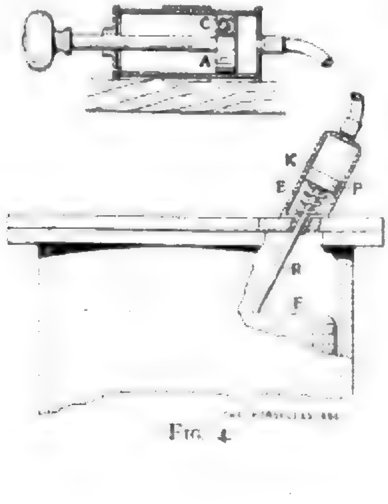


FIG. 4.

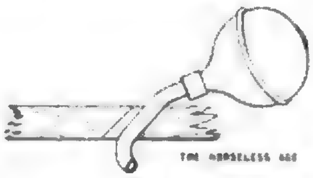


FIG. 5.

Brush Runabouts on Long Demonstration Runs.

The Brush Runabout Company will shortly undertake an ambitious demonstration of the practical qualities of their small car. With this end in view they will start four runabouts and one delivery car from Detroit on long runs across country. The trips of the runabouts will end at Minneapolis, Washington, Kansas City and Boston respectively, while the delivery car will take a load of goods from a Detroit merchant to a Chicago house and bring another load to Detroit on its return trip. Observers will be carried, and complete records will be kept of gasoline and oil consumption, repairs, adjustments, etc. The itineraries include twenty of the most important cities of the country and some 400 smaller towns, and the little cars will encounter some very steep hills and heavy roads. It will prove a most interesting and instructive demonstration of the touring capacity of these small cars.

Maintenance and Repairs

An Improvised Press.

In putting a patch upon a damaged inner tube it is frequently necessary to keep the patch and tube under pressure until the sticking solution has set. There are devices for this purpose upon the market, somewhat on the order of a copying letter press, but these are bulky, and as this operation is not often performed anywhere except in the garage they are usually left behind when most needed. The writer has carried an oak block, about 3x6x2, with one surface "dead smooth" for this purpose. When the patching was completed the tube was laid on the block with the patch uppermost, and a cardboard or other comparatively stiff substance placed over the patch. The ordinary jack supplied with the car was then mounted on top of the whole, and a strong piece of braided cord was passed around the block and tied over the lifter head. Pressure was then put on the patching by operating the jack lever, any desired pressure up to the strength of the cord being available. This arrangement can, of course, be put to various other uses around motor cars, as well as to the above.

Symptoms of a Broken Secondary Wire.

While running a single cylinder runabout for a season I had a very peculiar case of ignition trouble which, although easily corrected when found, caused a lot of annoyance while it lasted. When on the road the engine would miss six or seven explosions at a time. At first it looked like weak batteries, but after putting in a new set the trouble continued. Then we noticed that it occurred only when the car was in motion, and was worse where the road was rough, and this led to the conclusion that it must be a loose or broken connection somewhere in the wiring circuit. We finally located the break in the secondary lead just outside the coil box. As the insulation of this wire is very heavy it held the two ends together under normal conditions, but when running the vibration separated them. We cut off the broken end and made a new connection, after which everything was all right. The break was undoubtedly caused by the wire extending from the bottom of the coil box to the footboard, a distance of 8 inches, receiving accidental kicks from the passengers' feet.

A volunteer motorcycle corps of fifty men has been formed in Denmark, with Lieutenant Von Wedell in command. Every rider is equipped with an Ellehammer motorcycle and a Madsen automatic rifle, a revolver and a spade, as well as the necessary rounds of ammunition for both arms. The corps is to be accompanied by four motor trucks carrying reserve supplies.

COMMUNICATIONS

Springs.

Editor Horseless Age:

In your issue of May 20 you had a communication on "Spring Design" by E. Favary, answering my reply to his article. I intended answering this sooner, but lack of time prevented me.

I still maintain the ground I took in the first place, that Mr. Favary's article is very good as a treatise on spring manufacture of the old school, but it is not up to date in any one particular. It is like a treatise on the breeding of horses. Such a treatise might be the best that could be written, but it would not interest us of this age, since something better has come out.

Regarding what he says about lengthening and widening the spring, I said a number of companies had gone beyond the limit in this respect. It is a well known fact that the widening and lengthening of the spring on automobiles has proved a good thing, to a certain limit and no further. According to Mr. Favary, to get the spring suspension right, all the manufacturers have to do is to keep lengthening and widening the spring. This they have been doing for the past eight years.

One company in particular have been doing this on their semi-elliptic, and for their 1909 cars have abandoned it entirely; this shows that it is impossible to make a car ride right with the old style semi-elliptic spring. Another company, as I stated before, went to a 60 inch spring, but abandoned it after the first year for a spring 6 inches shorter.

Another company who have been using on their 1908 cars a spring 58 inches long have abandoned it for a spring 54 inches long for their 1909 cars.

One of the best mechanical engineers in the business today said to me that any company makes a mistake in making a spring more than 52 inches long, and certain costly experiments have proved this to be a fact.

Regarding what he says about patent springs, if people were not willing to adopt new things for old ones we would be still using the old ox wagon instead of the automobile, which is a bundle of patents from one end to the other.

The spring of the future, I firmly believe, will be the spring which will do its work in the shortest given space—a long, wide spring, with a limit of about 52 inches.

Mr. Favary still maintains it is the rebound which breaks many of the springs. This idea belongs to the last century, and has been riddled with proof so conclusive that this idea has been buried beyond the hope of resurrection, and I am surprised at Mr. Favary digging up the corpse again.

The rebound straps or check plates certainly stop the rebound, and in crossing street car tracks where the first bump will probably not break the spring, but the rebound from the first bump is intensified by the second, bending the spring to a breaking point; this latter can certainly be checked by the straps, thus preventing the second severe downward thrust.

S. Furmidge.

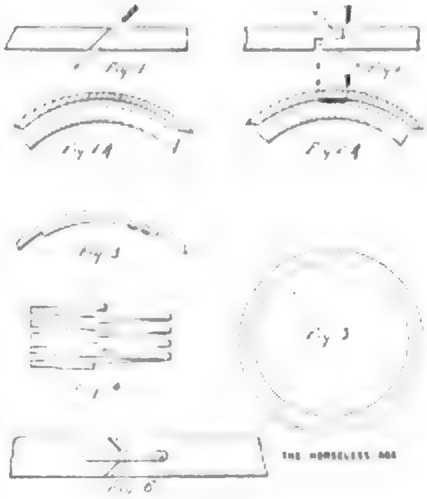
Piston Rings.

Editor Horseless Age:

Referring to an article titled "Two Piston Rings," by Mechanicus, on page 38 of your July 8 issue, I beg leave to call to your and your subscriber's attention the thoughtless conclusion which he has arrived at.

Firstly—Mechanicus argues that if the slot shown in Fig. 1 (of enclosed blue print corresponding to Fig. 1 in his article) does not make a tight joint when compressed in the cylinder compression would be lost, resulting in a corresponding loss of explosive force.

This is probably true in slow speed engines when the joint is very poor, but in high speed engines, such as automobile engines where four or more piston rings are used and the two ends of the rings come within a few thousandths of making a perfect joint (the usual case), it is impossible for any appreciable amount of gas to blow by the piston at the high speed at which it travels, although compression may be lost by the piston when the engine is standing idle.



Piston Rings.

Secondly—Since the rings and cylinders are both usually made of cast iron and their temperatures are approximately the same, if the rings are perfectly jointed when the cylinder and rings are cold, there will be no binding of the rings in the cylinder, and the joint will remain almost perfect under working conditions.

Thirdly—The arrows in Figs. 1 and 2 will show why the joint in Fig. 2, which is preferred by Mechanicus because of its being tighter than the joint in Fig. 1, is not tighter. The joint shown in Fig. 2 has a disadvantage which will far outweigh any advantage gained in tightness that may be claimed for it, and that is, that the ends X and X break frequently.

Take the pistons from almost any engine using rings jointed, as in Fig. 2, and generally one or two rings of each piston will have one or both ends X and X broken. The ends shown in Fig. 1 very seldom break.

If it is really desired to make a perfectly tight piston the joint in Fig. 2 may be used with an inside ring, as shown in Fig. 5, or with a plate riveted to one end, as shown in Fig. 3. Fig. 6 shows another joint which will make a tight piston ring. Fig. 4 is a spiral ring, sometimes used on steam pistons, which is said to be tight.

In conclusion, I have found that for automobile engines rings similar to Fig. 1 will be found as satisfactory as any, and that where compression is lost it is usually due to improper seating of the valves rather than poor piston rings. Generally speaking, engines with valves properly ground to the seats will hold their compression for a number of hours, regardless of the type of piston ring used, provided the workmanship is passing fair.

Robert E. Newcomb, M. E.

Gear Muffling Lubricant.

Editor Horseless Age:

The gear case lubricant referred to by Greenwood Brothers & Co. consists of cedar sawdust, such as jewelers use, and also called jewelers' sawdust, mixed with cylinder oil in the proportion of one sack of sawdust to a quart of oil. The sack of sawdust is about 3x8 inches in size and costs about 15 cents, is usually kept by all jewelers who do a repairing business. The gear case is filled about one-third full of this mixture. It is improved by about a tablespoonful of graphite to the quart of oil.

R. E. Hinman.

Responsibility of Car Owners for Accidental Injury to Others.

Editor Horseless Age:

Kindly give me the numbers of The Horseless Age which contain references and opinions bearing on the liability in case of a collision with an automobile as a result of the steering gear breaking, causing injury to a person traveling in the same direction. The steering gear had recently been inspected, and any flaw that may have existed was of such a nature as to escape detection.

K.

[There is no legal liability for a mere accident. This is the established and well settled rule of law. In order to create legal liability some person must have been at fault and failed to exercise reasonable care. In this case it would seem that there is no liability on the part of the person operating or owning the car which caused the injury by reason of the break in the steering gear, especially considering the fact that the steering gear was inspected just prior to the accident. All was done that could reasonably be expected; consequently there was no negligence, except possibly on the part of the manufacturer of the car in case a defective steering gear was carelessly used in the construction of the automobile. This would be a difficult matter to prove unless it is evident from an inspection of the broken part. The liability of manufacturers of automobiles under express and implied warranties may be found discussed in THE HORSELESS AGE of February 28, 1906.—ED.]

New Method of Using Graphite.

Editor HORSELESS AGE:

I have noticed from time to time comments on the use of graphite in the cylinders of automobile engines. These I have read with much interest, as I am a firm believer in the use of graphite in gas engine cylinders, but have never seen any account of its being used as I use it. I drive a four cylinder car, and about once a month clean all the old oil out of the crank case and fill it with fresh oil, and then take about two teaspoons of flake graphite and divide it into four parts and blow it, with a copper tube, into the cylinder when the piston is at the end of its stroke, so that the graphite remains on the wall of the cylinder. I have been making a practice of this for two years, and have yet to have the first dirty spark plug from the effects of the graphite. In fact I have driven over 3,000 miles this year and have not cleaned a spark plug. I think if some of your readers would use the graphite in this manner, and with some judgment, they would derive great benefit. H. W. ROBBINS.

Muffler Query.

Editor HORSELESS AGE:

I am driving a two cylinder car, dimensions 5½x5½, and have been using a plain shell muffler, which has proven unsatisfactory. I have experimented with two others with similar results. What dimensions and what arrangements should a muffler have to silence the exhaust of an engine of this size? While I know you will never recommend any particular make, yet I would like to have you put me in the way of learning how to graduate muffler size to engine size. JAMES H. WROTH.

[The necessary size of muffler depends upon the construction. One form of construction that we have found quite satisfactory is the concentric shell type, where the exhaust is directed into the outer annular space and escapes from the central chamber. You might make the muffler 8 inches in diameter by 20 inches long, using four concentric tubes of 8, 6, 4 and 2 inches diameter. This would make the outer chamber equal to 440 cubic inches or three and one-half times the volume of one cylinder, so that the gas would have plenty chance to expand before encountering any resistance. It would also have plenty chance to contract from cooling owing to the large surface of the outer shell, which must be made of heavy sheet iron and not covered by anything. Communication between the different chambers is effected by means of very fine holes drilled through the shells on one side, of an aggregate area of about 3 square inches, opposite sides of succeeding shells being perforated so the gas must pass entirely through each chamber. The last chamber, which is a gas pipe 2 inches in diameter, can project from the heads at both ends. It is advisable to introduce the gas into the outer chamber at an angle so as to pass it quickly over the whole cooling surface.

Another arrangement which has given very satisfactory results is to divide the muffler into two halves longitudinally by a partition wall cast on to a tube extending entirely through the muffler and beyond the head at each end, but which is also provided with a partition wall at the middle of its length. The gas enters the tube at one end, passes through perforations in the wall of the tube into one chamber, through a large number of small tubes forced into the partition wall into the outer chamber, through perforations into the other end of the tube and out. The ejector principle has also been found very satisfactory in muffler design.—ED.]

Autogenous Welding.

Editor HORSELESS AGE:

In the editorial which appeared in your issue of July 8, under the heading of "The Application of Autogenous Welding," you make several statements which might tend to hold back the natural development of the automobile industry.

You state that "a number of prominent companies are already experimenting" with the oxy-acetylene blowpipe. I would like to broaden that remark by saying that these prominent companies are making extensive use of the process in actual manufacture, but that the system has such tremendous possibilities that they are continually experimenting on new uses for it.

I would like to know what you consider the "practical difficulties in its use which must first be overcome" other than that of the dearth of "operatives skilled enough to secure reliable results on difficult jobs," as I have personally been unable to discover any, and with regard to this it does not assume such a serious aspect when it is known that the Davis-Bournonville Company instruct men free of charge to operate every plant they supply, and have no difficulty in training mechanics of ordinary intelligence to carry out the work satisfactorily in two weeks' time, and if the work is of a uniform nature less time is required and unskilled labor can be used.

With regard to the strength of the welds I have had tensile tests made which have proved that as far as machinery steel is concerned, at least 95 per cent. of the full strength of the material can be depended upon.

With regard to the effect of repeated stresses most welds come in such a position that this is immaterial, and in most cases a fillet is added or the metal is thickened up so that the weld is by far the strongest part.

When one considers the old methods of attaching parts, which this process is superseding, the strength of the welded joint is away ahead. Consider the case cited of welding frame gussets, the section of the weld would be considerably greater than the section of the rivets substituted.

The correct mixture of the gas for complete combustion has something to do with the strength of the weld, but in the high pressure apparatus supplied by the Davis-Bournonville Company this is automatically taken care of, so it need not be considered.

As this apparatus is being used extensively in France, and the above company's representatives spent considerable time in that country studying the subject, and, as stated above, will instruct operators, it seems hardly necessary to warn manufacturers "to be careful not to become too enthusiastic."

The use the apparatus can be put to is being demonstrated every day both for manufacture and repair, in taking care of breakages, blowholes, cracks, errors, wear, etc., in all metals, including cast iron and aluminum, on parts that otherwise would be scrapped.

It is appalling to think of the millions of dollars' worth of parts that have and are being scrapped which could be saved at slight cost by this process.

It seems to me that it would be more consistent with your policy of encouraging the development of the automobile to advise manufacturers to look into the possibilities of the apparatus, so as to place them on a par with France in this respect.

HENRY CAVE, A. M. I. M. E.

Overheating of One Cylinder.

Editor HORSELESS AGE:

I have a runabout with double opposed water cooled motor, with thermo-siphon circulation. One cylinder soots up, misses fire and has little power; after cleaning the cylinder as well as I can with kerosene and a scraper, the engine will run fairly well for an hour or two (except that the faulty cylinder is still weak), then will heat up, the water in the cooler will boil, and the engine will not stop when the switch is turned off. The engine cranks easily when the pet cocks are opened. The carbon deposit is usually dry; the compression is fairly good, decidedly better in the weak cylinder than in the one that does not smut up. There is the same weakness in the faulty cylinder when clean as when fouled with carbon deposit.

I think I have demonstrated that the cause for the trouble does not lie in the compression, batteries, coil or connections, timer, carburetor, oil (either quality or quantity used), spark plugs, leaking of air around any of the joints or water circulation.

I have had a number of so called experts examine the car. The cause of the trouble still remains a mystery.

Any suggestions either from you or any of the readers of THE HORSELESS AGE who have perhaps had a similar experience and found the remedy will be thankfully received.

H. G. DAVIS.

[We should think that the weakness of one cylinder was due to want of circulation through the jacket of that cylinder. Look over the pipe connections carefully and clean out the cooling system by the method described in our answer to another inquirer this week. The sooting may be due to the fact that this cylinder may receive more oil than the other one, as often happens in double opposed motors with splash lubrication.

Perhaps some of our readers have further suggestions to make.—ED.]

Short Valve Stems.

Editor HORSELESS AGE:

If the gentleman from Tucson, Ariz., who has had so much trouble with long valve stems on his inner tubes will simply have his old style rims removed by the Goodyear Tire and Rubber Company and have them put on their detachable style rims I will guarantee him that he will not have occasion to say "Sunday school words" about his long valves again. I had the same trouble until I made this change, and I would not under any circumstances be without detachable rims on my car. Hope my solution will solve his problem for him.

W. McD. MCALLISTER.

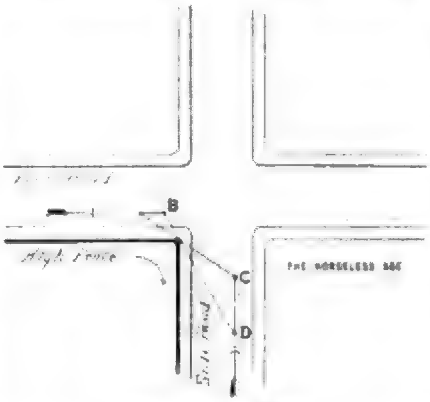
The Blind Turn.

A "blind turn" is an intersection of two roads where traffic upon one of the roads is invisible on the other until the intersection or crossing is reached. The objects obstructing the view may be trees or bushes, buildings or high fences. Over 60 per cent. of collisions between motorcars and other vehicles occur at blind turns, usually with disastrous results.

In the accompanying diagram, if two cars approach the intersection in the directions indicated by the arrows, one on the side road and the other on the main, and both move at the same speed, it is evident that they will catch sight of one another somewhere between the points D and C on the one hand and A and B on the other. The advantage of view in this case rests with the man on the side road, as he has more distance to travel before reaching the intersection, and can best decide what to do. The man on the main road catches sight of the other car only when he is quite near the intersection, and unless he is on the alert, is quite likely to be the collider. If the cars should be proceeding the one on the main road, as in the present case, and the one on the side road in the opposite direction, the conditions would be reversed, the man on the main road having the advantage of view. The particular "blind turn," represented by this figure, has been the scene of three collisions during the past spring, none being attended with fatalities, but all due to either neglect of the rules of the road or carelessness on the part of one or both drivers. The high fence not only prevents the drivers catching sight of each other but also prevents the sound of the horn being heard distinctly.

There is a still more dangerous turn on one of the suburban thoroughfares near New York city. Here the side road enters the main road and does not cross it. The main road has quite a grade at this point, and the view of the main road is shut off by buildings in both directions, not only at the intersection but for some distance back. Many spills occurred here in cycling days, but no automobile collisions have yet occurred here, the side road being little used by motorists.

Collisions under conditions similar to those represented by the diagram are due either to neglect of the rules of the road or to carelessness on the part of the driver. There are two safe methods of procedure when a "blind turn" is encountered. The car is, of course, supposed to be on the proper side of the road. The first of these methods is the best. It consists in slowing down at the points A and D for example, and proceeding slowly toward the intersection, looking in both directions to make sure that the way is clear, and then taking the crossing or turn into the other road at an accelerated pace. The second method requires greater command and knowledge of the car, and consists in coming smartly up close to the crossing, say, at the points B and C, unclutching and then, after having ascertained that the road is clear, taking the crossing or turn at the best pace possible. The speed at which the vehicle approaches the crossing should be such that it can be stopped by the brakes in time to prevent a collision. The horn should be sounded in all cases before reaching the "turn." Only under exceptional circumstances should the crossing be taken leisurely. Although the intersecting road may be only occasionally used by traffic, vehicles are apt to emerge from this road unexpectedly, and unless the car is clear of the crossing a collision is likely to occur.



THE BLIND TURN.

The above methods have been found the best by considerable driving experience, but they do not necessarily apply in every case. In case a collision is inevitable observation of the above rules will reduce the force of the blow, whereas if one vehicle traveled at a slower pace the collision might prove disastrous. A turn from one road into the other could only result in a rear end bump from a car traveling in the same direction, but with caution even this should not occur.

It would be desirable to have all turns, at least on main roads, indicated by some sign. This has been done by various European automobile clubs, but practically nothing has yet been done here.

Manufacturers' Associations Elect New Members.

The Chalmers-Detroit Company, of Detroit, Mich., has been elected to membership in the Association of Licensed Automobile Manufacturers. The new license granted is an independent one, and is the first issued by the licensed association in two years.

The American Motor Car Manufacturers' Association has elected to membership the Holsman Automobile Company, Chicago; W. H. Kiblinger Company, Auburn, Ind., and the Midland Motor Car Company, Moline, Ill. The first two firms are manufacturers of motor buggies, while the latter is continuing the factory formerly operated by the Deere-Clark Automobile Company.

Foreign Trade Opportunities.

The Bureau of Manufactures has received the following inquiries for American automobiles from United States consuls in foreign countries: A report has been received from an American consul in Norway stating that a business man in his district desires an agency for American automobiles, and wishes to communicate with manufacturers with that object in view. The consul adds that the interest in automobiles generally has been growing in that region, and the prospects for sales may now be said to be excellent.—Refer to No. 2,424.

A large Australian firm of coach builders advises the Bureau of Manufactures that it would be pleased to have catalogues and prices for New York delivery from manufacturers of complete chasses for motor buggies.—Refer to No. 2,427.

Chauffeurs Win Prizes.

The first three of a series of prizes offered by the Winton Motor Carriage Company to chauffeurs driving Winton automobiles with the least expenditure for repairs were awarded to Frank Snyder (first prize), A. J. Donovan (second), and James Donnolly (third). All three are members of the Professional Chauffeurs' Club of America, a fact which the club officials believe to be a strong recommendation of their members as competent drivers.

The Market Situation in New York City During the First Half of 1908.

The automobile market is apt to be an index of the money market, increasing in activity when money is easy, and vice versa. This was evidenced by the slackness of business in New York city during the first five months of the present year. There was also a change in the class of cars sold. At the beginning of the year numbers of customers had to be written off the lists of car dealers and agents, orders were cancelled and the market was overstocked both with new cars and with second hand ones. Conditions were especially unfavorable in the big car market, both imported and domestic. The purchaser considered not only the high first cost of these vehicles, but also the heavy maintenance charges, wages of chauffeur, etc., all of which factors count against such cars. This slackness of trade necessitated a reduction of expenses on the part of many sales agencies and a cutting of sales and garage forces followed. In addition, many of the agencies found it necessary to offer customers special inducements in the way of discounts, or extras, while a few closed up entirely. The majority weathered the storm. This depression in the market for high powered cars lasted well into the summer, and the number of this type of machines sold was much less than during the corresponding periods one and two years previously.

Another effect of the financial stringency was to throw a large number of cars of all types and grades on the second hand market. This was a benefit to the large and growing class of economical purchasers of cars, who want a serviceable machine at the lowest possible price. The smaller and medium sized cars sacrificed by the original owners mostly found ready purchasers, but high powered second hand cars were a drug on the market. The expedient of offering cars taken in exchange by Eastern dealers for sale in the West was tried and found successful. As summer approached there was a noticeable increase in the number of sales of half a dozen or so different makes of cars of 20 horse power or less and selling at a moderate price. One of the agencies for such cars which had been doing a modest business for a year back, was hard pressed for deliveries for several weeks, and has been able to catch up with deliveries only quite recently. The other agencies referred to did about the same business as in former years, and even a little more, selling strictly at catalogue prices.

Importers suffered more, comparatively, from the financial depression than dealers in machines of domestic construction. Sales of foreign cars fell off very abruptly in 1907, and the result was that prices were cut. This, however, did not check the decline in sales, and during the early part of 1908 only one agency in New York city sold any considerable number of cars. There was one failure among foreign agencies recently, and three other agencies have been combined into a single firm. Several attempts have been made during the last few months to establish new agencies here for foreign cars, but without success. At no time have cars been imported for any but the wealthy classes, and it seems that after the financial panic of last fall even this class of purchasers looked more closely to their dollars. Another condition which tends to restrict the market for foreign cars in this country is that rapid progress is being made by our own manufacturers, and that cars to suit even the most fastidious are now made here.

About the only branch of the automobile business which has shown considerable activity during this period is the taxicab business. A number of manufacturers took up this type of car, and numerous operating companies were incorporated; but outside of New York city few motor cabs have been seen on the streets so far. In New York about 500 cabs are now in operation, of which, however, scarcely 100 are of American construction. One reason why no more American cabs are used here is undoubtedly that some of the makers who wished to enter the field were unable to obtain the financial backing necessary for the quick production of a large number of cabs. Shortly after the taxicab boom set in a dozen firms, more or less, entered the field to import or manufacture taximeters, but, probably owing to difficulty in securing sufficient capital, quite a number have already disappeared from the scene, and at present there remain only one German, two American and two French companies still transacting business in New York.

Little need be said regarding the motor buggy situation; this type of vehicle is not built for New York city and has never sold here to any extent. Motorcycles sold well, a considerable increase in business over last year having been shown. There can be no question that motorcycling is growing in popular favor, and the observation regarding an increased sale of motorcycles is also in line with the general trend toward smaller and cheaper vehicles. There has been no increase in the number of American makers represented in New York city during this period, and all the established agencies had a good season. Only a few foreign motorcycles were represented, and these also sold freely; in fact, as fast as they could be obtained from abroad.

The market for motor trucks and delivery wagons was indifferent, and several local firms retired from business, the cause assigned being either that the factory had failed to make deliveries promptly or that the manufacture of the car represented had ceased. During the early part of the year several companies were organized to rent delivery wagons and trucks to business houses, and these have in most cases extended their scale of operations. Some users of commercial vehicles disposed of them during the "black" period and returned to horse power—whether permanently or not remains to be seen.

Business in accessories probably suffered most from the financial depression. Prices were generally cut and concessions were made to jobbers and even to individual owners. Tires were sold at great reductions and considerable business was done in retreaded tires and tires of defunct firms. Two dealers in European accessories failed, as well as a number of small supply houses, some of which, however, were reorganized. The majority of the accessories dealers, although suffering considerable losses, managed to stay in business and to profit by the turn of the tide. It is reported that the sales of speedometers, sirens and similar attachments fell off 50 per cent. during a period of two months, and there has been no appreciable improvement recently. Firms handling high priced foreign accessories were obliged to cut prices ruinously, in order to compete with similar domestic products.

Summing up, the whole of the industry suffered more or less from the financial depression, but the recent improvement noted in the general business situation holds out the promise that the automobile business will soon attain its normal proportions again, though it will probably be found, after the situation is cleared up, that the demands of the buying public have undergone considerable changes. In cars the medium powered, medium priced machines for either two or four persons will be the most popular types, and as regards accessories, only those which are necessary, or which serve a really useful purpose, will find an extensive sale.

Good Roads Conventions to Be Held Annually.

At the Good Roads Legislative Convention held under the auspices of the A. A. A. at Buffalo on July 7 and 8, with the co-operation of the National Grange and the American Road Makers' Association, resolutions were passed to hold a similar convention each year. To this end a committee was appointed to take charge of the convention of 1909, consisting of Robert P. Hooper, Philadelphia; ex-Governor Nahum J. Batchelder, Concord, N. H.; James H. McDonald, Hartford, Conn.; Charles Thaddeus Terry, New York; S. D. Waldon, Detroit, Mich.; Frank B. Hower, Buffalo, N. Y.; Alfred Reeves, New York; Wm. H. Hotchkiss, Buffalo, N. Y., and Frederick H. Elliot, New York.

The president of the A. A. A. was authorized to appoint an executive committee of twenty-one members, including the nine above mentioned members of the committee for the national convention of 1909, the duty of which committee shall be to see to it that the resolutions adopted at the convention of 1908 are carried out.

The French Army authorities have addressed to the Chambre Syndicale de l'Automobile an offer to rent eighty motor trucks for transporting provisions during the coming manœuvres

Commercial Applications.

Furniture Moving by Motor Truck.

A resident of the New York suburbs recently wished to move some of his household effects from South Orange, N. J., to Islip, L. I., a distance of 64.8 miles. In addition to trunks and furniture, there were to be moved a pony and a pony cart. By ordinary means it would have required two or three days to accomplish this move. A Packard truck now being used in demonstration by the Packard Motor Car Company, of New York, was put into service, picked up, and hauled and delivered the 4,500 pound load in one day. Below is the record of the trip:

Record of Trip of Packard Three Ton Truck From South Orange, N. J., to Islip, L. I., June 24, 1908.

Places.	Arrived.	Left.	Minutes Stopped.	Minutes Running.	Miles.
Mr. L.'s House, South Orange, N. J.	....	9:19	..	..	....
Railroad station, to pick up trunk	9:23	9:26	3	4	.5
On Road Newark, Jersey City	10:18	10:28	10	52	9.9
Jersey City Ferry	11:10	12:10	60	42	16.1
Springfield, L. I.	1:38	2:55	77	88	31.2
Babylon Park	5:05	5:21	16	130	54.
Islip (stables)	6:16	6:26	10	55	64.2
Mr. L.'s cottage	6:30	....	..	4	64.8

Miles driven, 64.8.
Elapsed time, 9 hours 11 minutes.
Six stops—for ferries, to pick up trunk, luncheon and gasoline, 2 hours 56 minutes.
Net running time, 6 hours 15 minutes.
Average rate per hour, 10.3 miles.
Load, 4,500 pounds.

The truck left the store of the Packard Motor Car Company, of New York, at Broadway and Sixty-first street, at 5:40 a. m. It crossed the Hudson on the Twenty-third street ferry and drove to South Orange through Newark, via the turnpike. The residence in South Orange from which the goods were to be moved was reached at 8:05, a running distance, by the odometer, of 19 miles from the Packard store. The truck was loaded with eleven trunks, three large dry goods cases, several pieces of furniture, a pony car, "Ben Hur"—a pony in a crate—a bale of hay, several go-carts and boxes of toys, a collection of kitchen implements and the proverbial suburban cat. The total load was 4,500 pounds.

At 9:19 the truck started on its return trip through Jersey City, via ferry to Brooklyn, and thence to Jamaica, Babylon and Islip. The summer cottage which was the destination was reached after 6:30 p. m. The truck attracted a great deal of attention along the entire route, especially owing to the oddity of the pony part of its load.

After depositing its load at Islip the truck started back for New York, but owing to the fact that the roads had been recently oiled and were black, and that the truck was not equipped with headlights, it was difficult driving after dark, so the party stopped at Freeport for the night, starting again at 8:30 in the morning and reaching the garage at Sixty-first street and Broadway at about half-past 11.

The summary of the whole trip shows that the total 132.5 miles on the road were done in twelve hours and twenty-four minutes running time, or an average of 10.7 miles per hour. The gasoline consumption was 6.6 miles to the gallon, 20 gallons of gasoline having been consumed, and 1⅝ gallons of lubricating oil.

New Police Patrol for Syracuse.

The H. H. Franklin Manufacturing Company have recently delivered a police patrol to the Syracuse police department. The patrol is built along the line of the modern police wagon and weighs only 2,000 pounds. The motor is of the air cooled type, 3¼x4 inches, rated at 16 horse power, and the car has a maximum speed of 18 miles per hour. The drive is by worm gear, the wheels are fitted with solid rubber tires and auxiliary springs are used to eliminate the vibration and shock which are natural with the use of solid tires. The body has a seating capacity of twelve and carries a load of 2,000 pounds. The entire construction is well protected and enclosed with wire grillework and removable storm curtains. The seats are of the folding type, arranged with a view to simplicity and ease in cleaning. Small electric lights are placed to give suitable illumination. The driver's seat, which is protected by an adjustable glass front and transom window top, is built on the extreme forward part of the car, forming a covering to the motor.

Commercial Notes.

Charles E. Worthy, agent for the J. R. Watkins Medicine Company, Manitowoc, Wis., has purchased an automobile provided with a medicine chest instead of the tonneau, in which to cover his territory.

The Frederick and Jefferson Turnpike Company, whose road between Frederick and Jefferson is claimed to be one of the best kept highways in Maryland, has decided to double its toll charges for automobiles. Hereafter the charge for two seated automobiles between Frederick and Jefferson, 8 miles, will be 32 cents.

A company recently formed to operate an automobile between Richmond, Ind., and the Reid Memorial Hospital has been unfortunate in the selection of a car for the purpose, as it finds that the machine will not climb the hills on the route. An attempt will be made to sell the car (which was intended more particularly for city work), and if the company succeed in this they will purchase another one which will not balk at the inclines.

Pope Dividend Affirmed.

Judge Curtis, of the Connecticut Superior Court on July 21 decided in favor of an order for transferring $380,000 of the funds of the Pope Manufacturing Company to the New Jersey jurisdiction for the payment of a 25 per cent. dividend, and $65,000 more, to protect the Unzicker claim, if the Vice Chancellor of New Jersey so desires. The receivers for Connecticut have on hand $628,921.27, and the total amount on deposit for the company in Connecticut amounts to $1,376,000. There is said to be some talk of a reorganization at Hartford.

Transporting a Big Case on Two Small Franklin Trucks.

LEGISLATIVE and LEGAL

What the Matter Is With the Rhode Island Law.

By Xenophon P. Huddy, LL.B.

Rhode Island automobilists are testing the validity of the Motor Vehicle Act passed by their General Assembly in January, 1908. As a revenue producer this law probably surpasses the New Jersey act. The validity of the Rhode Island law is at least questionable, and the Supreme Court of Rhode Island may declare the registration fees to be excessive, and in the nature of revenue rather than a reasonable sum to cover the expense of issuing a license under the police power.

To begin with it is stated in the Rhode Island law that "registration" has reference to the vehicle. In Section 8 it is provided that $25 must be paid for a vehicle of more than 40 horse power. This is certainly an exorbitant fee merely for registering a car, especially when it is considered that Section 6 of the law provides that upon the transfer of ownership the registration shall transpire, and in consequence, if an automobile is sold a number of times during the year, $25 will have to be paid every time the (40 horse power or more) vehicle is sold. Therefore the automobile must be registered every time it is sold, and each time the owner must pay the graduated tax. Whoever heard of property being subjected to as many payments of taxes during any one year as there may happen to be owners of the property? It practically amounts to a transfer tax.

That the registration fees under the Rhode Island law are taxes and revenue exactions cannot be denied. The simple rule of law is that where the fee is a reasonable sum for paying the expenses of issuing a license and maintaining the department in all its activities, then the fee is a license fee imposed under the police powers, but in this case $5, $10, $15 and $25 are demanded for registering machines of various horse powers. These fees are annual, and may be multiplied according to the sale of cars.

All money collected for registering automobiles, license fees and fines is to be turned over to the State Treasurer, to be used for the repair and maintenance of State roads. This provision of the law, which is found in Section 10, is alone sufficient to stamp the registration fees as revenue taxes. Nothing more would be necessary to present before any court. There are decisions which support this contention, and it is a well settled law that only reasonable fees may be charged for issuing licenses. Every charge in excess of the reasonable cost constitutes revenue. If the State seeks to derive revenue from the taxation of automobiles it must impose a tax according to constitutional standards and requirements.

There are other vitiating defects in the Rhode Island law, especially the lack of a provision in the act which specifically stamps and designates violations of the requirements concerning registration as misdemeanors or crimes. If you do not register your automobile, do you commit a crime? You are subjected to certain penalties, but it is questionable whether you may be said to have committed a criminal offense. If the omission does not constitute a crime, there is no cause for prosecution. Very true, the act speaks of certain penalties and imprisonment, and it says that if a person is convicted of violations of Section 11, 12 or 13 in a district court notice must be transmitted to the Board of Public Roads. But these sections do not have to do with registration. Section 18 provides that for violating any other provision of this act there may be a fine of $100 imposed or imprisonment for not more than thirty days, or both. This would naturally lead one to suppose that criminal proceedings are contemplated by the law, and the fact that bail may be given under Section 20 also sustains this theory, but from a reading of the whole act there is nothing which designates a failure to register a machine as a crime, and there is, therefore, no specific power given to the police to arrest a motorist who has neglected to register.

Legal Notes.

The police of Kalamazoo, Mich., recently timed a number of automobiles in the residence district of that city, and found that ten out of twelve cars passing exceeded the speed limit of 15 m. p. h.

A French court has just decided that the ordinary automobile accident policy does not cover risks incurred in driving automobiles at high speed. The widow of a man killed while testing an automobile at high speed claimed compensation under the accident policy, but the court held that the risk was similar to that incurred in racing, and dismissed her claim.

The city council of Rock Island, Ill., proposes to pass a wheel tax measure as recently adopted in Chicago. Automobile owners in the city have held a meeting at one of the local garages to protest against the proposed ordinance. One of the points raised is that motorists of the neighboring cities of Moline and Davenport, Ia., who use the streets of Rock Island almost as much as the local owners, will not be required to pay therefor.

Robson O. Bell, head of the automobile registration department of the office of the Secretary of State of California, proposes to raise the fee for registering motor cars from $2 to $5, the registration to be good throughout the life of the car. The moneys obtained from the registration of cars are to be turned over to the counties in which the cars are registered, and to be expended in the improvement of roads. The drivers' license fee is also to be raised from $2 to $5.

A suit of considerable interest to automobile agents has just been brought by a Cleveland dealer, who represents the Thomas-Detroit product in that locality for 1908, who is seeking to have the newly appointed agent of the company in that district, Charles B. Shanks, restrained by injunction from soliciting orders for Chalmers-Detroit cars. Evidently the point at issue is as to the duration of the contract with the original agent, which is alleged to cover the sales rights in that territory for the 1908 models of the company. Owing to the general precession of the season this year many companies will close contracts for the next season's output considerably less than twelve months from the time their last agency contracts were signed, so the points raised in this suit will no doubt come up in numerous cases.

Rubber Culture in Southern Italy.

As a result of long experiments made in Sicily, the Italian Ministry of Agriculture has been advised that rubber trees can be successfully cultivated in that part of Italy. The rubber secured from the experimental trees has been carefully tested by a Milan manufacturer and has proved to be of good quality. The official report declares that conditions of soil and temperature are equal in Sicily to those in the best rubber raising countries. It is estimated that ten years of preliminary cultivation is necessary there to bring trees to profitable productiveness, and as it is impossible for the country to tide over such a period the assistance of the Government has been asked and is being considered. As the proposition has reached the Ministry it is said to contemplate the free Government distribution of young trees and money awards for successful cultivators.

Horse Vehicle Speeds Officially Determined.

At the instance of the German Ministry of the Interior and of Public Works some tests were made at Charlottenburg on June 24, with the object of determining the traveling speeds of a number of different horse vehicles in a definite and undisputable manner. The Prussian police regulations provide that the speed of automobiles within built up districts must not exceed "a brisk trotting pace, about 15 km. per hour," and it has often been held that the speed of the horse is estimated far too low. Many high officials attended the trials, which were carried out over a course of 500 metres. The trials gave the following results:

	Aver. Speed. (M. P. H.)	Max. Speed. (M. P. H.)
One horse taxicab..........	12.8	13.7
Fire truck fully occupied..	14	15.3
Fire chief's runabout......	15.6	19
Private carriage...........	17.7	18.1

MINOR MENTION

The Lincoln Motor Vehicle Company, Lincoln, Ill., is reported to have changed hands.

The Smith Automobile Company, Topeka, Kan., has let the contract for a wood shop, 45x115 feet, to cost about $7,000.

The Michelin Tire Company, Milltown, N. J., wish to engage an advertising and publicity man to work under their sales manager.

The Aurora Motor Company, Aurora, Ill., are said to be negotiating for the purchase of the bleachery plant in Illinois avenue, that city.

The motion to have the receivership of the Berkshire Motor Car Company, Pittsfield, Mass., set aside has been overruled by Judge Bishop.

The Automobile Supply Company have opened a supply store at 1,320 Vine street, Philadelphia, under the management of W. C. Chambers and F. C. Winkle.

The Spare Wheel Company of Cleveland has opened an office at 1032 Euclid avenue, Cleveland, Ohio, to handle the Stepney spare wheel in that city.

The Owen Thomas Motor Car Company, Janesville, Wis., is negotiating with the Chicago and Northwestern Railroad Company for the lease of their abandoned machine shop.

A fire which destroyed the business portion of Greenwich, Conn., on July 17, started in the basement of a garage, a frame building back of the Greenwich avenue livery stable, at 11 a. m.

A company is being organized at Little Rock, Ark., to manufacture an automobile tire invented by F. N. Gibb. It is said to consist of two ordinary solid rubber tires supported on coiled springs.

The Cook Motor Vehicle Comapny, St. Louis, Mo., are bringing out a two cylinder runabout, with double cylinder air cooled motor, arranged transversely in front, friction change gear and chain drive.

C. M. Wyckoff and Carl Anderson have formed a partnership and secured the Cadillac agency for northwestern Iowa, northeastern Nebraska and a large part of South Dakota. They will locate in Sioux City, Ia.

It is reported that the Norton Grinding Company, Worcester, Mass., whose automobile crank shaft grinding department has been closed down for some time, will now resume its operation, owing to the receipt of scattering orders from automobile builders in various parts of the country.

The assessment of the Franklin Auto Company, 1450 Michigan avenue, Chicago, has been lowered from $61,506 to $25,000. The company gave the original cost of their merchandise for their valuation, and when they found that the assessment was placed at this figure they protested and were successful in having the assessment reduced to $25,000.

The Philadelphia Automobile Trade Association has secured permanent headquarters in Suite 216 Odd Fellows' Temple.

Ralph M. Burdick, Eau Claire, Wis., has disposed of his interests in the American Motor Company and formed the Burdick Motor Car Company, with the object of manufacturing a six cylinder car of 5½ inch bore and stroke each.

Foreclosure proceedings have been instituted against the Wabash Auto and Electric Company, Terre Haute, Ind., under a lien on the property for $1,498.60, which the company owed George W. Young for material furnished for the building occupied by the company.

There are now ninety-three physicians in Indianapolis using automobiles exclusively in their practice, about twenty having purchased runabouts or touring cars this season. The number of cars used by physicians, however, is more than 100, as several have two or more cars.

The Ford Motor Company state that they have manufactured eight different models to date, and they still continue to carry a complete line of spare parts for each of these models. It costs a good deal of money to maintain such a stock of repair parts, but it pays in the end.

It is stated that the Maxwell-Briscoe Motor Company will increase the output of cars at their Newcastle, Ind., plant to 6,000 next season, and additions to the factory are being made to take care of the proposed increase in production. About 2,000 men will be given employment next season, it is understood.

We are informed that the copartnership between L. J. Elliott and J. O. King, doing business as the King Leather Tire Company, in Racine, Wis., has been dissolved. Mr. King will continue the manufacture of the King leather tire in Milwaukee. Mr. Elliott and C. G. Beebe will bring out a new tire to be called the Ke-pa-go-in.

The California Automobile Dealers' Association will hold an endurance run to Del Monte, 131 miles, on Saturday, July 25. The rules will not be so stringent as to deprive the motorists of pleasure. On reaching Del Monte the cars having perfect scores will make 5 miles round the track, the speed required varying according to their horse power.

A speedometer company (Jones) has made an offer to the city officials at Indianapolis to post all of the roads leading to that city with signs stating the automobile speed limit. Mayor Charles A. Bookwalter has furnished the company with the desired information relative to the roads diverging from the city, and the signs will likely be posted at an early date.

The Secretary of State of Ohio reports that during the first month the present law has been in operation there have been issued 5,030 owners' licenses, 77 manufacturers' and dealers' licenses, 566 drivers' licenses and 251 certified copies. The total fee collections were $26,432. After deducting expenses $8,617 were turned into the State treasury for the Good Roads fund.

W. E. Rieman, of Chicago, and a number of associates have purchased the complete business of the Hillsdale Automobile Company, Hillsdale, Mich. It is stated that they will manufacture a car practically the same as that designed by John W. Raymond, of the Hillsdale Automobile Company, and that sufficient capital has already been subscribed to carry on the business.

The machinists of the Smith Automobile Company, Topeka, Kan., have been on strike for some time, the cause of the strike being said to be the dismissal of a machinist for refusal to instruct a helper in skilled work. State Labor Commissioner W. L. A. Johnson, of Kansas, is now endeavoring to open the way for a settlement of the difficulties between the company and the machinists.

The recent negotiations for the purchase of the Pope-Toledo plant by a Southern capitalist, who is said to have made an offer of $400,000, have fallen through. The receivers believe that after business conditions have improved the plant will sell at a much higher sum. It is stated that more men are being worked at the plant at present than at any time since the receivers were appointed.

Salesmen and agents of the Dayton Motor Car Company will meet in Dayton, Ohio, during the last week of July. The prime object of the meeting is, of course, to instruct the agents regarding next year's models and selling methods, but in addition to the business sessions a number of entertainments have been provided for, including a banquet at the Dayton Club and an outing to Wise's Camp.

Cities and towns in northern Indiana are taking up a crusade for better roads in the country surrounding them, and officials are forming organizations to facilitate the work. The Government is threatening to discontinue a number of rural routes in that part of the State, because of the bad road conditions. The South Bend Business Men's Association is among the organizations pushing the good roads movement.

The National Association of Automobile Manufacturers, at its meeting held in New York city on Wednesray last week, indorsed the action of the A. A. A. in deciding not to change the Vanderbilt Cup rules, which decision was reached at a joint meeting of A. A. A. officials and several representatives of the industry at Buffalo the day before. The N. A. A. M. disapproved of the double transcontinental race, recently proposed by a New York newspaper, which had not been sanctioned by the A. A. A.

It is understood that none of the manufacturers of gasoline cars in Indianapolis contemplate the manufacture of commercial vehicles next season. It is generally understood that present lines are to be continued with very few changes. The Nordyke & Marmon Company will place a medium priced water cooled runabout on the market. Other companies may make some changes in the designs of bodies, but it is generally understood there will be no radical changes in mechanical equipment.

The Lowell (Mass.) A. C., which is planning to hold a road race on Labor Day, has petitioned the selectmen of Tyngsboro for a hearing regarding their application for permission to include the roads of Tyngsboro in the course.

The E. R. Thomas Motor Company, Buffalo, announce a 1909 shaft driven, six cylinder model, at $3,000. It will weigh only 2,000 pounds, have a moderate wheel base, and be equipped with both magneto and spark generator ignition.

The three days' 500 mile Rocky Mountain endurance contest, held the first week of July, was won by a Rambler roadster, driven by C. W. Hurlbert. There were originally sixteen starters, but only eight of these were left in the contest at the start of the third day's run. The start and finish of each stage was at Denver.

The Rapid Motor Vehicle Company, Pontiac, Mich., have let the contract for a new factory building, 60x300 feet, and two stories high. It will be built of concrete on the Kahn system, entirely fireproof, and is expected to be ready for occupancy by November 1. This will practically double the capacity of the Rapid plant.

The Wambold-Brunchweiler Company, Appleton, Wis., brass founders and supply agents, have decided to move their plant to Milwaukee, and a foundry, office and finishing shop will be erected at Thirtieth and Lisbon avenue at once. There will be 12,000 square feet of floor space, most of which will be devoted to the manufacture of automobile lamps, shield frames and automobile specialties in brass.

The Cleveland Auto Cab Company has been organized, with an office at 318 Garfield Building, Cleveland. The following officers were elected at a meeting held last week: T. W. Alden, president and general manager; L. E. Ewing, vice president and treasurer; W. C. Lytle, secretary; A. C. Meyers, superintendent. The company will locate in the factory of the Old Geneva Automobile Company, Geneva, Ohio.

Club Notes.

The Kansas City A. C. at a meeting held on July 9 elected W. W. Cowen president, E. H. Jones and W. G. Coumbe vice presidents, W. P. M. Stevens secretary, and Frank A. G. Dean treasurer.

The Litchfield County A. C. was formed at a meeting held in Agard Hall, Torrington, Conn., last week. The club will become a member of the Connecticut State A. A. The following officers were elected: N. D. Holbrook, president; John N. Brooks, vice president; W. P. Norton, Jr., secretary, and George E. Cole, treasurer.

The organization of the Rhode Island Motor League was completed at a meeting held at the Alfredian Hall, Providence, on July 13. The following officers were elected: George H. Huddy, Jr., president; J. Ellis White, first vice president; Stanley G. Smith, second vice president; William W. Scott, secretary; George C. Arnold, treasurer. A resolution was adopted to the effect that the league will endeavor to secure as members all automobile owners in the State, but will not antagonize any existing automobile organization in the State.

The Omaha (Neb.) A. C. has been incorporated with W. R. McKeen as president; Frank Colpetzer, first vice president; F. S. Parmalee, second vice president; Gould Dietz, treasurer, and E. L. McShane, secretary.

The New Jersey Automobile and Motor Club, of Newark, has issued a statement controverting a report that appeared in various newspapers, that the club was about to secede from the Associated Automobile Clubs of New Jersey. The trustees of the club state that they are in hearty accord with the proposed suit to test the constitutionality of the New Jersey law, and that the club will bear its proportionate share of the expense for this suit.

Garage Notes.

Bronson & Kaley have opened a garage and repair shop in McPherson, Kan.

Harvey Smith has opened a garage and repair shop at 20 East Second street, Fond du Lac, Wis.

Williamson & Finley, of Sioux Falls, have opened an automobile establishment in Mitchell, S. Dak., in a brick building back of the Mitchell Hotel.

Dave Rea and Chesbro Smith, of Fargo, N. Dak., have formed a partnership and opened a garage in the old Deering Building on N. P. avenue.

The Buick-Losey Automobile Co., Indianapolis, Ind., has moved its salesroom and repair shop from Massachusetts avenue to 130-132 E. New York street, the premises formerly occupied by the Capital Automobile Co.

The Indiana Automobile Co., Indianapolis, is making an addition to its garage and salesroom that will give the company 2,000 square feet more floor space. This will make their total floor space 17,000 square feet, and will also give an entrance on Massachusetts avenue.

A fire in the garage of the Johnson Service Co., Jefferson and Jackson streets, Milwaukee, Wis., caused a loss of $21,000. Six cars, including one of the leased United States mail cars, were destroyed. The fire was caused by a pilot light left burning on the mail car.

New Incorporations.

Motor Supply Co., Lowell, Mass.—Capital, $10,000. The officers are: President, J. Fred Walsh; treasurer, H. K. Noyes.

Gyroscope Automobile Co., New York.—Capital, $5,000. Directors, A. L. Kull, Douglas Hamilton and Charles P. Fleming.

City Motor Service, New York.—Capital, $50,000. Directors, George A. Melbourne, H. C. Fuller and M. A. Doyle.

Sommer Motor Co., Chicago, Ill.—Capital, $25,000. Incorporators, Willis N. Baker, L. A. Semmer and Harold F. White.

Keating Garage and Engine Co., Oswego, N. Y.—Capital, $10,000. Directors, Patrick R. Keating, Jr., James Dunlap, Jr., and Albert C. Coon.

National Taxameter Co., Jersey City, N. J.—Capital, $30,000. Incorporators, Ernest P. Bennett, Frank E. Ellison and Albert White.

Sollday Motor Car Co., Milwaukee, Wis., has filed an amendment to its articles of incorporation increasing the number of directors from three to seven.

Chalmers-Detroit Motor Co., Philadelphia, Pa.—Capital, $25,000. Incorporators, F. R. Hansell, W. F. Eidell and J. A. MacPeak. To manufacture automobiles.

Hitchcock Motor Co., Warren, Ohio.—Capital, $20,000. Incorporators, J. A. Hitchcock, W. H. Creahen, H. E. Craig, L. M. Burton and S. E. Wavowaker.

Western Auto Sales Co., Chicago, Ill.—Capital, $2,500. Incorporators, John B. Guile, Howard T. Heath and Morris Brown. To manufacture and deal in automobiles and supplies.

Cleveland Auto Cab Company, Cleveland, Ohio.—Capital, $150,000. Incorporators, A. C. Miller, J. C. Brooks, A. L. Welch, M. C. Mulhall and George A. Howells.

Miller Auto Manufacturing Co., Grand Rapids, Mich.—Capital, $2,000. Incorporators, Joseph Reniban, William A. Bates, William F. Stadel, Charles E. Hessey, A. J. Miller, Harry W. Bissell and Michael Colleton.

The Foxhall-Wilson Co., Passaic, N. J.—Capital, $5,000. Incorporators, Thomas Foxhall, Clarence A. Wilson and George H. Dalrymple. To manufacture and sell surgical instruments, bicycle, automobile and hardware supplies.

Trade Personals.

J. W. De Lamater, who has long been identified with the importation and sale of Hotchkiss cars, has succeeded A. M. Archer as manager of the Hotchkiss Import Company, New York city.

A. J. Demarest, president of the carriage and automobile body firm of A. J. Demarest & Co., 335 Fifth avenue, New York city, died of ptomaine poisoning at Greenwich, Conn., on July 13, aged sixty-seven years.

H. E. Butcher, formerly of H. E. Butcher & Co., manufacturers' agents, with offices in the Stevens Building, Detroit, has joined the Timken Roller Bearing Axle Co., Canton, Ohio, as traveling representative. His headquarters will be at Detroit, Mich.

Charles L. Stevens, formerly manager of the Hartford Suspension Company, has been appointed Eastern sales manager for the Midland Motor Car Company, of Moline, Ill., and is now located at the New York headquarters of the Midland Company, the Allenhurst Garage. Before accepting the position with the Midland Company Mr. Stevens was connected with the Mathewson Auto Company, of Denver, Col.

Trade Literature Received.

The Corbin-Church Co., New Britain, Conn.—Circular of automatic power feed drills.

Peerless Motor Car Company, Cleveland, Ohio.—Advance catalogue of 1909 Peerless models.

Joseph Dixon Crucible Co., Jersey City, N. J.—"Questions and Answers on Automobile Lubrication."

The Firestone Tire and Rubber Co., Akron, Ohio.—Book of applications of Firestone side wire tires.

The Hess-Bright Manufacturing Co., Philadelphia.—Catalogue and circulars of Hess-Bright ball bearings.

The Premier Motor Car Co., Indianapolis, Ind.—"Quality," pertaining to various achievements on the road of Premier cars.

S. F. Edge (1907) Ltd., 14 New Burlington Street, London, W.—Instruction book for Napier cars (price of book, 2s. 6d.)

American Manganese Bronze Co., 99 John Street, New York.—Catalogue of Spare's manganese bronze, white bronze and hydraulic bronze.

Hoyt Electrical Instrument Works, Penacook, N. H.—"The Hoyt Voltmeters and Ammeters for Direct Current"; "The Hoyt Voltammeter for Ignition Testing"; bulletin on automobile supplies handled by the company.

New Agencies.

New York City.—Carl H. Page Co., Chalmers-Detroit.

Cleveland, Ohio.—W. H. Barger, 1839 Euclid avenue, Cadillac.

Glidden Tour—II.

(Continued from page 110.)

IN CASE OF A TIE.

In answer to questions asked, Chairman Hower announced that in the event of two or more clubs securing a tie score the run-off would be held by sending the cars from Saratoga to Buffalo. If this should be necessary arrangements will be made to have the course marked with confetti the same as is done for the original run.

VIOLATING ADVERTISING RULE.

A number of complaints had been received by the committee previous to reaching Boston to the effect that several of the non-contestant cars were violating the rules of the run, inasmuch as they were carrying advertising signs. The committee had decreed that no car should carry any mark other than the maker's usual name plates and the official number, and no record whatsoever of any previous performance. A number of the independent cars had reported at the start at Buffalo with all sorts of records outlined in bold letters on their bodies and hoods. The committee had insisted upon these being covered up, and they were. After the first few days, however, the coverings began to disappear. Formal protests were finally made, and at Poland Springs matters came to a climax. The Studebaker press car was singled out, and the statement was made that it had continually violated the rules in regard to displaying advertising matter, and had also run ahead of the chairman's car, starting out a night in advance of the tour in order to get notoriety. The driver of the car was notified that this must stop, and that the car would be declared out of the tour and would be compelled to remove its numbers and leave the regular body of the tourists. There was no difficulty in this respect, as far as any regularly entered car was concerned, although some of the manufacturers got around the rule by having the names of their cars painted on the rubber shirts of their drivers, while others sewed the names on the sleeves of the drivers' shirts. This, however, was not objectionable.

Little Details of the Tour.

There are a thousand and one little details in connection with a tour such as the annual Glidden event which are interesting and which go by unnoticed in the rush of events. A great deal of originality is displayed on the part of both drivers and passengers as to the manner of storing baggage, holding themselves in the car, etc. The men who have had to ride as observers on the rumble seats of the Hower contest runabouts have been having a rather hard time of it, and many of them have found it necessary to strap or rope themselves into the cars, in order to hold their seats. In the tonneaus of most all of the machines ropes have been stretched across the seats on which the passengers swing and brace themselves, as they are actually in danger of being thrown out on many occasions when the machines plunge at high speed over mountain roads intersected with water bars.

The tour is as much of a strain on the drivers as it is on the machines, and the various poses assumed by them are interesting. Some of the men at the wheels assume an easy lounging position, many of them crouching so low down in their seats that they can rest their necks on the top of the seat backs. Others sit bolt upright and seem to be straining all of the time. One of the drivers took things so easily that he was able to shift gears by kicking the lever with his feet. Mrs. Cuneo used unpadded seats in her car and a small bolster for her back. She has had the body specially made, it having been cut so that the front seats are 2 inches nearer the dash than in ordinary cars, and as a result of this she is enabled to assume an easy position and have full control of the machine at all times.

That air cooling is a success has been fully proven to the automobile fraternity by the performance of the four Franklin cars entered. They are the only air cooled machines in the run, but every one of them has been able to negotiate the roads as fast as any of the other cars, and has been among the leaders at the night control each night. Two of them broke rear springs, but none of the machines have experienced any mechanical troubles whatsoever, and entry No. 13 had the same air in its tires at Poland, Me., that was in when it left the factory. No. 14 had experienced tire trouble only one. The Franklins have done very good work in the mountains, and the only precaution the drivers take is to be sure to get the same kind of oil each time. Oil is shipped ahead to every night stop for their use. The erroneous idea that these cars are big oil eaters was disproven when car No. 14 drove from Albany to Poland Springs on the quantity held in its regular oiler and 1 gallon of extra oil carried.

William Hurlburt, the old Cadillac man, who is now boosting the Garford interests, has won the title of the fastest driver on the run. He is very clever, or he would no doubt have met with a serious accident, as he has hit some terrific paces. He is credited with having gone so fast that he ran both speedometers off his car and had them continually out of commission.

The tire men have been particular active on this trip, and there is great rivalry among them. Tire representatives question the entrants at each night control as to what tire troubles they have had, and tires are offered galore. The tire men encourage the entrants to change their tires if they show any signs of wear, in the hope of avoiding trouble on the road. It is claimed that the cost per mile for tires on this tour has been less than on any other Gliddden event ever held.

That the tendency among automobile manufacturers is toward the shaft drive, in place of the double side chain, is evidenced by the fact that there is only one car in the tour with a double side chain drive, that being the big Thomas, No. 111, entered by Gus G. Buse, of Buffalo. Six cylinder cars are more prominent than ever before, the following entries all being of the six cylinder type: Nos. 1, 2, 3, 11, 12, 13, 16, 17, 98, 99, 100 and 103.

Each car on the tour carries its passengers, observers and drivers' baggage, there being no baggage wagon as in previous tours. The result is that some close figuring is necessary to get everything on board, and still leave room for the passengers. With the touring cars baggage racks are used, but the runabout men cannot avail themselves of these. Some of these have adopted the expedient of strapping a suit case on either side of the hood, while others have them on either side of the rumble seats.

Poland Springs to Rangeley.

(Special Telegram.)

Rangeley, Me., July 21.—One of the perfect scores in the Glidden contest was ruined on the run to Rangeley Lakes, when Marmon car No. 22 was penalized ten points on time, the machine having been delayed on the road by engine trouble, until it was impossible for it to make up its time. The driver of the car, W. Clark, and his mechanic worked heroically in an endeavor to make repairs in time, but were unable to do so. The Marmon car No. 23, driven by Mr. Marmon, in which his wife is riding with him, waited until the last minute to see how things were going on, and then rushed on at high speed, finishing in time. It was stated by the observer on the penalized car that the rear brakes had heated up and bound, and as a result of this the engine had been badly overheated. It was quite a lengthy job to free the emergency brakes, so that the car could proceed on its way. The driver of the penalized machine complained that for the early part of the run he had been held back by the chairman's car, which was acting as pace car. Everything went all right with him until about 15 miles from Rangeley. He maintained that if the chairman's car had gone along at its usual speed and not held him back he could have gone fast enough to have been sufficiently in advance of his schedule to have made up the time lost in making the adjustments necessary, and still have finished within the limit. It seems to be the general idea that Chairman Hower, instead of running an hour or more in advance of the competing cars, will only be fifteen minutes ahead of them. This will mean that cars will be unable to race and get an hour or more ahead of their schedule, and in the event of trouble will not have so much time to make repairs. This move is made with the evident intent of trying to eliminate perfect score cars in the remaining two days of the run. This is a very important proposition, and the tourists were all anxious to have a definite decision, but the chairman made no definite announcement.

Oakland No. 28 was ditched and broke its left rear spring 4 miles out of Rangeley. The spring was braced up with part of a fence rail, and the machine finished forty-two minutes late. Mrs. Cuneo had some trouble with her engine, which delayed her, and reached the finish line with but four minutes' leeway.

PERFECT SCORES AT RANGELEY.

GLIDDEN CONTEST.

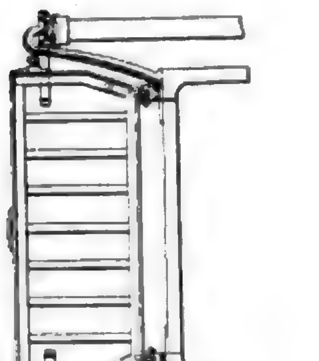
No. 1—Pierce.
No. 2—Pierce.
No. 3—Pierce.
No. 4—Reo.
No. 5—Peerless.
No. 6—Peerless.
No. 7—Peerless.
No. 8—Premier.
No. 10—Garth.
No. 11—Thomas.
No. 13—Franklin.
No 14—Franklin.
No. 15—Rainier.
No. 16—Stevens-Duryea.
No. 17—Stevens-Duryea.
No. 19—Haynes.
No. 20—Haynes.
No. 21—Marmon.
No. 23—Marmon.
No. 24—Studebaker.
No. 26—Studebaker.
No. 27—Oakland.
No. 30—Garford.
No. 35—Oldsmobile.

HOWER CONTEST.

No. 100—Pierce.
No. 103—Pierce.
No. 104—Premier.
No. 112—Stoddard-Dayton.
No. 107—Stoddard-Dayton.

The perfect score clubs are now Buffalo Team No. 1, Columbus Team and the Chicago Motor Club Team No. 1. At this point 81 per cent. of the mileage has been covered, and 63 per cent. of the cars have perfect scores. There are 314.5 miles yet to be covered. Driver A. C. Miller, of No. 100, Stoddard-Dayton, was ordered by wire from the factory to quit the tour here, no reason being given.

The Paris Chambre Syndicale de l'Automobile at last meeting decided to protest against a bill in the Chamber of Deputies which imposes a duty of 10 centimes per litre (7.5 cents per gallon) on gasoline. The chambre also considered a motion of the body builder Kellner, that it should urge the free temporary admission of chasses for the purpose of equipping them with bodies in France. No decision in regard to this matter was reached.



No. 890,654.

MOTOR VEHICLE PATENTS

Review of Specifications.

890,654. Motor Vehicle.—Russell Huff, of Detroit, Mich. June 16, 1908. Filed October 21, 1907.

This relates to a baggage rack or grid adapted to fit between the dumb irons at the rear of a motor car. The rack is hinged to brackets below the plane of the frame and fastened to the rear cross member thereof. Claw shaped pieces are attached to the lower spring shackle pin, their extension giving the necessary support to the rack. A strap passing through a flat eye and over a bar bracing the legs of a "tiger" seat upon the frame a vehicle, retains the rack in an upwardly inclined position when not in use. The framing of the rack is of channel section, with cross pieces of flat stock. A bolt fitted with a nut upon a pivot fastened to each side of the rack engages in a suitable slot in the supporting piece, the tightening of which nut upon its bolt retains the rack in position for use.

Patents Issued June 15, 1908.

890,615. Automobile.—Albert J. Davis, Schenectady, N. Y. Filed February 8, 1904.

890,616. Lubricator.—Frank M. Davis, Milwaukee, Wis. Filed September 10, 1906.

890,643. Two Cycle Internal Combustion Engine.—Herbert S. Hart, Madison, Wis. Filed July 13, 1907.

890,654. Motor Vehicle.—Russell Huff, Detroit, Mich. Filed October 21, 1907.

890,666. Brake Mechanism for Self-propelled Vehicles.—Hermann Lemp and Henry S. Baldwin, Lynn, Mass. Filed August 7, 1905.

890,667. Weather Screen for Motor Vehicles.—Joseph Lingley, Peckham, England. Filed May 6, 1907.

890,673. Fuel Pump for Internal Combustion Engines.—James D. Macpherson, Providence, R. I. Filed April 7, 1905.

890,674. Safety Device for Internal Combustion Engines.—James D. Macpherson, New York, N. Y. Filed August 25, 1906.

890,757. Automatic Oil Check for Lubricator Drain Passages. William E. Bryant, Detroit, Mich. Filed July 1, 1907.

890,785. Protecting Device for Tires.—George D. Moore, Worcester, Mass. Filed January 3, 1907.

890,815. Reversing Device for Explosive Engines.—Charles M. Stround, Hastings, Minn. Filed May 9, 1907.

890,875. Awning and Dust Screen for Vehicles.—Henri S. Samuel, Paisley, Scotland. Filed April 18, 1907.

890,952. Lubricator.—Howard C. Woodbridge, Salamanca, N. Y. Filed September 23, 1907.

890,904. Lever Locking Means.—Howard E. Coffin, Detroit, Mich. Filed October 15, 1907.

890,970. Carbureting Apparatus for Explosive Engines.—Fritz Dürr, Karlsruhe, Germany. Filed March 2, 1907.

890,981. Suspension Frame for Automobiles.—Rheinhold Hermann, Crafton, Pa. Filed April 25, 1906.

891,007. Motor Truck Valve Controlling Mechanism. William A. Roberts and Ferdinand W. Stuhl, Fern Ridge, Mo. Filed March 26, 1907.

891,030. Armor for Rubber Tires.—Vendel L. Mikeš, Cleveland, Ohio. Filed December 9, 1907.

891,051. Automobile Construction.—Godfrey Engel, Pittsburg, Pa. Filed September 6, [illegible]

891,072. Controlling Mechanism for Motor Vehicles.—Charles H. Humphreys, Torquay, and Vincent J. Scantlebury, Reading, England. Filed February 2, 1906.

891,078. Explosion Engine.—Hugo Junkers, Aachen, Germany. Filed June 12, 1905.

891,102. Attachment for Motor Cycles.—Theodore W. Razoux, Brooklyn, N. Y. Filed April 18, 1907.

891,108. Power Transmitting Mechanism.—George W. Smith, Henry, Mo. Filed May 27, 1907.

891,112. Spark Plug Protector.—Charles H. Stuart, Newark, N. Y. Filed November 13, 1905.

891,119. Engine.—John Weisenborn, Quincy, Ill. Filed December 26, 1907.

891,132. Force Feed Lubricator.—George D. Banta, Detroit, Mich. Filed January 25, 1907.

891,152. Driving Mechanism for Motor Vehicles.—William H. Douglas, Belleville, N. J. Filed October 9, 1907.

891,169. Spring Tire.—Bernhard Hilger, Elgin, Ill. Filed June 19, 1907.

891,219. Carburetor.—Albert W. Menns, Malden, Mass. Filed March 6, 1907.

Patents Issued June 23, 1908.

891,302. Radiator for Automobiles—Max Steiner, Newark, N. J. Filed February 15, 1908.

891,322. Carburetor for Explosive Engines.—Patrick H. Brennan, Syracuse, N. Y. Original application filed January 11, 1901. Divided and this application filed November 21, 1902.

891,357. Motor Vehicle.—Frank J. Mohan, Detroit, Mich. Filed September 30, 1907.

891,366. Internal Combustion Engine.—James H. Pierce, Bay City, Mich. Filed November 8, 1906.

891,368. Means for Preventing Reversing of an Explosive Engine.—William B. Potter, Schenectady, N. Y. Filed November 26, 1904.

891,462. Spring Wheel.—Samuel S. Childs and William Childs, Jr., Bernardsville, N. J. Filed May 23, 1907.

891,522. Vehicle Wheel.—Lee W. Bryant, St. Louis, Mo. Filed September 6, 1907.

891,523. Lifting Jack.—F. C. Butler and Eugene Cook, Kalamazoo, Mich. Filed August 21, 1907.

891,536. Change Speed Gearing.—William E. Goodyear, Newark, N. J. Filed November 20, 1906.

891,517. Wind Shield.—Oscar C. Graff, Chicago Ill. Filed January 23 1908.

891,552. Igniter.—Charles B. King, Detroit, Mich. Filed June 9, 1906.

891,559. Ratchet Wrench.—Maurice H. Mills, Foley, Minn. Filed October 8, 1907.

891,617. Shock Absorber.—Frank Doront, Paterson, N. J. Filed September 25, 1907.

891,623. Engine Starter. Clayton B. Lazenby, Chicago, Ill. Filed August 7, 1907.

891,647. Igniter.—William L. Wayrynen, Dolph, S. Dak. Filed June 15, 1907.

891,697. Radiator Fan for Motor Vehicles.—Russell Huff, Detroit, Mich. Filed March 26, 1907.

891,714. Dust Collector for Motor Vehicles.—Everard H. Morgan, Didsbury, England. Filed June 14, 1907.

891,799. Friction Clutch.—Giovanni Enrico, Turin, Italy. Filed December 10, 1906. Renewed April 15, 1908.

891,800. Change Gear Mechanism for Vehicles.—Giovanni Enrico, Turin, Italy. Filed December 10, 1906. Renewed April 15, 1908.

891,803. Base and Crank Case for Hydrocarbon Engines.—Henry B. Joy, Detroit, Mich. Filed May 21, 1906.

The two automobiles which will be placed in service by the post office at Washington, D. C., for collecting the mails will be operated by Louis P. Steele and L. W. Baum. The district to be covered by the two cars is now covered by four horses and wagons, to each of which one man is assigned.

The Horseless Age

First Automobile Journal in the English Language

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The Glidden Tour—III.

BY HARRY B. HAINES.

Rangeley to Bethlehem.

The hotel accommodations at Rangeley Lakes were entirely inadequate and unsatisfactory, and the tourists were piled six and seven in a room, and charged $4 a day each. The hotel management had secured an option on every room in the village, and the tourists either had to pay up or sleep in the open. Previous to this place the hotel arrangements had been excellent, and the tourists had been well cared for, and most reasonably charged.

FIRST RAIN.

Tuesday had been cloudy and the rain that had threatened all day started to fall about 6 o'clock, and continued in a perfect downpour all during the night. The schedule had been announced as six hours and forty minutes for the running time from Rangeley to Bethlehem, N. H., a distance of 130 miles, but Chairman Hower changed this to seven hours and thirty minutes on account of the rain.

Mr. Hower overslept on Wednesday morning, and as a result did not start until half an hour after his regular time, and the competing cars were not allowed to check out until 7:30 a. m., instead of 7 o'clock, as is usual. It was noticeable that, despite the fact that the rain had stopped, the big cars were not as anxious to be checked out first as they had been in fair weather. All of the entrants seemed a little inclined to let someone else go first and break the roads for them. The Pierce team, as usual, were to the front, and got away early, and Mrs. Cuneo followed close behind. It was after 8 o'clock before the last car had checked out. All of the entrants immediately after checking out stopped to put on their tire chains, some of them putting chains on both front and rear wheels in order not to take any chances on the mountain roads, which were reported to be in very bad condition. This report proved to be without foundation, however, for the roads proved to be as good and in many places even better than those met on any stage of the run, except the trip from Albany to Boston, Mass. Apart from one or two showers there was no rain to speak of during the day, and the mountain roads, which had dried up very quickly, were in excellent condition. There was no dust, and as the tourists sped along the narrow mountain roads, arched for miles with bowers of green trees, and winding around the bases of sombre mountains whose peaks were hidden in the clouds that bearded them a misty white, they were all unanimous in their opinion that they had never had a finer trip. The scenery en route beggared description, for at each hilltop a fertile valley surrounded by towering mountains opened up to the gaze, and the roads rolling in well graded stretches up and down hill were a veritable natural roller coaster. The motion as the cars rushed down one grade and up another with speed undiminished was exhilarating and fascinating in the extreme.

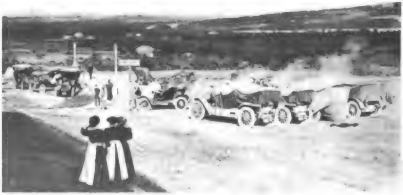
The roads were of clay loam and gravel, and at the turns were cut up to a depth of ten or twelve inches as the chain girded wheels of the big machines skidded around them. There were a number of stiff grades, and one particularly long and hard climb of nearly a mile and a half after leaving Gorham. The base of the gigantic White Mountains was skirted, the climb up them being avoided by bearing to the right at the fork after passing Cherry Mountain.

Every cross road was lined with cheering motorists, and many of the houses en route were decorated with flags.

MISHAPS GALORE.

The day was one of many mishaps, and Mrs. Cuneo had to do some very fast driving to keep her perfect score intact. She lost an hour in taking the fan belt of her machine off and patching it, and as a result had to make the trip over the mountains at high speed. She made the last 8 miles into Bethlehem in fourteen minutes, and came up to the finish line with her hat blown away and her hair flying. She was on time though, and checked in amid the cheers of the guests who lined the hotel porch, and the loud applause of the tourists.

Chairman Hower, driving in the Pierce six cylinder, met with his first accident when near Rumford Falls. The big car was being driven by John Winchester, and he turned way out to the side of the road to allow a fractious horse to pass. The machine had been slowed down to a twelve mile an hour pace, and as Winchester swung to the side of the road the ground gave way, and in an instant the car slid down from the top of the road and crashed into the ditch. As the car toppled over Chairman Hower was thrown with great force and landed in a huckleberry bush at the foot of a deep embankment. Mr. Hower rolled over and over in a descent of 18 feet, and lay forgotten at the bottom of the gully, while Mr. Glidden and the other passengers in the car, apparently forgetting his fate, started in to find out what damage had been done to the machine. Keller, who also takes a hand at driving the Pierce, was the first to remember the chairman, and he went to his assistance without delay. He found Mr. Hower stunned but not injured, trying to pick himself up. He helped him up to the road. Tom Fetch happened along at this time in the Packard press car, and hitching a rope on the chairman's car pulled it back on the road and it continued without further mishap to the night stop.



CARS PARKED AT POLAND SPRINGS.

SOME OF THE TROUBLES.

No. 110, the ill fated Overland, on this day's run met what will probably prove its quietus. When about 20 miles out of Rangeley and on a narrow mountain road the machine dropped into a deep hole and the rear axle was snapped off close to the spring seating. A fence rail was secured and the machine was pried off the road so as not to block the other cars. Repairs will be made and the car will endeavor to rejoin the tourists in order to be in at the finish at Saratoga.

Car No. 28, the Oakland, was tied together with pieces of wire when it started from Rangeley. The front left spring was broken, as were both the front and rear axle truss rods, and it was hardly a safe task to try and drive it over the hilly mountain roads. The driver was game, however, and put the car through, arriving at Bethlehem only nine minutes late and suffering a penalization of nine points.

The Marmon car, No. 22, which was delayed on the run to Rangeley as a result of its brakes locking and suffered a penalization there of ten points, which destroyed the perfect score of the Bay State A. C., went down and out on the run to Bethlehem. The machine dropped into a deep hole and smashed a rear wheel. Word of the accident was telephoned to Bethlehem and the machine was officially withdrawn from the contest, a penalization of 1,000 points being entered against it.

No. 25, Studebaker, met with an accident near Shelburne which came very near proving disastrous to both it and its passengers. The road approaching a sharp but hidden turn to a bridge was particularly good. The car came along at high speed, and the driver was almost on the turn before he saw it. He was unable to slacken the speed of the car a great deal and took a chance, swinging the corner at high speeed. The machine skidded and nearly went over, and before the driver could regain control of it crashed into the bridge. Luckily the auto was not damaged, although the bridge was somewhat "banged up." The car continued after replacing a tire, which was torn off when the skid occurred.

Car No. 18 the Gabriel Horn Oldsmobile, skidded when a few miles out of Rangeley, and striking a stone in a gully bent its rear axle. Driver Foster managed to run the car to Bethlehem, despite the fact that one of the rear wheels was badly out of line. He took it to a blacksmith shop and made repairs. Car No. 101, one of the Reo entries, was slightly delayed as a result of the necessity of tightening up its transmission.

Car No. 23, one of the Marmons, was delayed by tire trouble, but finished on time. The Packard press car broke a leaf in its front spring and made repairs in thirty-five minutes. No. 111, Overland, was also delayed en route as a result of the necessity of making adjustments to its engine. No. 4, Reo, went to a blacksmith shop and repaired a broken rear axle truss rod.

RUNNING WITH PARTS MISSING.

A number of the machines are running with broken or missing parts. Van Tine's Garford has no starting crank, and it is necessary to push the car until it gets under headway and then throw in the gears in order to start the engine. No. 24, Studebaker, has its oiler driving gear broken and is splash oiling its engine. No. 12, Franklin, is running under the same conditions as a result of a broken oiler pipe.

No. 109, Stoddard-Dayton, in accordance with a telegraphic order received from the factory, withdrew from the run on Wednesday morning at Rangeley. No reason was given. The car had previously been penalized for breaking its radius rod bracket. The machine will be shipped back to the factory.

At Bethlehem.

The usual evening meetings of the contestants had not been held for several days, but one was called for Wednesday evening at Bethlehem, and all of the tourists attended. It was announced that, in keeping with a desire expressed by the tourists, they would be allowed to check out at 6 o'clock for the last day's run instead of 7 o'clock, the usual hour, in order that they might reach the finish line early on Thursday. Most of the tourists have had enough of the tour and will be more than glad when the trip is over, as it has been a very strenuous ride. The cars will check out in the same manner that they did at Buffalo, i. e., in the numerical order that their entries were received. This is to avoid any friction as to which cars are to go into Saratoga first, and will prevent racing to reach the finish line. The competing cars will be held up a few miles out of Saratoga by the chairman and will go into the city in their numerical entry order, in one line, to the finish point at the Grand Union Hotel.

The drivers were warned that the horses in Vermont are very skittish, and although notices have been posted up on the roads to be followed through the State, the drivers were asked to be very careful and to give horsemen every chance in order to avoid accidents and possible damage suits.

The entrants were notified that they would be served breakfast at 5 o'clock and must be at the garage at 5:30 in order that the start might be made promptly at 6. The running time was set at nine hours and twenty minutes, and it was announced that in the event of rain this time would be extended forty minutes. Letters were read to the effect that the Adirondack A. C. would serve the tourists sandwiches and coffee at Sandy Hill, and the citizens of Saratoga would serve a complimentary luncheon at Saratoga, at which the tourists were invited to attend even before they cleaned up if they desired, as everything is to be informal.

THE RUN OFF.

The entrants were informed that all perfect score cars upon arrival at Saratoga must have their bags of spare parts examined by the committee before their observer leaves them. They will then be at liberty to do whatever they please with their machines. The cars composing perfect score teams will, however, be held in the official garage for the run off. Arrangements have already been completed for scattering confetti. The first day's trip will be from Saratoga to Syracuse, N. Y. The perfect score teams at Bethlehem are A. C. of Buffalo, Team 1, composed of three Great Arrow cars; Columbus A. C. team, composed of three Peerless cars, and Chicago M. C. Team No. 1, composed of two Haynes cars and an Oldsmobile. It is remarkable that these three cars, which are of the so called cheaper class, should have made such an excellent showing against cars selling at from $4,000 to $6,000. It is a great victory for the medium weight, medium priced cars.

When noses were counted at Bethlehem it was found that the Premier Century car, running independent as a press car; No. 31, Garford, driven by Hurlburt, and No. 22, Marmon, were missing. The Marmon was reported as having broken a wheel in a skid, and the rumor spread that one of the passengers had been hurt. No confirmation of this could be secured. The Garford was reported as having been wrecked, and also as having a broken axle, and there was some talk that someone had been injured in this car. No news as to the Premier was obtainable. After 8 o'clock, when the cars had not yet arrived, Tom Fetch started off in the Packard press car to look for them and extend assistance if possible.

Charles J. Glidden figured that at this point of the tour 90 per cent. of the mileage had been covered and 63 per cent. of the cars still had perfect scores.

William Otis, the observer on Marmon car No. 22, reached the Sinclair House at Bethlehem, N. H., at 10 o'clock Wednesday evening, after having taken five different railroad trains in the effort to reach the hotel from Gorham. He stated that the Marmon car had been disabled a few miles out of that place. The brakes on the car were not working as they should have been, and as the machine rounded a sharp curve at a fair speed it came suddenly upon a horse. The only alternative to hitting the horse was taking the ditch, and William Clark, the driver, did this, and as a result the big machine crashed into the embankment and the front wheel and axle were broken. Clark was jammed up against the steering gear and was injured slightly. None of the other occupants of the car were hurt. The machine was damaged beyond temporary repair, and will be shipped back to the factory. Clark was communicated with by 'phone, and the report was received that, although badly shaken up, he was not seriously hurt, and was suffering more from shock and fright than anything else.

In regard to the accident to the chairman's car in which Mr. Hower went down an embankment after the car was ditched, it developed that both he and Mr. Glidden jumped as they felt the car go over the bank. Mr. Glidden rolled about 10 feet and picked himself up unhurt.

Bethlehem to Saratoga.

Thursday, July 23, the twelfth and last running day in the Glidden tour, dawned bright and clear, and even before the sun itself was half way up on its preliminary peep over the hills the contestants and tourists were up and about ready and anxious for the start. Four o'clock calls were the rule, as the start had been set for 6 o'clock, and the confetti cars had gone off at 4 on the last day's run. The chairman's car was under way shortly after 5 o'clock, and at 5:30 the contestants and their observers were allowed to go into the garage and uncover their cars preparatory to the start. The machines were lined up in numerical order of entry, and the following cars were in line ready for the word to go at 6 o'clock:

Glidden Contest.

No. 1—Great Arrow (perfect score).
No. 2—Great Arrow (perfect score).
No. 3—Great Arrow (perfect score).
No. 4—Reo (perfect score).
No. 5—Peerless (perfect score).
No. 6—Peerless (perfect score).
No. 7—Peerless (perfect score).
No. 8—Premier (perfect score).
No. 9—Premier (non-contestant).
No. 10—Gaeth (perfect score).
No. 11—Thomas (perfect score).
No. 12—Franklin (non-contestant).
No. 13—Franklin (perfect score).
No. 14—Franklin (perfect score).
No. 15—Rainier (perfect score).
No. 16—Stevens-Duryea (perfect score).
No. 17—Stevens-Duryea (perfect score).
No. 18—Oldsmobile (non-contestant).
No. 19—Haynes (perfect score).
No. 20—Haynes (perfect score).
No. 21—Marmon (perfect score).
No. 23—Marmon (perfect score).
No. 24—Studebaker (perfect score).
No. 25—Studebaker (non-contestant).
No. 26—Studebaker (perfect score).
No. 27—Oakland (perfect score).
No. 28—Oakland.
No. 29—Garford (non-contestant).
No. 30—Garford (perfect score).
No. 31—Garford.
No. 32—Selden (non-contestant).
No. 34—Packard (press car).
No. 35—Oldsmobile (perfect score).
No. 38—Locomobile (Fisk tires).
No. 39—Premier (press car).
No. 95—Reo (press car).
No. 96—Packard (Red Cross car).

Nos. 97 and 98, the two pilot and confetti cars, went out early, and No. 99, the chairman's car, preceded the run as usual.

Hower Contest.

No. 100—Great Arrow (perfect score).
No. 101—Reo.
No. 102—Moline (non-contestant).
No. 103—Great Arrow (perfect score).
No. 104—Premier (perfect score).
No. 106—Franklin (non-contestant).
No. 107—Stoddard-Dayton (perfect score).
No. 111—Overland (non-contestant).
No. 112—Stoddard Dayton (perfect score).

This completed the cavalcade that set out over the roads toward Saratoga on the run of 184.5 miles, the second longest day's run of the tour.

The roads were fair from Bethlehem to Rutland, Vt., being of sand and clay and somewhat heavy at times. Clay roads were encountered from Rutland to Kingsbury, and from that point to Saratoga the pike was good. There were a number of very sharp and dangerous turns, and great care was necessary on the part of the drivers to negotiate the roads without accident. The reception along the route was most enthusiastic, and every cross road was lined with cheering people, while every farmyard had its quota of interested spectators. American flags were displayed along the entire route, and the last day's run was most certainly a triumphal one. At Rutland the town took a holiday and the streets were lined with crowds who watched the autos pass.

This day's run proved to be an easy one, and all of the cars finished without serious mishap. The little Overland, No. 110, which broke a rear axle up in the mountains, limped in early Thursday morning and continued with the run, finishing at Saratoga. Hurlburt's Garford did not reach Bethlehem at the time the tourists checked out, and Clark's Marmon was also missing. The roads for the entire run to Saratoga were fair, although there were some very nasty water bars in the mountains that tested the machines and strained the running gears. Most of the cars finished an hour in advance of their schedule time, however, and also stopped at Taftsville, N. H., where luncheon was served, and at Glens Falls, where the automobile club had stationed pretty girls in the public square with all sorts of edibles, and also with all kinds of drinks and smokes. A band played various selections, and the tourists were given a most enthusiastic reception. Every car stopped for a short time.

The only car to fall down in the day's run was Marmon No. 23, driven by Mr. Marmon, whose wife also accompanied him throughout the tour. This car had been making a most excellent showing, but when near Sherbourne met its quietus as a result of cracking one of its cylinders. Word was sent to the officials of the tour at Saratoga, stating that it would be impossible to make repairs, and that the machine was officially withdrawn from the contest and would be shipped home. A penalization of 1,000 points was entered against it.

BRIDGE DAMAGED.

Cars Nos. 8, 11 and 25 were delayed by tire trouble. The big Pierce, No. 1, came down heavily on a temporary bridge over a culvert about 10 miles from Saratoga and smashed in several planks. The entire structure threatened to collapse. The machine was hustled off it and workmen held up the other cars until the bridge could be strengthened by placing beams underneath it. The car had a very narrow escape. Franklin No. 14, driven by Mr. Bates, in crossing the same bridge skidded at the sharp turn at the approach and crashed into the guard rail, demolishing it. The car was not damaged beyond breaking a lamp, and Bates managed to swerve the machine so that there was no danger of its going over the side. These were the only two incidents of the day worthy of mention.

A large crowd of summer guests welcomed the tourists at Saratoga, and they were served with punch and a light luncheon in the court yard of the Grand Union Hotel. All the cars were photographed as they checked in, and later a panoramic photo of the entire party was taken on the rear porch of the hotel. The tour ended as it were in a blaze of glory, and everyone seemed to be happy. The tourists to a man had had enough and were anxious to get home. Mr. Buse, of Buffalo, who drove the big Thomas, No. 11, through with a perfect score, and was about the only entrant independent of factory connections, left for Albany a half hour after checking in, on the first stage of his run back to Buffalo. Others of the newspaper men and tourists arranged to get out on night trains immediately after the final meeting at 8 o'clock.

Arrival at Saratoga.

At Saratoga.

There was considerable comment and no little excitement at Saratoga when the report was circulated that the Great Arrow car No. 3, driven by J. W. Maguire, had been penalized three points as a result of an error made in figuring its checking in time, and that the perfect score of the Buffalo team No. 1, which the Great Arrow cars represent, was destroyed. This would leave the Columbus A. C., represented by the three Peerless cars, and the Chicago Motor Club team No. 1, represented by two Haynes cars and an Oldsmobile, as the only perfect score teams.

EXCITEMENT RAN HIGH.

It was unofficially stated that the Pierce car had taken three minutes for tire repairs, and had failed to add this to its running time, and as a consequence had checked in three minutes too early, and would suffer a penalty of three points as a consequence. This put a very serious face on the situation and excitement ran high.

To add to this, Andy Auble, who drove the perfect score Oldsmobile, announced that he would not enter into a "run off," as he had been away from his business as long as he could afford to, and had received an urgent call from his partner to return without delay. He announced his intention of starting for his home at Akron, Ohio, on Friday morning, and said that he would not compete for the Glidden Trophy in a run off under any conditions, as he had had enough. This situation seemed to leave the Peerless team practically the only perfect score team and the apparent winners of the Glidden Trophy. The observer on the Pierce, which was reported as penalized, was Mr. Krueger, a man nominated by the Studebaker Automobile Company, and the friends of the Pierce claimed that some game was being played on behalf of the Studebaker interests, and the statement was made that they were sore on the Pierce team because the latter had openly "knocked" them for running their army car along the route of the tour with advertising signs on it in defiance of the rules. Argument ran hot between the factions on both sides, and at 8 o'clock, when Chairman Hower called the meeting of the contestants to order, things were at the boiling pitch.

The Tour a Fiasco.

In an outburst of accusations and indignation, with charges of unfairness and impartiality, and even offenses of a graver nature the Glidden tour died an unnatural death at Saratoga on Thursday evening, and the cause will be known after the official autopsy has been performed at some future date. The withdrawal of the Haynes-Oldsmobile team left the Peerless and Pierce teams as the only perfect score men, and when the observer's report on car No. 3 showed that this machine had checked in three minutes too early after waiting an hour at the finish line, it left the situation technically that the Peerless cars alone had perfect scores. It is, of course, highly ridiculous that an award for the merits of an automobile should be based upon the ability of its driver to compute time, but, nevertheless, this was the rule, and Chairman Hower had more than once at the evening meetings made the special point that it was "up to" the occupants of the cars to see to it that their time was figured properly, and that if any mistake was made he would see that the car offending was penalized, and there would be no recourse. Despite this, when the Pierce situation developed the chairman did not maintain his firm stand. The Pierce driver had signed the observer's card, but later claimed that he had not read it. At all events the penalization was there, and it was up to Mr. oHwer to make a decision. It was stated that the observer on the Pierce had figured the amount of time required to take off tire chains improperly, and as a result of this the discrepancy in time had arisen. The chairman stated that he had interviewed all the passengers in the car, and they had stated that the time as figured by the driver was correct, and that the observer was in error. The Peerless Company had in the meantime filed a protest in which they stated that as their cars were the only perfect score cars in the Glidden contest they felt that they had won the cup fairly and honestly, and were entitled to it, and they would not under any circumstances enter into a run off. Mr. Hower finally decided not to allow their protest, and held that the Pierce car No. 1 was still in the perfect score class. This decision caused a storm of protest in many quarters, and the assertion was openly made that the chairman had favored the Pierce cars because of the fact that they had supplied him with a luxurious $6,000 car to ride in at the head of the tour. At all events Mr. Hower was obdurate, and his decision was final.

E. H. Parkhurst, vice president of the Peerless Company, who was at the Grand Union Hotel, was indignant at the result, and stated that under no circumstances would the Peerless cars enter into a run off. He said that the chairman's decision spoke for itself, and he need say nothing further about it, but he would maintain that his cars had won the trophy, and would not contest further for it.

Henry May, vice president of the George N. Pierce Company, who was at Saratoga, had a long conference with Mr. Hower. The latter advised him not to accept the trophy on behalf of the Pierce cars under the circumstances, and suggested that he allow the trophy to revert to the donor, Mr. Glidden, to be contested for next year. Mr May called a meeting of the Pierce men, and after the session decided that the Pierce cars would line up at the starting line on Friday morning prepared for the run off, and that if the Peerless cars were not there they would then decide that they had formally won the trophy for the third consecutive time, and that inasmuch as this slight dispute had arisen they would not accept the trophy, but would allow it to revert to Mr. Glidden to be contested for next year.

The evening meeting on Thursday at Saratoga was interesting. Mr. Hower as usual presided, and thanked the tourists for their uniform courtesy to him and the other officials. Mr. Glidden made a short address, in which he stated that he felt that the contest just ended had been a most strenuous one and had done a great deal to show that the American automobile is equal to any in the world. He stated that he felt that with the possible exception of the Panhard no foreign car could have completed the run, as none of them have sufficient clearance to negotiate the water barred mountain roads that the tourists went over. David Beecroft, on behalf of the Chicago Motor Club, presented Mrs. Cuneo with a handsome silver loving cup. Mrs. Cuneo responded feelingly and said that she had gone on the tour with the hope of advancing the interests of touring in general and to demonstrate that a woman may safely and easily tour in this country and enjoy herself. She was loudly applauded. The meeting then adjourned and the tourists devoted their time to a discussion of the Pierce-Peerless incident.

Friday at Saratoga.

The three Pierce cars were at the starting line in front of the Grand Union at 8 o'clock Friday morning prepared to check out in the run off. The Peerless men were not there, as it had been stated they would not be, and after waiting until the Hower Trophy runabout contestants had been checked out the Pierce contingent started on the run back to Buffalo. The Franklin cars also accompanied the Hower contestants to Syracuse.

The things that were said for and against Mr. Hower were for the most part unprintable. Some of the contestants stated that they would never enter into a contest again if he was to be the chairman, while others felt that the only fair way for manufacturers to hold such an event would be to run it off themselves. Both the Pierce and the Peerless contingents had their adherents, and the talk ran riot. Speaking in his own defense to a Horseless Age man, Mr. Hower stated that he had made a thorough investigation into the protest of the Peerless people, and had found out that the observer had made an error in computing the time. "I know that I am being criticised for my decision in this matter," he said; "but the fact that I have ridden in a Pierce car has not influenced me. It would have been the same no matter what car I had ridden in, and as you know I must ride in some machine. I don't care what people say as long as I know myself that I am doing what is right and honorable."

THE PIERCE PENALIZATION.

In further explanation of the Pierce penalization situation, the following explanation is timely. The cause of the protest was as follows. In coming out of Bethlehem, N. H., J. W. Maguire, of Pierce No. 3, stopped his car to take off his tire chains, but did not stop his motor. The observer who was riding with Mr. Maguire made a note that it took three minutes to take off the chains.

Maguire drove his car across the finish line at Saratoga without taking out the time, and according to the rules should have lost one point for checking in ahead of time, as each car is allowed a two minute leeway in checking in.

Maguire claimed that it did not require a minute's time to remove the chains, and cited the fact that the car that checked out sixty seconds after him did not pass him while he was standing still, despite the fact that he had only driven one-tenth of a mile before stopping. As stated, Mr. Hower overruled the protest and refused to penalize the car.

CHAIRMAN HOWER.

It is doubtful if Chairman Hower even in his most imaginative mood ever expected the hot roasts and critical comments which his actions on the tour just ended evoked. In justice to him it must be said that to outward appearances he endeavors to act fairly, but he has a brusque manner and a dictatorial air that naturally engenders antagonism.

THE HOWER RUN OFF.

There were five perfect score cars in the Hower runabout event, and these were sent off at 8 o'clock Friday morning on the run off. The five were Pierce No. 100, Pierce No. 103, Premier No. 104, Stoddard-Dayton No. 107 and Stoddard-Dayton No. 112. The first day's run was from Saratoga to Syracuse, N. Y., a distance of 160 miles, which was to be made in eight hours flat. The Reo pilot and confetti cars left at 6 o'clock to mark the route, and the runabouts, with their officials observers, started at 8. The chairman left later in his Pierce Arrow car, and will ride over the route as far as Buffalo. The second day's run of the run off will be from Syracuse to Buffalo, and then the course of the tour just completed will be taken up. The runabouts will keep to the road until all but one have been eliminated. Apart from No. 112, which has a leaky radiator that has been plugged up, all of the cars were in perfect shape, and the run off will no doubt be a hard fought contest, and will be watched with increasing interest by automobilists all over the country.

Glidden Tour Notes.

Among the 1909 model cars that are being tested out in the tour this year are the three Marmons and the Packard press car and Packard Red Cross car. The latter machine is being driven by Russell Huff, the designer of the Packard. A number of minor changes have been made in the car, particularly in the ignition system, which has been simplified. The front axle has also been strengthened.

The Marmon cars are all 1909 models, and have four cylinder motors, with 5⅛ inch by 5 inch cylinders, and are rated at 50 horse power. One of the novel features is the new rear axle made by the company. It has the differential housing fitted with a circular plate at the rear through which the differential gears complete can be removed. The brakes are internal bronze, the shoes being faced with a fabric cover. These are located side by side, and expand within a 17 inch cast steel drum 4 inches in width, so that each expanding shoe has a width of almost 2 inches. The adjustment of each set is by a screw which acts within a worm sector carried on the shaft which has the expanding cam on it. The double three point suspension is retained, but modified in that the motor and gear set are carried on a cradle, which at its front rests on the front springs, and at its rear is trunnioned on a drop cross piece of the frame which carries the car body. The cars have made a most excellent showing.

SIX CYLINDERS IN THE GLIDDEN.

The six cylinder cars in the Glidden tour this year have demonstrated beyond argument that this type of motor is particularly adapoted for mountain touring, and for any work where elasticity of power and the ability to do hard work on the high gear are required. The Pierce, Franklin and Stevens-Duryea sixes have been to the head of the line in every day's run through the mountains, and they have been able to get along without the constant gear changing work that the other cars have been obliged to resort to. The six cylinder cars are particularly valuable in negotiating the mountain roads that are intersected with water bars. It is necessary on these roads when ascending hills at speed to slow up as the front wheels lift over the high parts in the road. The six cylinder cars could do this and pick up their speed again without difficulty, but the fours in many instances have to use lower gears than they ordinarily would, owing to their inability to pick up speed quickly enough.

GLIDDEN STATISTICS.

The following statistics of the Glidden and Hower tour contestants are interesting:

Number of starters in two competitions	46
Chain drive	3
Shaft drive	43
Four cylinder cars	32
Six cylinder cars	9
Two cylinder cars	5
Water cooled	42
Air cooled	4
Friction transmission	2
Planetary transmission	7
Progressive sliding gears	12
Selective sliding gears	25
Jump spark ignition	35
Make and break ignition	11
Opposed motors	3
Vertical motors	43

RADIATOR TROUBLE.

No. 16, Stevens-Duryea, came into Bethlehem with a very bad leak in its radiator. The car had been troubled with this all day, and an effort will be made to fix it before starting for Saratoga. This is not the only machine on the tour that has had radiator trouble. In fact a number of competing vehicles have suffered with leaky radiators which were not the result of collisions, but simply due to the radiators springing a leak after the hard bumping and twisting resulting from high speeds over water barred mountain roads. Most of the radiators seem to spring a leak at the base, which would seem to indicate that they are too rigidly mounted on the frames.

An interesting test of the high tension magneto as a sole means of ignition, with batteries eliminated, has been made on the Franklin runabout No. 106, and on No. 14, one of the perfect score Franklins. Both cars are so equipped, and have not experienced the slightest ignition troubles. Many cars of the future will no doubt depend on high tension magnetos alone for their ignition.

CONGRESS SPRING
PARK

Pilot Reo at Saratoga.

A Personal Idea Regarding the Glidden Tour.

By Harry B. Haines.

The just concluded Glidden tour was a reliability contest in every sense of the word, and even something more, for it had all the features of a road race, with the usual accompaniment of a mile a minute speed, wild chances, harebrained driving and smash-ups. Two machines were ditched and smashed. One hit a telegraph pole, and another met its quietus up against a tree. Three cars smashed wheels, frames and springs were broken, and even axles gave way under the terrific strains imposed. The time allowance made by the committee provided for an average speed at all times within the legal limit, and had these speeds been maintained the cars would have come through in good shape, and without any racing. The contestants, however, felt that they must make high speeds and get ahead of this schedule, and the result was that they raced madly through the country, and many days finished an hour, and even two hours, ahead of their time.

The committee was cognizant of this racing, for the chairman himself had seen these cars in the night stops waiting to check in away ahead of their schedule time. Nothing was done to stop this, however, and despite the fact that the time required to repair tires was not to be made up, the pace was as hot this year as ever. As I stated on the first day of the run, I do not think it possible to formulate any set of rules that will prevent speeding, unless every car is required to follow a pace car that will not exceed a certain limit, no car is allowed to pass a car ahead of it, and controls are established along the line at which the cars are checked. These control points should be known to the committee only, and not to the contestants.

The fact that the only axles broken were of the I beam type was quite a victory for the advocates of tubular axles, and they were duly pleased.

It was pleasing to note the fact that broken frames were the exception rather than the rule, but it is evident that there is room for improvement in springs. The three wheels that were broken were smashed as a result of reckless driving, and not through weakness or faulty construction. It is hard to determine in a contest of this kind anything about the serviceability of tires, for all of the companies have their tires shipped to each night stop, and in the event of a puncture the whole casing is changed and not repaired, as would be the case were the tire on the car of an individual user. There is no doubt that tires used on Glidden tour cars, after they have once been punctured, give less mileage service by far than do those on cars in private use. On the other hand some of the drivers finished the first 1,000 miles with the same air they had in Buffalo. This should not be considered anything remarkable. In fact it is a pure matter of luck, and any tire ought to give at least 3,000 miles of service.

Ignition, cooling and lubrication systems gave little or no trouble, and it is evident that these parts of machines have reached a stage of development that insures their reliability and serviceability. It is in the running gears where strength is principally needed, for on the mountain roads of this country cars are subjected to the roughest treatment and the most terrific strains.

In conclusion I feel free to say that I believe that these annual events do much to arouse public interest and curiosity in automobiling, but I doubt if at this stage they really result in the securing of many converts and new buyers. The man who wants an auto nowadays won't buy it simply because it finished the Glidden contest with a perfect score when driven by a trained factory mechanic. In the end the manufacturer who spends his money in producing an honest car, well built and intelligently constructed, will win out even if his product never engages in a 1,600 mile road race for a silver cup.

Club Scores.

	Points.
Buffalo Team No. 1	1,000
Chicago Team No. 1	1,000
Columbus Team	1,000
Chicago Team No. 2	980⅔
Buffalo Team No. 2	666⅔
Rochester Team No. 1	666⅔
Rochester Team No. 2	666⅔
Syracuse Team	666⅔
Bay State Team	333⅓
Cleveland Team	333⅓

Perfect Scores.

GLIDDEN CONTEST.

No. 1—Pierce.
No. 2—Pierce.
No. 3—Pierce.
No. 4—Reo.
No. 5—Peerless.
No. 6—Peerless.
No. 7—Peerless.
No. 8—Premier.
No. 10—Gaeth.
No. 11—Thomas.
No. 13—Franklin.
No. 14—Franklin.
No. 15—Rainier.
No. 16—Stevens-Duryea (Cert.).
No. 17—Stevens-Duryea (Cert.).
No. 19—Haynes.
No. 20—Haynes.
No. 21—Marmon.
No. 24—Studebaker.
No. 26—Studebaker.
No. 27—Oakland.
No. 30—Garford.
No. 35—Oldsmobile.

HOWER CONTEST.

No. 100—Pierce.
No. 103—Pierce.
No. 104—Premier.
No. 107—Stoddard-Dayton.
No. 112—Stoddard-Dayton.

The Hower "Run Off."

The first day's route for the run off in the Hower contest led from Saratoga to Utica, N. Y. All five cars reached Utica without penalization, and continued the next day to Buffalo, where all of them arrived during the afternoon, with their scores still intact. They checked in at the headquarters of the Buffalo A. C. and then proceeded to the Buffalo Carburetor Garage, where the cars were stored over Sunday. On Monday morning eight cars left Buffalo to start over the original route of the tour anew. These were the five cars tied for the Hower Trophy, the Reo pilot and confetti car and two Pierce cars, which were Nos. 1 and 99, respectively, in the regular tour. The Reo car was the first to leave, at 5:30 a. m., being occupied by R. M. Owen and Secretary Dai Lewis, of the Buffalo A. C., who is in charge of the "run off." On Monday the route was from Buffalo to Cambridge Springs, and on Tuesday from the latter point to Pittsburg. In order to eliminate perfect scores with the greatest possible dispatch the average speed for each day's run was fixed at 20 miles per hour.

The Premier car, No. 104, was eliminated on the run from Cambridge Springs to Pittsburg. The front axle broke and the car was ditched. All the other four contestants reached Pittsburg in good shape, and started on Wednesday morning for Bedford Springs.

Records of Penalized Cars.

GLIDDEN CONTEST.

No. Car.	1	2	3	4	5	6	7	8	9	10	11	12
9—Premier	0	0	0	0	0	0	0	1,000	Out.			
12—Franklin	0	0	0	60	Non-contestant.							
22—Marmon	0	0	0	0	0	0	0	0	0	10	Out.	
23—Marmon	0	0	0	0	0	0	0	0	0	0	0	Out.
25—Studebaker	0	0	0	0	0	0	Out.					
28—Oakland	0	7	0	0	0	0	0	0	0	42	0	0
29—Garford	0	Non-contestant.										
31—Garford	0	0	6	0	0	0	0	0	0	0	Out.	
32—Selden	0	0	0	Non-contestant.								

HOWER CONTEST.

No. Car.	1	2	3	4	5	6	7	8	9	10	11	12
101—Reo	0	0	0	0	0	12	0	0	0	0	0	8
102—Moline	0	0	0	51	Non-contestant.							
105—Gearless	Out.											
106—Franklin	0	0	0	181	Non-contestant.							
108—Overland	0	0	9	102	Non-contestant.							
109—Stoddard	0	0	68	0	0	0	0	0	0	Out.		
110—Overland	0	0	0	302	0	33	0	Non-contestant.				
111—Overland	0	0	Non-contestant.									
113—Blomstrom	0	296	Non-contestant.									

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Defects of the Glidden Tour Rules.

Nothing could serve better to prove the defectiveness of the rules under which this year's Glidden Tour was run than the squabble with which the tour ended at Saratoga. In the first place it seems ridiculous that the rules should be such that the chance of winning the trophy could be spoilt by a slight miscalculation or act of forgetfulness on the part of a driver at the last moment when a car had completed the whole run with a perfect record. Suppose there had been two perfect score teams left during the last day's run, and that the score of one had been spoiled by such a miscalculation as is alleged to have been made by the crew of one car. Suppose also that the miscalculation had been acknowledged or proven, the trophy would then have gone to the other team, although the cars in the two teams respectively would have made exactly the same showing. This is really what happened in the contest which has just come to an end, except that the miscalculation is not admitted. It is quite obvious from this that the winning of such a trophy as the Glidden Cup is a comparatively empty honor; of course, the car which wins it must have done as well as any of the competing cars; but one-half or more of the cars entered may have made an equally good record. This year's run proves again the contention which has been made in these columns repeatedly, that it is not logical to hold a reliability contest for a single prize. Reliability is not such an absolutely determinable quality as speed, and with our present contest methods all that can be done is to ascertain whether or not a car is capable of accomplishing a certain run under certain conditions which may be assumed to require a certain standard of reliability. The logical, sensible thing to do if any more reliability contests are held is to return to the old certificate system. Give Glidden and Hower back their trophies and make an award of a perfect score certificate to every car that finishes without penalty points against it. In the present contest for the Glidden Trophy twenty-three cars finished with absolutely clean scores. Only three could possibly share in the honor of having won the trophy. Why should any three cars of the twenty-three be singled out to receive the award, and the other twenty, which so far as the contest has shown are equally meritorious, go unrecognized?

It is of course the club team entry feature of the regulations that killed the chance of many of the perfect score cars to participate in the award. This club entry system is nothing more nor less than a farce. It was originated because the manufacturers through their association had announced that they did not want a contest that year, and it then seemed to be possible to obtain entries only through the agency of the clubs. It soon became evident, however, that club members without trade affiliations will not enter their cars—the one or two private owners in each of the yearly runs have formed the exception that proves the rule. The entries still must come from the manufacturers, and if the latter have decided not to enter the clubs cannot alter their determination. The club system has, of course, the effect of more rapidly breaking up perfect scores. Where there would have been twenty-three perfect scores at the end of the last Glidden Tour under the individual entry system there were only three under the club entry system. But it also has this pernicious effect, that a perfect score of a single car does not count; not the car, but the team, is the competing unit, and where cars of different makes form a team a comparatively excellent make of vehicle may be deprived by a poor team mate of all chance of figuring as the winner. If the event were of a sporting nature the team system might be all right, but for a practical test of the merits of different makes of cars it is wrong.

The "one man" management plan has also proven defective. We still believe that the idea of a single manager of the tour is all right, if there were a committee representative of all of the entries back of the manager, to which any such involved questions as the Peerless protest could be referred. The "single manager" plan would make for expeditiousness in the ordinary routine work of the tour, while if all protests that are not plainly covered by the rules were referred to a representative committee there could be no charge of partiality. It was stated in one report of the finish of the tour that the dispute which arose was referred by Mr. Hower to Dai Lewis, Starter Ferguson and several other officials. As these were all his appointees and underlings, the proceeding was hardly more satisfactory than if Mr. Hower had reserved the decision to himself.

In conclusion a word should be said of the excellent aggregate showing in this year's tour. Of the thirty starters in the Glidden contest no less than twenty-three finished the 1,600 mile run with perfect scores, and of the fourteen starters in the Hower contest five finished with perfect scores and are now continuing the "run off" until all but one of the perfect scores shall have been broken. A great many of the cars which dropped out of the two contests did so as a result of a collision or ditching accident at high speed and entirely independent of the merits of the car. Had there been less speeding even more cars would have reached Saratoga with perfect records.

The Vaporizing Function of Carburetors.

It would seem that there has recently taken place an important change in the point of view from which the carburetor problem is being regarded. Originally considered as essentially a problem in effective vaporization, and attacked by providing an enormous surface of gasoline moistened material with which the air for the mixture was brought into intimate contact later, and especially for the last few years, the accent seems rather to have been placed upon the measuring function of the carburetor or the proportion borne by the liquid fuel supplied to the air admitted. No doubt this latter view of the problem was given too slight consideration in the days of surface carburetors, but it is beginning to be suspected that in modern carburetor design it is being considered to the neglect of the matter of vaporization per se. Recent analyses of exhaust gases and investigations concerning the state of the mixture in the intake manifold and inlet passages have demonstrated that much of the liquid fuel supplied the cylinders reaches them, and that a portion leaves them in an unvaporized or nucleated condition. That is, there is not an intimate mixture of the hydrocarbon with the oxygen of the air at the time of the entrance of the charge into the cylinder, and often not a complete mixture at any time. In most modern carburetors the gasoline, leaving the spraying jet in minute globules, must be vaporized, if at all, by the air in which it is entrained in the way in which water globules are in wet steam. The amount of heat present in the admitted air being limited, and the time available for vaporization being excessively short, the process of gasification at the carburetor and in the piping is very imperfect. There is a reasonable suspicion that a large part of the actual process of carburation is, in fact, accomplished in the ports and cylinders. It would be interesting to know, in this connection, whether the admittedly superior fuel economy of the air cooled engine is not as much a matter of its presumably greater capacity for this vaporizing action as it is a matter of lower cylinder wall losses.

Recently, attention has been directed toward the shortcomings of the modern carburetor as a *vaporizer*, and something has been accomplished toward their elimination. A reversion toward the idea embodied in the old time surface carburetors seems to be indicated: that is, toward the provision of increased surface within the carburetor, or in connection therewith, upon which the properly measured liquid fuel can form a readily vaporizable film. The provision of adequate heat energy, and especially the arrangement of the heating surfaces, which carry the fuel film, so that the transfer of heat may be prompt and sufficient, is of the greatest importance. Water jacketed intake passages, such as are found in recently designed "block" motors, are a step in this direction.

Researches are also being conducted concerning the relative volatility of various fuels and their component hydrocarbons, their specific heats of vaporization and the temperatures and pressures under which they will maintain the vapor state. Such investigations are of extreme importance, especially as fuels more difficult of evaporization are now being forced into use.

The use of improved carburetors and connections, which shall deliver a "dry gas" to the cylinders, will not only result in fuel economy, cleaner cylinders and higher weight efficiency of engines, but will reduce the disagreeable and harmful nature of the exhaust gases. It is pretty evident that the carburetor of the future, while it must be correct in its measuring function, must also possess improved powers of permanently vaporizing and mixing the fuel which it handles.

Our Runabout Number.

On September 23 we will publish a special Runabout Number, devoted wholly to runabouts and similar light cars in the use of physicians, contractors, real estate men, traveling salesmen, mail carriers, farmers, etc. Every phase of this branch of the automobile business will be discussed. We intend to publish in this issue articles on the design and construction of light machines for strictly business purposes, the field for and prospects of one, two and four cylinder runabouts respectively, runabout body design, bodies of different materials, special bodies for carrying samples, equipment, etc. We will also have numerous articles from men of the above enumerated classes who have used the automobile in their work, relating their experience in so far as it may be of interest to other users or prospective users. A number of articles coming under this heading have already been received, and we wish to hear from others who have used cars in their business or profession and are willing to write down their practical experience. The following points should be covered in articles of this sort: The advantage of the automobile over the common means of travel in the particular field; type of car used and its features, and any special reasons for its selection; cost of operation; provisions for caring for cars; any special incidents in the use of the car proving its value for the particular line of work; uncommon mishaps and unusual repairs or improvements made to the car.

In addition to the technical and experience sections, this special number will contain a foreign markets section, consisting of articles from correspondents in almost all foreign countries of importance as to the possibility for selling American runabouts there. It is a well known fact that with few exceptions the demand for automobiles in undeveloped countries is for light, sturdy, economical cars, mostly for local use, and there seems to be good reason to hope that the American industry, which was the first to develop this type of car, will eventually secure a large share of the market in all countries where these conditions obtain and which have no automobile industry of their own.

Readers who can furnish articles relating either to runabout design and construction or to the use of runabouts—writing from experience—are requested to write to the editor at once.

Sliding Scale of Dealers' Discounts.

The sale of commercial vehicles undoubtedly involves greater effort than the sale of pleasure cars. The agent in many instances must demonstrate the paying qualities of his car before he can make a sale, and this necessarily involves considerable expense. Moreover, it is extremely desirable from the manufacturer's standpoint that his agents in the larger cities establish some sort of maintenance system, which, in turn, necessitates a considerable investment on the part of the agent. While the location in a large city and the possession of a well equipped sales and garage establishment are factors tending in themselves to an increased number of sales, and thus to increased revenue, it would seem that the risks incurred by the agent in making the investment and the benefit which the manufacturer may derive therefrom warrant an increased commission on cars, as compared with the commission paid to small dealers who are making practically no investment, and perhaps handle the commercial car only as a side line. The prospects for the success of the cars in the hands of users are far better if all are sold through a few large agents who look after the cars on a maintenance contract basis than if sold through small agents whose interest in the cars ceases as soon as payment has been received. Recognizing these conditions a newly established commercial vehicle manufacturing firm offers a sliding scale of discounts from 30 to 20 per cent., dependent entirely upon the volume of business done by the agent in the course of a year. It would seem that this arrangement is fair to both the small and the large agent

Two Cycle Motors.

(Address by E. W. Roberts before the Mechanical Branch of the A. L. A. M. Slightly condensed.)

There are quite a number of features in two cycle motors, like fuel economy, etc., that I have not been able to test out to my satisfaction, because I have not been able to run the tests for any length of time, and, as is well known, a short test is absolutely useless from an engineer's standpoint. The most important things from a designer's standpoint are, as a rule, ports, port location and port areas. I have designed in the neighborhood of ninety-two cycle motors in the last four or five years, on the basis of tests made in my own factory, having conducted an experimental workshop for three years before I started manufacturing. I have not been able to take any indicator diagrams, and have not worked in as scientific manner as I should have liked.

PORT TIMING.

In the first place, let us take the crank circle, which plays a most important part in the design of a four cycle, when laying out the valve movements. The usual practice, as I have seen it, is to open the inlet valve at or near the head centre and hold it open until the other centre is passed. In four cycles I have had very good success by holding the inlet valve open from 12 degrees past the head centre to 42 degrees past the outer centre. This is a little longer than the practice of a good many.

The principle I have always gone on in the opening of the intake, both in the four and two cycle, is to hold open as long as possible without blowing back at moderately low speed. In two cycles the time of the opening is limited in this way: If we are to use only one carburetor on a four cylinder engine, we must not have two intakes open at the same time, and, therefore, we have to use a little less than 45 degrees on each side of the centre. So the intake must be open a little less than 90 degrees; 43 to 44 is about what I use.

The exhaust timing is not so important in this regard, if the exhaust is so carried off that the gases from the various cylinders will not interfere with each other.

The intake port to the crank case, which is opened and closed by the lower edge of the piston, I usually arrange so it will start to open 44 degrees before the piston reaches the head centre. The opening and closing will take place at the same angular position of the crank pin. This will leave the intake port open during 88 degrees of the crank circle. Now, in a single, a two or a three cylinder engine it is practical to leave the port open a little longer, and I have used as much as 48 degrees on each side of the centre, without a blow-back through the carburetor.

CRANK CASE COMPRESSION.

The lowest crank case compression that I have found to give good results is 4½ pounds. I usually aim to get between 6 and 8, and most of my engines have 8 pounds.

PORT OPENINGS.

Let us take up next the cylinder inlet port, or that which communicates with the transfer port leading to the crank case. I refer now to the plain three port engine. In the engine as ordinarily built for marine purposes this port can be kept open for the same time as the inlet port to the crank case, i. e., about 90 degrees. In the large ported high speed motors I have had to reduce this time somewhat. It must be remembered that the cylinder intake port should open after the exhaust port in order to allow the pressure in the cylinder to fall below that in the crank case before the port leading to the crank case starts to open.

It is my custom to make the opening of the exhaust about 58 or 59 degrees on either side of the centre. It must be remembered that the exhaust must not only open soon enough but it must also open full enough to prevent any chance of the hot gases rushing back through the transfer port to the crank case, and thus cause a crank case explosion, or, as it is often called, a "back fire." You can prevent this to a certain extent by the use of a screen in the by-pass, but I have very little use for a screen as a rule, because it is troublesome to take care of. It chokes up very easily, and the easiest way to clean it is to put in a new one.

As I have already pointed out, in the ordinary type of slow speed marine engines with small port areas I have used 90 degrees as the port opening for the cylinder inlet. But when I enlarged the ports for efficient running at high speed this angle proved too great. I am unable to tell you the exact angle off hand, but on 5 inch stroke the distance along the piston travel was reduced one-eighth inch.

LAYING OUT PORTS.

When laying out the ports of a two cycle do not work to the proportion of the piston travel. Always lay out the angles on the crank circle and work to the points these angles will give you, and remember that it is a case of time and not distance. Another thing you must bear in mind is the shortness of the time that the two cycle three port intake is open as compared to a four cycle. You must have a larger area than you would with a longer opening. While the crank case inlet of a two cycle motor is open but 90 degrees, the inlet valve of a four cycle is open anywhere from 200 to 210 degrees. Let us say 200. You will see, therefore, that you have in a four cycle more than twice the time of opening that is employed in a two cycle of the three port type. Hence the area of the intake must be more than twice as great in the latter as in the former. Common practice is to keep the average speed of the ingoing air at the normal speed of the engine down to 100 feet per second.

ROTATIVE SPEED AND POWER.

In order to keep close to this speed in a 4½ inch by 5 inch engine I have had to use a 2 inch carburetor. On a four cycle about 1¼ inches would be ample. For marine purposes I have usually designed for a normal speed of 750 r. p. m. In boats of the ordinary type one is limited by the speed at which a propeller may be operated efficiently, as at high speed cavitation occurs. I have designed a great many 4½ inch by 5 inch marines for this speed and have always used a 1½ inch carburetor. I found that with this size and with ports in proportion, the torque began to fall off at speeds above 600 r. p. m. By the use of a 2 inch carburetor with corresponding ports I have been able to keep the torque practically constant up to 1,000 r. p. m.

I found that with a brand new 4½ inch by 5 inch two cylinder I obtain about 20 actual brake horse power, or 19.89 b. h. p. to be exact.

AUTOMOBILE MOTORS.

I will now take up the question of two cycle motors in automobiles. It has usually been found that they give more power in proportion at low speeds. When climbing a hill or doing heavy work they will hang on to their load tenaciously. This is due to the fact that they are low in torque at high speeds, owing to being choked. If you will figure out the speed of the air entering the crank case during 90 degrees of the piston travel, and at 900 to 1,000 r. p. m., you will find that in the average two cycle motor it is enormous. As I remember, a 4½ inch by 5 inch, with a 1½ inch intake, figures out 190 feet per second at 900 r. p. m. With a 1½ inch intake the port will be about 2¼ inches long, measured along a chord of the cylinder bore. With a 2 inch intake the area is five-eighth inch greater, and the ports are correspondingly longer.

PORT BARS, CRANK WEBS, ETC.

In order to keep the rings from jumping in the ports when they are so long it, is necessary to use bars across them. I find the best way to make an exhaust port bar is to core it hollow and run water through it.

Referring again to the crank case compression, in my judgment 8 pounds is about right, and I find if I go beyond 10 pounds I am likely to get into trouble. You will find that a great many designers who are just starting on the two cycle engine proposition have the impression that it is necessary to get the highest possible pressure in the crank case. And, in order to get it, they use filling blocks; that is, discs attached to the crank webs. I find that by making the crank case as close to the moving parts as possible, leaving approximately one-quarter inch clearance, I usually obtain 8 pounds crank case compression. In other words I follow as closely as possible to the path of the crank shaft and the connecting road.

DEFLECTING PLATE.

Quite a little importance attaches to the design of the deflecting plate so as to get the best results. I get very good results by turning the ends of the deflecting plate toward the cylinder wall. In large engines the top of the piston should slope away from the deflecting plate toward the exhaust port. The deflecting plate should project from the piston as far as the clearance will allow, making it reach within about three-sixteenth inch of the cylinder head when at the end of the stroke.

CRANK CASE LEAKAGE.

With reference to keeping the crank case tight, there is a mistaken impression that as the engine wears the crank case will leak along the shaft, and quite a number have attempted to use packing to prevent it. This can be done quite readily on single cylinder engines, but on a multiple cylinder it becomes quite a difficult proposition. The best practice is to use something that will stand the wear, and use a comparatively long bearing. I am using die cast nickel babbitt.

For lubricating the crank shaft on marine engines I use No. 3 Albany grease, but for automobile motors I use a force feed oiler. The grease acts as a packing, and with a force feed oiler, the oil being under higher pressure than the air in the crank case, usually prevents its escape. If you do not use pressure feed the pressure in the crank case may prevent the oil feeding properly.

I have known a crank shaft bearing to be worn one-thirty-second inch without impairing the action of the motor. I know Elmore motors have been running around our town for four or five years without renewing the bearings, and they are still giving as much power as when new. One in particular I have in mind, which is now used by a piano salesman who is on the road a great part of the time, and, in fact, his car is the old "Pathfinder," which made the trip to St. Louis from New York and back twice, and you can imagine the wear that it has been subjected to.

CYLINDER LUBRICATION.

Regarding the matter of lubricating the cylinders I have tried about everything imaginable, and I find I get the best results by feding the oil to the intake just beyond the carburetor. The oil then goes in with the mixture, separates out in the crank case, and distributes all over the interior. This may possibly take a little more oil than other methods, but it works best.

However, when you lubricate the crank shaft bearings by a force feed oiler you can eliminate the oil feed to the intake manifold. This may be done by feeding considerably more to the bearings than they require, and the oil will pass through them to the crank case, and in this way reach the cylinders. I have run a racing boat at full speed for three hours at a stretch using this method of lubrication. It has the advantage that if one cylinder is not getting enough oil you can feed more to the bearing nearest to it.

SPARK PLUG POSITION.

The best position for a spark plug is, I believe, directly in the centre of the cylinder. If it is placed on the side of the cylinder, especially on the exhaust side, it is apt to require too much lead. The two cycle engine is very sensitive to placing the spark plug in a pocket, for this will increase the lead, and if you do not get enough lead at light loads you are very likely to get crank case explosions.

CRANK CASE EXPLOSIONS.

Crank case explosions are due generally to the exhaust gas in an incandescent state rushing down through the transfer port, and setting fire to the mixture in the crank case. Sometimes they are due to an overheated crank case. The period of inflammation of the mixture is the same in fractions of a second for the same proportion of mixture and the same compression. For low compression and weak mixture the period of inflammation is longer than for high compression and rich mixture. Now, one of the necessary points in avoiding crank case explosions is to get the flame out when the intake port opens so as to not set fire to the incoming charge; that is, the charge that is entering the cylinder from the crank case. Therefore, when running on low throttle, and consequently on low compression, it is necessary either to enrich the mixture or to advance the spark. Therefore you can quite often stop crank case explosions at low speed; or, in fact, at any time by advancing the spark.

THE CARBURETOR PROBLEM.

The carburetor problem on a two cycle motor is a difficult one. We have had carburetor men at our factory time and again who had to confess themselves "beaten." One thing I have found is that the initial air intake on a two cycle carburetor should be much less than on a four cycle. In fact, on my smaller motors I use no initial air intake at all.

We are all familiar with the Schebler Model D, in which there is an initial air opening in the throat of the valve head just below the valve. In one of these carburetors, which I use on two cycle motors, there is no such opening, and all the air passes through the compensating valve. This has a tendency to give a slightly richer mixture at low speeds than at high speeds. I have tried as small a fixed air opening as one eighth inch, but the motor would back fire at low speed with this opening. In the larger sizes where I use the 2 inch carburetor I employ a fixed air opening of three-eighths inch diameter. If I do not use this air opening the carburetor will flood when I slow down.

I have found that the small size carburetor, in which I use no initial intake, will stand a small initial air opening when used on a single cylinder engine. Why this is I cannot tell, and I do not know whether other two cycle manufacturers have had the same experience or not.

I cannot use the type of carburetor with a throttle on the gasoline, because this carburetor gives a richer mixture at high speed, while in a two cycle you must have the rich mixture at low speed. This is why you have to make your initial air intake very small.

MANIFOLDS.

For the exhaust manifold I use a long curve in the form of a U which leads the gas from two cylinders. In a four cylinder engine I join these two by a long curved Y pipe so designed that the exhaust does not interfere with that of another pair of cylinders. With three cylinders or less we do not have to be quite so particular, but still it is best to let the exhaust out with as little resistance as possible. In my small motors I use a straight pipe with the branches from the various cylinders curving into it. This makes a very convenient form, but is not quite so efficient as the manifold with the large curves.

The intake manifold needs careful attention, and if not properly designed will cause one cylinder to get more gasoline than another, so that while one cylinder is getting the proper mixture the other will be flooding. The best form of intake manifold for a three cylinder engine is shown in the accompanying drawing (Fig. 1). In another form I tried bringing the mixture down from above so as to raise the carburetor, and found that the reversing of the current has a separating action and causes the gasoline to deposit in the corners of the manifold. I was compelled to abandon the pouch and go directly to the straight pipe joining the three cylinders, as shown in the illustration of the larger manifold (Fig. 2).

STRONG SUCTION EFFECTS.

No matter how well designed your intake is, if the carburetor does not give a homogeneous mixture, one cylinder is sure to get more gasoline than the others. The carburetor must be such that it will give a homogeneous mixture. You must remember that the suction from the intake port of a three port engine starts with a high vacuum and the air goes through the carburetor with a rush. For example, when one of our large engines is run by a belt at 300 revolutions, a board held three-quarters of an inch from the opening will be pulled out of your hand. In fact, I have placed a box weiging 8 pounds against the intake and the suction held it there.

It is customary with many manufacturers to use paper gaskets for the joints in the crank case. These are generally pasted to one side of the joint with shellac. It is quite a little work to put one on and much more of a job to take it off. A much better way is to scrape the joints to a surface plate and put the parts together metal to metal, and in this way make an air tight joint.

THROTTLE LOCATION.

I formerly held to the opinion that the only proper place for a throttle for a two cycle engine was in the by-pass or transfer port. The theory was that if you throttle at the carburetor you weaken the pressure in the base, and that the pressure in the base being lowered would not resist the rush of the flame from the spent charge in the cylinder. I assumed that by throttling in the by-pass I would retain the pressure in the crank case and at the same time choke the passage and between the two prevent the burning mixture from rushing down into the crank case. This proved good practice with an ordinary carburetor that did not give a good mixture, but by using a carburetor which gave a good mixture I found I got better results by throttling at the carburetor. I was very glad to discover this, as the by-pass throttle is difficult to make.

CRANK PIN LUBRICATION.

In a slot in the bottom of the connecting rod I fasten two or three thicknesses of flat lamp wick. This wick is allowed to extend so it will rub against the inside of the case, and it soon wears off until it just touches the case. Much of the oil is swept up through the transfer port as fast as it enters, and very little of it left in the crank case, but no matter how little oil is in the crank case, some is wiped off the side by the wick. I have frequently examined the wicks after they have been in use and can always squeeze three or four drops of oil out of them.

CRANK SETTING—VIBRATION.

The cranks are set 180 degrees, and therefore they get very little vibration. In a four cylinder engine the cranks in each pair of cylinders at the ends are set at 180 degrees to each other, and each pair is set 90 degrees to the other pair. That is, Nos. 1 and 2 are set 180 degrees to each other and at 90 degrees to Nos. 3 and 4.

In order to show you how steadily a four cylinder will run, I would say that I have taken a full length Eagle Diagraph pencil and, after removing the eraser, have stood it on end on the cylinder. I ran the engine at 600 revolutions, holding a tachometer on it all the time, and the pencil stood up just six and one-quarter minutes. Of course you can do that with a four cycle engine using a short pencil. Even with a two cycle if one of the cylinders gets out it is apt to vibrate and throw the engine out of balance.

HEATING—CYLINDER FINISHING.

I have had some difficulty with some of our large engines heating in the cylinders when first started up on the testing block. I have found a very peculiar thing in three or four cylinder engines. If the cylinder in one end stops working for any cause the cylinder on the opposite end will start to heat.

The construction of two cycle engines requires very careful work. I find it advisable to mill the ports by using a milling cutter of small diameter and drop the cut right into the port. This gives the right width and the right distance from the end of the cylinder. If you do not get your ports right you will get into trouble. A great many manufacturers file them to gauges, but this is troublesome and inaccurate. You really have got to grind a two cycle cylinder to get good service, because a reamer will jump more or less in going over the ports. A great many have the mistaken idea that grinding the cylinders will imbed emery in them. Some lap the pistons into the cylinders.

PINNED PISTON RINGS.

I do not know why it is that so many two cycle manufacturers use the very small ports that they do. It may be that when they use the long port the rings will spring out and break. It is necessary to pin the rings so that they will not turn and allow the opening to come opposite the port. I have been compelled to use piston ring pins of three-sixteenths of an inch diameter, because when putting in one-eighth of an inch pins the men would twist them nearly in two and they would break off in use.

DIMENSIONING PARTS.

The only thing that I take into consideration in providing for the precompression is the clearance in the crank case, and I try to make it as close as I can, and I always use as short a connecting rod as possible—1.8 times the stroke is about as short a rod as I dare use. For instance, I would use a 9 inch rod for a 5 inch stroke. I have found that the diameter of the piston must be greater than the stroke. If you wish to hold the same conditions in one engine as in another you must keep the area in the same proportion to the stroke. From three and one-half to four and one-half times a stroke is the area that you will find gives the best results. I have designs in all kinds of proportions. The bulk of them run from 4½x5 to 3x2½.

POWER—FUEL CONSUMPTION.

I find that I can usually get about one and one-half times the power from a two cycle engine that can be obtained from a four cycle. In the formula which I published in the "Gas Engine Hand Book" some six years ago, in which the numerator is the diameter squared and multiplied by the stroke in inches, multiplied by the revolutions and divided by a constant to give the horse power, I have found 13,500 is about right for the best practice in four cycle engines, and that 9,000 agrees with the usual results I obtain from two cycles.

Fuel consumption I have not been able to determine in a satisfactory manner, but I believe it runs about 10 per cent. greater than in a four cycle. A great deal depends upon the carburetor. I find you must get as thorough a mixture as possible or you are apt to get a condensing action in the crank case. The engine should be enclosed in a hood so that the crank case can be kept warm; if the crank case is exposed in cold weather the gasoline will separate from the air and remain in the base.

LOW SPEED DIFFICULT TO MAINTAIN.

It is difficult to get low speed on a three port engine. By low speed I mean below 150 r. p. m. You would have to have mechanically operated valves as on the Koerting, and to get good results you should use a separate air pump.

As an instance of the peculiar action in the crank case of a three port engine, I would say that on a 4½x5 inch of my design I put a pressure gauge on the crank case; at a certain speed the gauge would show 8 pounds pressure. Below or above that speed the pressure would gradually drop to nothing. Why? I puzzled for a long time over it. I believe it is because that at low speed the mixture escapes and at high speed it does not get in.

Another thing that should be remembered is the contact angle of the timer. I find you have to use at least 34 degrees. Beyond 85 pounds compression I get self ignition and pounding. With kerosene in four cycle engines I cannot go beyond 70 pounds.

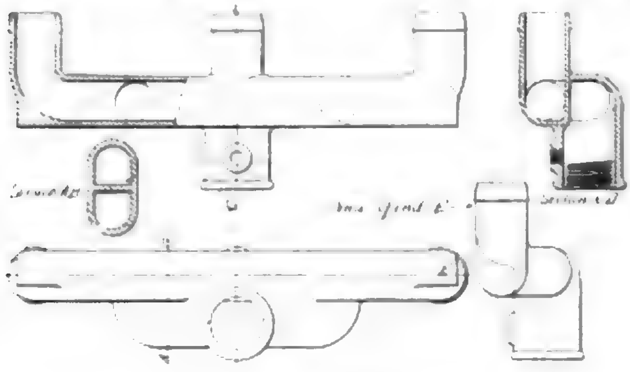


FIG. 1.

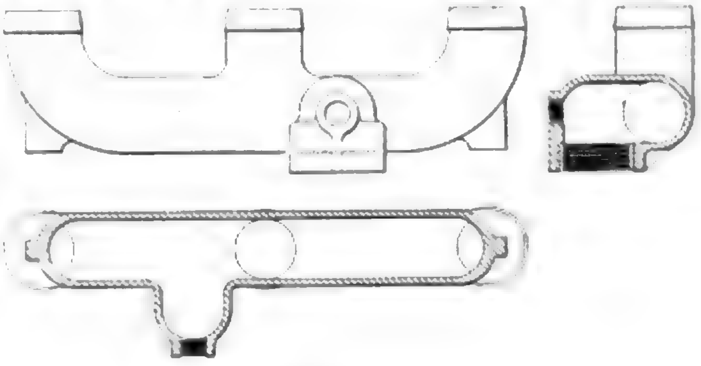
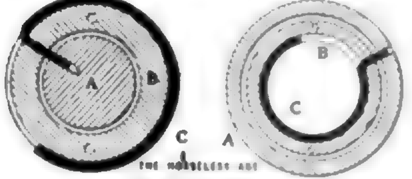


FIG. 2.

Odds and Ends.

By Warren Noble.

When I work up some new design or lay out a detail I very often find it difficult to neatly and completely carry out certain portions of the design dependent upon work already done and approved of, and presuming that other designers are occasionally meeting with like difficulties, I have compiled a number of such cases that have come up within the scope of my experience. Such matters are, of course, difficult to arrange in any order of continuity, but I hope that the reader will glance at the sketches and find at least some that are new to him.



Figs. 1 and 2.

LOCKING CIRCULAR NUTS (FIG. 1).

A groove is turned in the unthreaded circumferential portion of the nut B to a depth of about half the diameter of the spring wire C, which is bent into the form of a ring as shown. The nut is screwed up as desired, then the radial hole is drilled in any desired position through the nut and into the shaft A. The wire ring is then sprung into position, completing the lock. Fig. 2 shows the lock applied to an internal nut.

THE BUTTRESS THREAD.

The buttress thread is self locking when loaded in the direction of arrows A in Fig. 3; when it is loaded as shown by arrows B it will support heavy pressures without binding. The diagram Fig. 4 gives the most desirable proportions of the thread. Such a thread is particularly useful in cramped spaces, since, being absolutely self locking, it dispenses with the need of a lock nut.

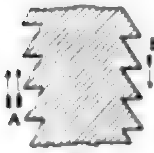


Fig. 3.

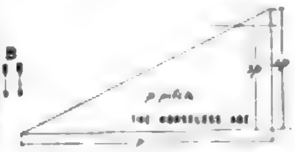


Fig. 4.

An adaptation of the buttress thread giving an absolutely positive lock is shown in Fig. 5 It is of particular advantage in exposed places, since all threads are completely incased. When used on steering connections and on running gear parts, these may be taken apart as readily as they can be assembled, even after long periods of use under adverse conditions.

FIXING FLANGES (FIG. 6).

The use of steel balls instead of bolts, combined with a holding nut to secure all of the balls, is particularly economical where there are a number of flanges in series, as in a gear box. The arrangement is not only stronger and cheaper than the usual arrangement, but there is considerable advantage in the entire absence of nuts. To permit of readily inserting the balls drill small holes through the assembled flanges, and after taking the flanges apart again, form sockets with a ball ended bit. This sytem is almost universal in its application. I have used it in ordnance machinery subjected to extraordinary strains with unfailing satisfaction. In automobile engines it is particularly useful as a means of avoiding studs and reducing lengthwise dimensions.

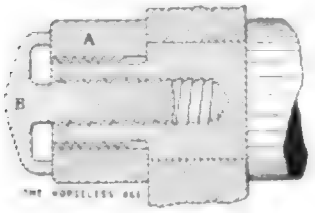


Fig. 5.

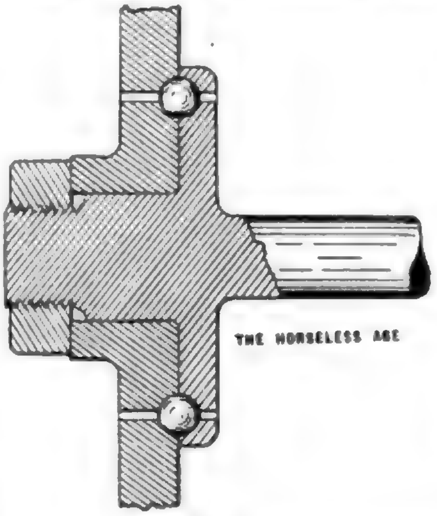


Fig. 6.

UNIVERSAL TOOLS.

A universal tool system is possible, but not always advisable. For some purposes, however, the system has many advantages, as, for instance, in connection with the port plug shown in Fig. 7, which can be handled with greater ease by adopting this system. Fine gear teeth are cut on the edge of the plug, a bushed hole is drilled at a distance from the centre of the plug to locate the tool, which consists of a length of hardened cast steel cut over its whole length, with teeth of the same pitch as the port plug. One end of this tool is turned down to fit the locating bush, and the other end is provided with a cross handle for the operator. The tool, therefore, becomes a standard pinion, and the leverage possible is considerably increased. The adoption of such a system for large annular nuts and similar parts is in the end more satisfactory than the supply of a series of special tools.

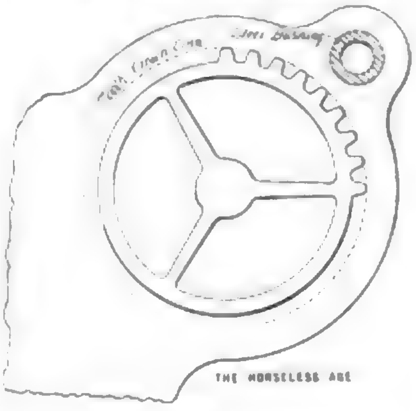


Fig. 7

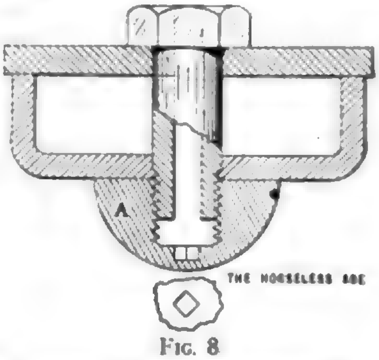


Fig. 8

SMOOTH FINISHED BOLT FIXING.

The bolt, Fig. 8, is drilled, and the nut A has a spare recess cast in it. To assemble the bolt and nut a piece of square stock is run down through the bolt into the recess in the nut, to hold the nut by when screwing the bolt home.

INTRODUCING A RING.

Fig. 9 shows a method of introducing a spherical ring into a housing without dividing the housing. The housing A is slotted radially on one side, the slots being just deep enough to clear the housing for the width of the ring B to be introduced to its greatest diameter. The ring B is then introduced at right angles to the direction of its final location in the housing, and then turned around into place, when it is securely assembled, and can only be taken apart again after being rotated into the plane of the slots.

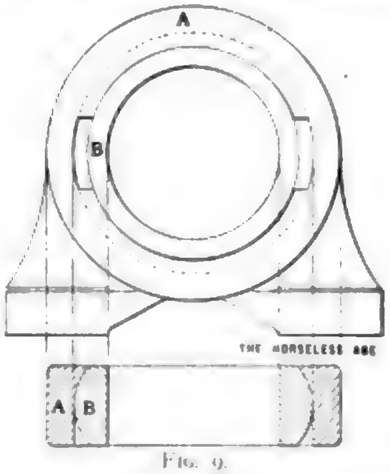


Fig. 9.

This method of assembling is very useful at times. I have applied it successfully to radiator trunnion construction, mounting the spherical ring upon a cylindrical extension of the radiator bracket, this permitting of motion in the direction

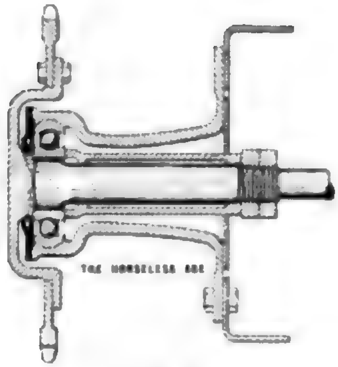


FIG. 10.

of the normal to the plane of the spherical ring, and providing an absolute universal motion.

The application of this method to a sprocket shaft bracket is shown in Fig. 10. It is the best arrangement for this purpose that has yet come to my notice, and the only drawback in its use is that the outer oil retainer must be divided.

PROTECTING BALL BEARINGS.

For keeping a ball bearing absolutely clean there is no better method than that illustrated in Fig. 11. The drawing really shows two variations of the method. On one side of the bearing the thin steel washer bears against the outer brace, this representing construction A. In construction B the washer is just clear of the race. Personally I prefer construction A, for, although there may be some slight friction where this is used, it is so small as to be negligible. The revolving washer has a tendency to cause all grit getting between it and the outer ring of the bearing to move outward, thus protecting the bearing.

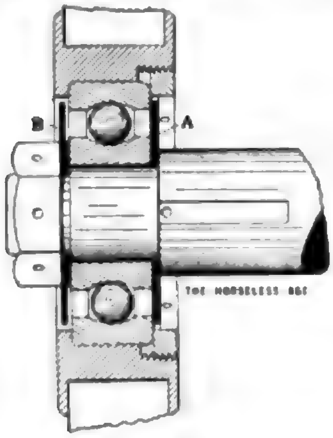


FIG. 11.

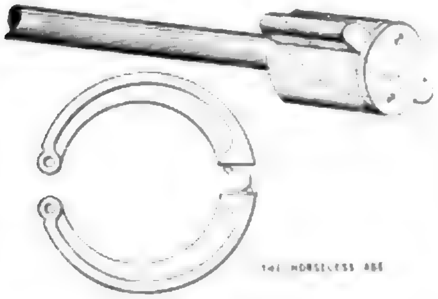


FIG. 12.

SPREADER CAM FOR BRAKES.

Fig. 12 illustrates a useful kink in connection with an expanding brake or clutch operated by means of a spreader cam. Here the cam is in the form of a tongue, which is free to slide diametrically to its operating shaft in a slot cut in the head of the shaft. A retainer plate holds the tongue in place. With this device uneven bedding of the clutch or brake shoes is impossible, as the tongue slides across until the pressures are equal.

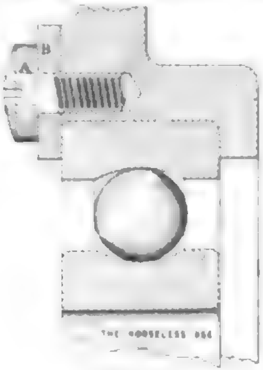


FIG. 13.

BALL BEARING RETAINER.

In Fig. 13 a means of retaining an uncaged ball bearing is shown. Two or more holes for small machine screws A are drilled and tapped so close to the edge of the outer race socket that a portion of the finished washer B will bear against the race and so retain it in position. Four such retainers are ample and will withstand quite heavy duty.

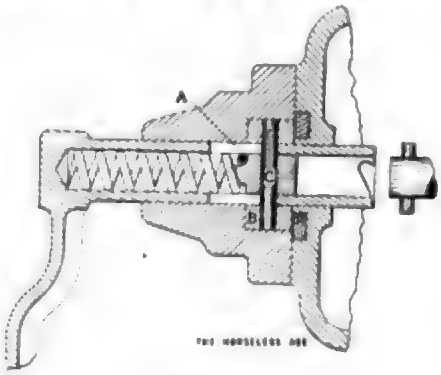


FIG. 14.

SELF CONTAINED STARTING CRANK.

A self contained starting crank without a stationary spring device is illustrated in Fig. 14. The starting crank shaft is provided with a longitudinal slot A. Above this slot and free to slide is a collar B, which may be retained in the direction of the shaft by any suitable means. A cross pin C passes through the slots and through a block sliding within the bore of the shaft of the starting crank. The spring is located within the bore of this shaft, and its free end presses against the internal block. If the device is assembled as shown in the sketch it will not get out of order.

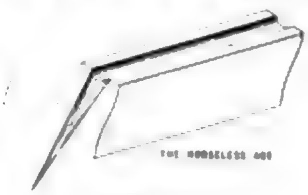


FIG. 15.

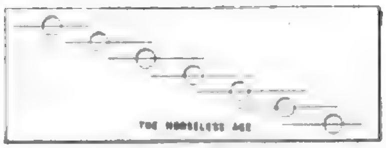


FIG. 16.

GEAR PUMP KINK.

In making gear pumps for water or oil it will be found an advantage to cut a shallow groove radially on the end of each tooth and also along the crown of the tooth. The radial grooves end at the centre of the gear and do not communicate. This is the water seal of the Albany Pump Company.

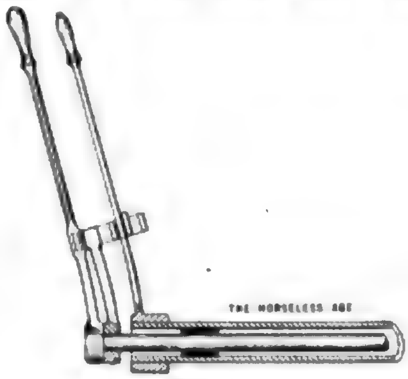


FIG. 17.

DEVELOPMENT OF FRICTION SURFACE.

Where a metal to metal braking or clutching surface is exposed to oil or dirt, which is found to reduce the friction, the trouble may sometimes be overcome by drilling holes through the rim of the friction drum along a diagonal line (Fig. 16) of the developed surface, so spaced and of such size that the transverse diameters of adjacent holes overlap. These holes act as scrapers, which cover the whole friction surface in a single revolution.

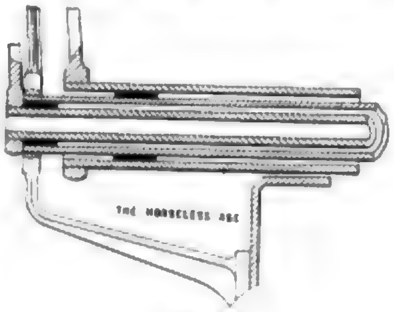


FIG. 18

PREVENTING STICKING OF SLIDE TUBES.

Trouble is often experienced with selective gear changing mechanisms, having a cross slide tube, owing to the fact that the shaft sticks when dust is thrown on to it while in the extreme left hand position. This may be partially overcome by so arranging the gear that the lever is in either the fore or aft extreme right hand position

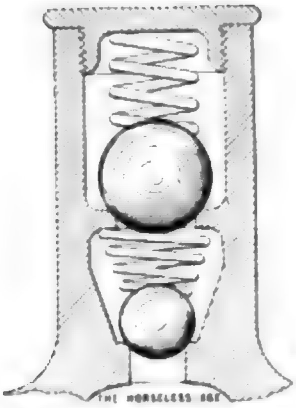


Fig. 19.

when the general running gear is in. A complete remedy for the trouble consists in locating the outer bearing for the cross tube at a distance from the end of the casing equal to the travel of the lever. If this is done that portion of the tube which slides through the bush is at all times protected.

Much trouble is also experienced with cross slides sticking when the side brake lever is in the "on" position. This is due to the twist in the cross brake tube under torsion, but a similar binding action often occurs in a "whippy framed" machine when standing on uneven ground. The ideal arrangement consists of three tubes, the central one supporting the cross slide tube and the brake tube. The central tube is supported universally from the frame brackets.

BALL CHECKS IN A SOLID HOUSING.

Fig. 19 shows a pair of ball checks in a solid housing. The lower ball is dropped in and the spring is introduced by coiling it closely, so as to pass through the opening closed by the larger ball.

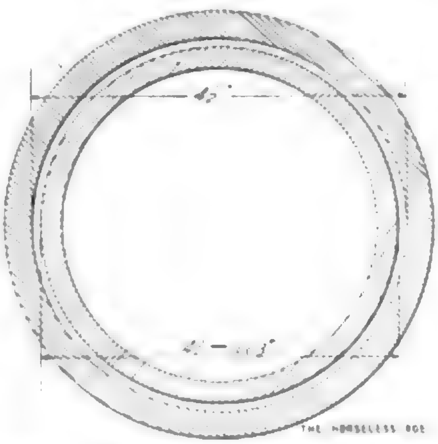
Piston Diameters.

By F. E. Watts.

There are three reasons why we make pistons considerably smaller than the bore of the engine cylinders, as follows: (1) To allow for inaccuracies in workmanship, (2) to provide room for an oil film, and (3) to compensate for unequal expansion due to heating. Sufficient allowance must be made so that in spite of inaccuracies in workmanship and unequal expansion there will always be room for an oil film.

There will always be a certain inaccuracy in machine work, but the limits we can work to are becoming closer year by year. At the present time it is quite common to allow the grinder hand a variation of half a thousandth in the diameter, both on the cylinder and the piston. But the variation on the piston must be below the drawing size, and that on the cylinder must be above. So the greatest variation permissible is one one-thousandth of an inch looseness. Pistons and cylinders may be finished practically cylindrical, so this one one-thousandth variation on the diameter is practically the only variation in the machine work. The expansion due to heating is the only factor which remains to be accounted for, and is what usually determines the relation between diameter of cylinder and piston. Let us consider the section through the cylinder and piston shown in the figure. The dimensions are such as might be put on the drawings, and represent the sizes when the cylinder and piston are cold. As the engine is run, both cylinder and piston heat and become larger.

The cylinder, being cooled, let us say, with water, does not get so hot as the piston, which is cooled only by the air inside it, and by radiation to the cylinder through the intervening oil film. Consequently the piston expands more than the cylinder, particularly at its head, where it is subjected to the greatest heat. In any engine which is run at a constant speed and load, the temperature of both piston and cylinder can be determined within narrow limits, and consequently the expansion of the two parts can be predicted. But under such speed and load variation as automobile engines are commonly subjected to, the proper allowance for expansion can only be ascertained by experiment. In addition to changes in size we must provide for distortion. The pistons and cylinders which we make at present never remain truly cylindrical when they are heated, and the effects of their warping out of "round" and "straight" add greatly to the complication of the problem. This side of the question has been admirably treated by Mr. Duryea in a recent communication on the subject of hot and cold motors. As he states, the subject of preserving cylindricity while the motor is running has not yet received the attention which it deserves. It would seem advisable from now on to devote thought to this end, rather than to more accurate methods of finishing. For there is little practical value in finishing to a closer limit of accuracy until we can make the expansion more even. Formerly some designers considered that a method of cooling in which the jacket water was evaporated and condensed promised much in this direction, as it maintained the cylinder at a practically constant temperature. But I think that this system has been entirely abandoned. The thermo-siphon system of cooling would seem to promise more even cylinder temperatures than the pump system, and this ideal would seem to be borne out in practice, for No. 4 in the appended table of water cooled engines is the only one which is cooled by this system, and its clearances are the smallest in the table.



Section Through Cylinder and Piston.

Since the cylinder of an air cooled engine is hotter than that of a water cooled motor, it would seem natural to suppose that its expansion would more nearly equal that of the piston. This, too, seems to be borne out by the table, for the best air cooled engines have a very small clearance, indeed. The figures in the tables are from late models of some of our best makers, and are the sizes which they think they are getting in the shop. It has been the writer's experience, however, that often variations from the drawings are allowed by the inspectors, so it would very likely be necessary to work in the inspection rooms of each factory to confirm the figures.

Piston Diameters for Water Cooled Engines.

No.	Bore.	Diam. Smaller Than Cyl. Head End.	Diam. Smaller Than Cyl. Open End.	Remarks.
1	3¾	.006	.002	
2	5	.004	.0015	
3	4⅝	.010	.001	
4	5⅜	.015	.0005	
5	4⅜	.006	.003	
6	5	.009	.005	Taper.
7	4	.007	.004	Taper.
Average.	4⅝	.0081	.0023	

Piston Diameters for Air Cooled Engines.

No.	Bore.	Diam. Smaller Than Cyl. Head End.	Diam. Smaller Than Cyl. Open End.	Remarks.
1	4	.007	.0025	Taper.
2	4¼	.008	.002	
3	4⅜	.003	.003	
4	5½	.003	.003	
Average.	4.54	.0052	.0026	

It would seem from these tables that we have not as yet any very accurate precedent for dimensioning the pistons of a new engine. Indeed, the piston sizes vary more than the dimensions show. With some only the top land is reduced in size; others make each succeeding land from the top down about a thousandth larger; still others turn the entire piston above the pin to the smaller size.

It seems to be more or less accepted practice to make the pistons of air cooled engines cylindrical. For instance, in one well known air cooled engine the piston is cylindrical, with an allowance of only .002 inch. It would seem to be more logical to finish the piston taper, which I understand is a common practice abroad, but one which has never been general in this country.

Holland some time ago adopted an automobile law which prescribed no definite speed limit, but made motorists responsible for any injury caused by their cars. This liberal legislation has not proven successful, and an amendment has been proposed by the Government to limit the speed to 15 km. in inhabited districts. The lower chamber of the Dutch Parliament has even reduced this limit to 10 km. p. h.

The Importance of a Careful Road Test After an Overhauling.

By The "Trouble Man."

When a car has been generally overhauled in a repair shop or has been placed there to have certain work done upon it, one naturally assumes that it will be delivered in a perfect condition, capable of immediate severe service. This is very often the case, but sad experience teaches that there is no time when a car should be used more carefully or watched more closely than just after it has been through the overhauling process.

This statement is made in no spirit of criticism of the automobile repair shop, imperfect as its methods sometimes are. The fact is that the overhauling process carries with it dangers that seem to be inseparable from it, so long as it is done by fallible human mechanics, no matter how conscientious they may be. It involves the loosening and removal of a large number of nuts and holding devices, upon the correct and secure replacement of which the future satisfactory and even safe operation of the car depends. A great many adjustments, most of which have proved satisfactory for some time past, are changed in the course of the overhauling, and the new ones may not be so nearly correct. In short, the parts of the machine which during long use have "shaken down" into a sort of mechanical harmony are more or less thrown out of relation by being disassembled, and this is, in a way, the reason why the first long ride after shop overhauling is so often fraught with mechanical incidents.

Even though the car is not in the shop for a general overhauling, but to have some specific work done upon it, the various parts of an automobile are so interrelated that the work frequently requires the disassembling of a number of parts other than the one in question, and the disturbing of these frequently leads to trouble.

EXTENUATING CIRCUMSTANCES.

That a car should leave a repair shop in such condition as soon to develop defects is due primarily to carelessness on the part of those who have worked upon it, but there are often extenuating circumstances. A mechanic may be assigned to the job, but on account of the exigencies of the occasion he may be taken off and put upon some emergency job. When he returns, perhaps after a considerable lapse of time, he does not remember just where he left off, and the result is that something is forgotten. Sometimes another man is put on the job in his place, and there is a misunderstanding as to just what has been and has not been done, especially in the matter of assembling. When two or more men are working upon the same car there is a strong likelihood that some misunderstanding may occur between them as to the state of the work. The fact that the average automobile owner is usually in wild haste to get his car into service again, after it has been in the shop, and does not allow time enough for a thorough piece of work to be done, also has its effect. The owner, too, is usually averse to having his car tried out on the road extensively before it is returned to him, and the repair shop man is often undesirous of having this done for other reasons perhaps. It is doubtful, however, whether a perfect and permanent running condition can be assured without such a "tryout" of rather an extended nature.

INCOMPLETE ASSEMBLING.

On the whole the most common cause from which trouble is experienced after repair work which involves disassembling has been done upon a car is the failure to replace or to properly replace the various holding devices which have been removed. This may include the failure to replace nuts or to set them up properly, or to secure them by means of lock washers, check nuts or cotter pins. One reason which leads to such neglect is that nuts are frequently put on tentatively, without their safety devices, in order to try the adjustment of the part or in order to that a tryout may be had, and then the attention of the mechanic is transferred to some other part of the car. The nut is then forgotten, and in the final inspection, which is often a hurried one, the cotter pin or check nut is left off. Every time a nut is taken off it fits more loosely on its thread, and the need of a safety holding device becomes greater. Frequently nuts are put back upon the wrong bolt or stud, and it is human nature to take the path of least resistance and put on the nut which can be turned on by the fingers. Such a nut is liable to work loose if it has no lock washer under it. Nuts are often lost during the overhauling process and are replaced with others of easier fit and more prone to unscrewing. There are some holding devices which it seems impossible to make permanently tight until after a car has been run a while and the parts have settled into shape. Rust on the threads and paint and varnish around the nuts on the running gear are excellent substitutes for lock nuts, but when the rust film or the paint is broken in the taking apart process this safeguard is removed. One or two examples of how accidents occur from the failure to properly replace holding devices may not be amiss.

SOME EXAMPLES.

A two cylinder car was in the shop to have its connecting rods taken up, and it was supposed the work had been thoroughly done, as the motor ran very quietly. Its owner, a novice, took the car out in the usual hurry for a long trip. It came back with a broken connecting rod and a hole in the crank case. Investigation showed that the check nuts and cotters on one connecting rod had not been replaced, and the owner, not heeding the very audible signs of distress, had driven until the nuts had worked loose, so that the end of the rod freed itself. A car was laid up with a defective front wheel bearing, and in repairing it the drag link was disconnected from the steering device. After being run a short distance, the car ran wild, rushed over a railroad track and broke a front spring, giving the passengers a good scare. The cotter which should have been put into the pin holding the drag link to the steering device had not been replaced.

OIL LEADS NOT CONNECTED.

Oil leads are sometimes accidentally left unconnected when a car is sent out. In one instance a car was sent in to have its piston heads scraped clean of carbon. The work was very thoroughly done, and the engine ran very nicely in the shop during a short run. When taken out for a long drive by the owner the engine heated and squeaked, but as oil was dropping in all the sight feeds, lubrication was thought to be perfect. When finally it could be driven no further the piston was found to have seized in one of the cylinders to which the oil lead had not been connected, although the end of the oil pipe hung so close to its coupling that the error was not readily discernible. New piston rings were required, and it was a long time before this cylinder recovered its usual degree of gas tightness.

INTRODUCTION OF FOREIGN PARTS.

A common danger arising from the overhauling process is the unnoticed introduction of nuts or small tools into the gear or crank csases. Such foreign objects may not give trouble during a short tryout of the car on level roads, but sooner or later they are likely to be caught between two gears or otherwise, and then "things happen." The following is a curious incident of this kind:

A mechanic using a portable incandescent lamp in a gear case allowed it to be caught in the gears and broken, distributing finely broken glass all through the case. He was called to attend to another "rush job," and the new man who was put on to finish the work on the gear case was not informed of the accident. The result was that the car was sent out without having the pulverized glass cleaned out, and the ring oiled plain bearings, which were supplied by the gear splash, were nearly ruined. Similarly a bolt accidentally dropped into the bevel drive housing, ruined the bevel gear and pinion, and nearly broke through the aluminum housing.

BEARING ADJUSTMENT.

When a car has had any of its bearings taken up, rebushed or rebabbitted, the chances of the owner's meeting with trouble are large if a thorough testing out on the road has not previously been gone through with. The difference between the adjustment of a bearing (especially a new one) so tight that it will bind and heat, and so loose as to be noisy, is very slight, and the correct adjustment can hardly be found with certainty except by repeated trial. If any owner takes out his car, after such work has been done, without careful preliminary road testing, he should understand that he must carefully note the condition of these bearings at frequent intervals, and act promptly upon the first intimation of overheating, as otherwise, serious trouble may result.

RETAINING TEMPORARY ADJUSTMENTS.

On chain driven cars an occasional repair shop fault is the leaving off of the cotter pins or other fastening devices of the master chain link. It is easy to see how such a thing happens. In replacing the chain after the car has been overhauled it is put together "temporarily" while it is decided whether or not a link will have to be taken out. In the process of lining up the rear axle, adjusting the distance rods and the brakes, it is forgotten that the chain is only temporarily fastened together, and the car may be sent out in this condition. The writer remembers hunting in the dark for a chain lost in this manner. Temporary adjustments made to save the time required for making complete adjustments, and inadvertently allowed to stand as permanent adjustments are the most common cause of the mechanical derangements which show up after a car has been disassembled.

In making some repairs upon the horizontal engine of a certain car the gasoline tank, which was located nearly over the motor, had to be removed. When the engine was thought to be in condition, the tank was set back upon its supports, and the holding nuts were loosely replaced, as it was thought the tank might again have to be removed. As everything about the engine proved to be right on the first trial there was no need of taking the tank down again, and it was forgotten that it had not been securely put in place. The car was sent out on a long hard trip, and the tank "worked" so much in its loose fastenings that the seams opened, the fuel escaped, and the car had to be towed to a repair shop.

The removal of one part or a change in its adjustment very often changes the action or otherwise affects the working of other parts. When chains are readjusted by moving the rear axle the hub brakes are generally thrown out of adjustment and usually caused to work less powerfully.

TRYING BRAKES.

A car owner ought to be very careful to try the action of his brakes after any change in chain tension has been made, or they may fail him in an emergency.

Another inadvertence sometimes attendant upon the overhauling process is the failure to fill the gear crank and differential cases with the proper quality of oil or grease, or to pack certain bearings with the proper lubricant. It pays the owner personally to verify these points, even at some inconvenience. Taking for granted that such things have been attended to is not always safe. A bad case of trouble is recollected which happened through the "temporary" replacing of the draw-off plug of a gear case. The plug dropped out on the road, the oil entirely ran out and matters were in bad shape before the cause of the difficulty was ascertained. Incidents of the effects of careless assembling could be multiplied almost without end and in the greatest variety, but this is unnecessary.

RULES OF SAFETY.

A few safeguards against carelessness in overhauling a car may be mentioned. The same man or men who begin the work should complete it, and they thus have a certain definite responsibility. If possible, they should keep at the work without any but the necessary interruptions until it is finished. They should have adequate opportunity for all legitimate trying out in the shop and on the road, and should not be unduly hurried. As the parts of the car are disassembled they should be placed in a box or other secure place, and not even a cotter pin should be thrown away until another has been provided to take its place. By this method, if any cotters or lock nuts remain when the car is supposed to be fully assembled, it is at once known that something is still not securely fastened. The owner should himself inspect all the parts known to have been dismounted, and all other parts which have to be disturbed by so doing, and should drive for the first 100 or 200 miles with his ears open for unusual sounds and with a close attention to the running of his car, stopping when practicable to look things over a little. Until a car has "found itself" anew after the disturbing process of overhauling is is a time for careful watchfulness.

Preposterous Claims for Carbonic Acid Motor.

John Carroll, the Philadelphia inventor, is again credited in Philadelphia newspapers with preposterous claims for his carbonic acid automobile motor, which he demonstrated to newspaper men in his shop last week. The engine has three cylinders of 2 inches bore each, and six pistons of 2 inches stroke each, being of the well known double piston type. This engine is said to develop 100 horse power, although its outside dimensions are only 13½x10½x4½ inches, "half the size of a typewriter." Carroll estimates that an owner of one of his machines could take a party of five or seven to Chicago (presumably from Philadelphia) for $1. The machine needs oiling but once a month, it is claimed. The power storage system is described as follows:

"The power is furnished by a small tank which is filled with carbonic acid gas. This tank is connected with the engine, the gas going to the engine through a small copper tube about as thick as a lead pencil. When the gas has gone through the engine it goes back into an exhaust tank, after passing through which it is recondensed and flows into the first tank from which it originally came. In addition to these two tanks there is an auxiliary tank for conveying an extra supply of carbonic acid."

What it would be interesting to know is how the condensing is accomplished, as it takes more power to condense the acid than it can give out in expanding. To carry five or seven people from Philadelphia to Chicago would require 20 horse power continuously for sixty hours at the very least, making 1,200 horse power hours, and as one horse power hour of electrical energy, say, is seldom sold in small quantities for less than 5 cents, this would figure out to $60 instead of $1. Besides, of course, a set of tires might have to be "written off" at the end of the trip.

Milwaukee A. C. Tour.

Seven cars participated in the first annual Wisconsin tour of the Milwaukee A. C. July 15-18. The event proved so successful it will be repeated annually. The following participated:

No. 1. Thomas-Detroit "Forty" Roadster, Pilot and Pacemaker—W. L. Hibbard, owner and driver; A. C. Brenckle.

No. 2. Wayne Four Cylinder, Five Passenger—O. F. Fischedick, owner and driver; C. Frieschmann, Frank Kuhumuench and Dr. Louis Fuldner, president Milwaukee A. C.

No. 3. Merkle Four Cylinder, Five Passenger—Christian Schaltka, owner and driver; Mrs. Schaltka and daughter; C. F. Keck.

No. 4. Packard Six Cylinder, Seven Passenger—H. J. Langholff, owner and driver; Mrs. Langholff, R. C. Chidester and wife.

No. 5. Peerless Four Cylinder, Five Passenger—August Jonas, agent, owner and driver; Gustav Jonas, August G. Mueller and Albert Mueller.

No. 6. Rambler Four Cylinder, Seven Passenger—Theodore B. Roach, assistant superintendent Rambler Garage Company, of Milwaukee, driver; C. F. Kurth, Thomas M. Drought and James T. Drought, secretary.

No. 7. Mitchell Four Cylinder, Five Passenger—F. P. Wilbur, owner and driver; Mrs. Wilbur and family.

The tourists made a halt at Wausau, where Neal Brown, president of the Wisconsin A. A., has a country place on the Plover River, the most famous trout stream of the West. An elaborate brook trout dinner formed the principal feature of their stay here. The tour was mainly arranged on the solicitation of President Brown. The party covered the entire eastern half of Wisconsin, including all territory between the Wisconsin River and Lake Michigan, in five days. One car took a short route and arrived in Milwaukee Saturday night, the remainder taking various longer circuits and getting in Sunday night. Strict rules against exceeding speed limits were enforced. Secretary Drought says that the Milwaukee automobile owners found that the farmer of northern Wisconsin has changed from enemy to friend.

Acording to a recent report of the chief of the Berlin department of street cleaning the several motor vehicles used by the department have proven entirely successful and cheaper than horses, and it is hoped that the entire equipment will be motor propelled. The city has recently acquired a motor truck for removing dead and sick animals.

Maintenance and Repairs

Oxidizing Brass Parts.

By John W. Few, Jr.

Now that the automobile has reached such a state of general perfection the designer's attention should be directed toward the many little features in which the majority of cars woefully lack. One of the faults of the automobile today, from the standpoint of the suburban owner, who perchance takes care of his car, is the excessive amount of brass scattered about the car: lamps, lamp bracket, screws, guards, trimmings, cranking handle, beading, and dozens of other places where there is not the least excuse for its use are in this metal. Indeed, for some of the places where nuts and bolts and threads are used brass is very unsuitable.

At the last New York shows lamp makers made a start in the revolution which is bound to come by offering, in an apologetic way, a few lamps in black, but they did not receive much attention. They were too sombre, probably.

With the help of a good electroplater I have made quite a change, and I think improvement, in the brass work about my car. All that could be removed has been given a copper-oxide finish. The brass was thoroughly cleaned, then copper plated; afterward it was rubbed off on a soft wheel. Again it was copper plated, and after being thoroughly dried was immersed in a solution of sulphate of potassium. After being thoroughly dry it was burnished. To lighten up its appearance it can be cut through in spots to the copper, giving a streak or point here and there of a copper color. This is done on a felt wheel. Most persons are acquainted with the appearance of copper-oxide as seen on door plates, desk fixtures and knobs, and any well equipped plating company can do the work.

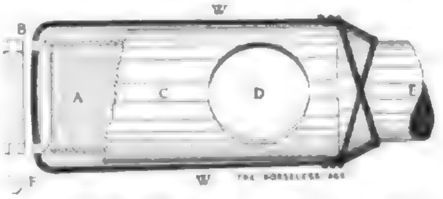
A friend of mine prefers the black but highly polished surface secured by immersing the brass parts in a bath of copper and ammonia, and then polishing. This also can be cut through in spots, showing the brass beneath. The latter treatment, however, cannot be given an article containing copper, as the copper will not "take." Both finishes are durable and the appearance of the car is enhanced. A slight rub with a dry cloth occasionally will suffice to keep the surface clean and in excellent condition.

A Safeguard for Steering Connections.

Accidents are frequently caused by the steering rod connection separating from the ball end of the steering arm, thus at once putting the steering wheels beyond control. This separation is due to the loosening of the cup which retains the ball end in place within the connection, and consequently allows the connection to shake off the ball end. To remedy this the following "retainer" was devised, the materials used being one-quarter of an inch bar iron and steel wire.

In the figure C is the connection and E the rod, the ball end working within the aperture D and being retained in place by the cupped end of plug A. This plug is furnished with slots to enable it to be screwed up by means of a lug wrench or spanner. The one-quarter inch bar is machined (or filed) to the shape shown at B, and inserted into one of the slots. Wire W is then passed between the projecting ears F, F on B and securely wound upon the connection as shown, using a pair of pliers to insure tightness. The arrangement shown does not interfere with the action of the ball end, and even should the wire shift the plug A will still be held from coming out or loosening to any extent.

A less efficient method would be to use only wire in place of the "retainer" B, but this would only prevent the plug from coming away. If greater security is desired a screw or pin might be placed to bear against the wires close to the "retainer," thus eliminating any chance of the plug turning, short of shearing the wire. The device was put on a well known doctor's car, owing to the frequency of the separation of the ball end and connection thereon.



Safeguard for Steering Connections.

The Smoky Exhaust Nuisance.

Prior to the advent of the motorcab in the metropolitan automobile world it was quite unusual to see a car give off a smoky exhaust, as private owners and hirers well appreciated the evils resulting from over-lubrication of the motor, as well as from under-lubrication. It was a point of pride for drivers to have as "clear" an exhaust as possible, and no complaints of smoky automobiles had been made with the authorities for some months. But the exhaust of motorcabs, particularly one European make, is generally a cloud of oily smoke. This applies not only to half a dozen cabs or so but to a very large percentage of the whole number. Already complaints have been made on this score, particularly by those living near buildings in which these vehicles are garaged and near places where they stand for hire. So common is this smoke nuisance that the phrase "Smoking like a taxicab" has come into vogue. Petitions are being passed around to be presented to the Board of Health for the abatement of the nuisance, and these are expected to be submitted in a short time.

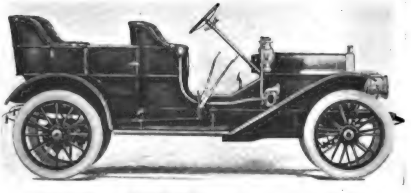
As is patent to those familiar with automobiles, the smoky exhaust is due to over-lubrication of the motor. Owing to carelessness in lubrication of certain taxicabs in the service of one of the large companies, motors were ruined and had to be practically rebuilt in several cases, so that the company issued general orders to lubricate liberally to prevent the recurrence of such cases, the result being that practically all the company's drivers lubricate to excess, thus causing the objectionable smoking. That this is of no benefit to the operating company is shown by the filthy condition of the motors themselves, and the frequency with which the motors must be dismantled for removing the resulting carbon deposit upon both pistons and cylinder walls, to keep them in serviceable condition.

Not only does the oily exhaust offend the senses but it has a bad effect upon pavements. The dropping of oil upon asphalted streets has been found to soften the surface of the asphalt and allow the working in of dirt, horse droppings, etc., thus breaking up the surface and shortening its life. This effect may be seen upon any street where motorcars are operated in any number. Macadam pavements are even more affected, owing to the looser nature of the bond. The treated wood block pavements, on the other hand, seem to be unaffected by oil, whether deposited by the exhaust or dropped from the mechanism of automobiles. This has been recognized by the police authorities of London and Paris, the former making a representation that such avenues and streets as are subjected to considerable motor traffic should be paved with treated wood blocks. The police regulations of both these cities, too, forbid the emission of smoke or the dropping of oil from motor vehicles, and fine offending parties for the same. It would seem that similar regulations enforced in our larger cities would prevent the nuisance, and preserve the pavements, as well as the health and comfort of the public.

Foreign Business Opportunity.

A report has been received by the Bureau of Manufactures from an American consul in a city of western Europe, stating that an automobile company recently organized in his district has now received its first car, which was purchased in Germany. Only one American firm submitted a bid for this machine, and this bid arrived too late to receive consideration, but the secretary of the company was so favorably impressed with the description of the American machine that he would be pleased to receive bids from American firms for future purchases. Quotations should be given c. i. f. certain European cities. Address the Bureau of Manufactures, Washington, D. C., referring to No. 2,441.

NEW VEHICLES AND PARTS ❧ ❧

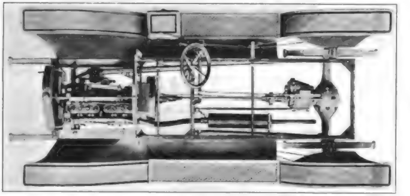


E.-M.-F. "30" Touring Car.

The E.-M.-F. "30."

This new car is the product of the Everitt-Metzger-Flanders Company, of Detroit. As is well known in trade circles, this company represents the consolidation of the Wayne and Northern companies. Preparations are being made to manufacture this car on a very large scale, and this fact, taken in conjunction with the extensive experience of its designers, manufacturers and sales force, renders every detail of its construction of great interest.

Although there is nothing new or radical about the car, there are quite a few of its details which are adapted from foreign practice and are new to users in this country. Pressed steel parts are used to an extent made possible only by the large number of cars which will be produced.



Plan of E.-M.-F. "30" Chassis.

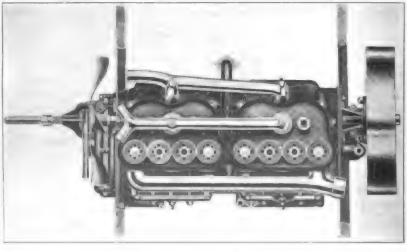
The motor has all valves on one side, and the cylinders cast in pairs, with water space between. Its bore is 4 inches, stroke 4½ inches, and it is rated at 30 horse power. The base of the cylinder casting is extended so that it includes the holes which receive the bushings for the push rod guides. These holes are drilled and reamed at the same time as those for the valve stem bushings, thus insuring absolute alignment.

The valves are forged from a special steel and are unusually large, 2⅛ inches in diameter. Their seats make an angle of 60 degrees with the stems, instead of the conventional 45 degrees. Valve ports are very large and free. The exhaust manifold is of cast iron, while the inlet manifold is of pressed steel. The carburetor is carried low down on the opposite side of the motor from the exhaust, rendering gravity feed certain and avoiding danger of fire in case of a leaky carburetor. The cams are forged integral with their shaft, and the cams and bearings are ground after hardening.

The crank case is an aluminum casting of the barrel pattern. The three bearings are split, and are bushed with a special babbitt. That in the middle is hung from a cylindrical seat by through bolts, while the end bearings form the plates which close the ends of the crank case. They are secured to the case by studs and fit into long cylindrical seats in the case. Between their flanges and the case are clamped the pressed steel supporting arms for the motor. These arms slip over pressed steel brackets, riveted to the frame sides, and are secured to these brackets by bolts.

The connecting rods are drof forged, bushed with die cast babbitt at the crank end and with phosphor bronze at the piston end. The cap is tongued and grooved into the rod and secured by two bolts. A drop forged crank shaft is used with unusually liberal bearings, that at the rear being 1¾ inches in diameter by 4⅜ inches long. The other bearings and pins are 1½ inches diameter, with the following lengths: Centre, 3⅜ inches; front, 4 inches; pins, 2⅛ inches.

The pistons are 5 inches long, with four rings. All reciprocating and rotating parts are carefully balanced. Lubrication is by splash, the oil level in the crank case being maintained constant by gravity feed from a tank cast upon the side of the crank case. Cooling is by a vertical tube radiator, using thermo-siphon circulation. The return pipe to the radiator is horizontal and branches just before reaching radiator. This forces any steom formed in the engine to pass through a tank of water which condenses it. The rate of feed is self regulating, for the amount of air which enters the oil tank through the supply tubes to the crank case

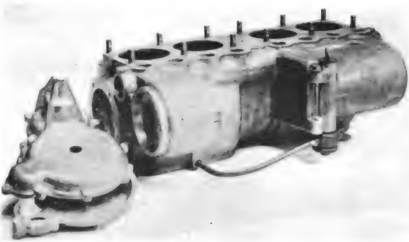


Top View of Engine.

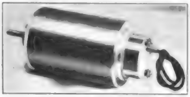
keeps the air pressure above the oil so much below that in the case as to properly regulate the flow.

A double system of ignition is employed, current being supplied either by a storage battery or by a Heinze low tension magneto, which is accurately placed in a special chamber in the crank case. The outside of the magneto is finished to a cylindrical shape and fits a bored hole in the case. Thus, when the magneto is in place its gears are enclosed and properly meshed. And all moving parts are enclosed in an oil, dust and water proof case. Both magneto and battery use the same Heinze quadruple dash coil and roller contact timer. The connections of the coil are so placed that all the wires pass directly through the dash instead of being underneath, as is the usual practice.

The clutch is a typical expanding band construction, and its principal novelty lies in the use of pressed steel for the spider.



The Crank Case.

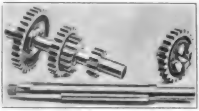


Magneto.

Transmission of power to the rear axle is through a propeller shaft with two universal joints. The change gear is mounted on the rear axle. It is of the sliding selective type, giving three speeds and a reverse. The gears are of different grades of chrome nickel and high manganese steels. Those that are fixed to their shafts are secured to flanges by four good sized "Dutchmen" rivets. The sliding gears have the hole for the splined shaft ground central after the gear is hardened. And the shaft, which has four keys milled from the solid, is ground all over both keys and shaft. Timken roller bearings are used except for the reverse gear.

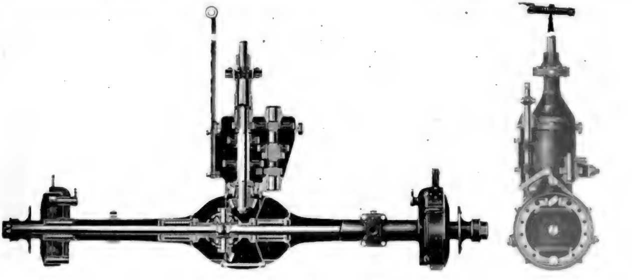
The aluminum casing for the change gear forms a spacer for the two sections of the pressed steel rear axle. These are connected by a number of through bolts and are held in alignment by their fit on the aluminum casing. Bearing supports, spring brackets, etc., are welded to the pressed steel members by the autogenous process. Hyatt roller bearings, running in hardened and ground sleeves, are used for the axle shafts. The differential is of the bevel type, with four hardened pinions. A straight I section drop forging is used for the front axle. The wheel pivot centres are vertical and the wheel centres are offset to the rear, so the car would tend to run straight ahead even if the steering gear were disconnected. This gear is a large diameter worm and sector, with the working parts carefully hardened. The steering wheel is made of pressed steel in two parts welded together along the centre line of rim and arms.

Semi-elliptic springs are used in front and full elliptics at the rear. The rear axle is held in alignment by two long radius rods. Its torque is taken by a pressed steel torque rod with tapered channel section. The frame is a typical pressed steel construction.

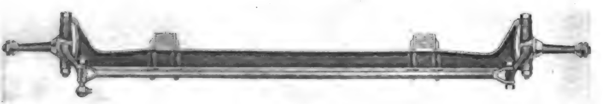


Change Gear Parts.

Both sets of brakes act on the wheels. The internals are cam expanded, gray iron shoes acting upon pressed steel drums. The band brakes are made double acting by a simple and ingenious arrangement: pins at

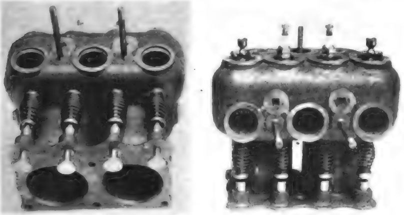


E.-M. F. Rear Axle and Change Gear.



E.-M.-F. Front Axle.

each end of the band anchor in hooks which are part of the forged brake supports. The brake linkage only serves to pull the band into contact with the drum, after which it applies itself.



Two Views of a Cylinder Pair

The gear shifting lever is of the rocking type, originated by the English Daimler Company, but is improved over former designs in that the lever is automatically locked in each position. All bearing parts of the car, and many other surfaces, are ground.

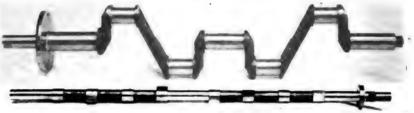
The wheel base is 106 inches, the tread 56½ inches. Tires are quick detachable, 32x3½ inch.

Touring car, runabout, roadster and demi-tonneau bodies will be furnished. The weight with touring body is given at 1,800 pounds.

E.-M.-F. Change Speed and Driving Gear Casing and Differential Gear.

G. E. Enameled Magnet Wire.

A new kind of insulated magnet wire has just been placed upon the market by the General Electric Company, Schenectady, N. Y., which may be of interest to manufacturers of automobile ignition coils. Instead of being wound with a single or double sewing of cotton or silk, as is ordinary copper magnet wire, the conductor is given a number of coats of a highly insulating, closely adherent enamel, the nature of which is not stated. It is said, however, that the coating is an amorphous cellulose, and if this is the case its dielectric strength should be similar to that of silk fibre. Being non-fibrous and very dense, it is claimed that it does not absorb moisture, and it is stated that the coating is so adherent and flexible that the conductor carrying it may be bent around a mandrel of four times its own diameter without affecting its insulation.



E.-M.-F. Crank Shaft.

The chief advantage claimed for this type of insulation is that it is very considerably thinner than ordinary wound insulation. This is of especial importance in the smaller sizes. According to published figures, the insulated diameter of No. 36 B. & S. gauge enameled wire is .0062 inch, as compared with .0070 inch for the same wire, single silk covered. The enameled wire has thus about 12 per cent. smaller total diameter than the single silk covered wire and a cross section about 29 per cent. less. This means that a certain number of turns of enameled conductor may be wound in a wire space less than three-quarters of that required to hold the same number of turns of the same gauge of single silk covered wire. The total weight of the copper will be less with the enameled wire than with the silk wound wire on account of the shorter length of the mean turn. On the other hand, proportionally more turns of enameled wire may be wound in the same wire space.

If this new wire proves to be all that it is claimed to be it may be possible for jump spark coil makers to produce somewhat more compact secondaries and smaller coil units without sacrifice of their electrical properties. It is possible, too, that the electrical efficiency of such coils may be slightly increased on account of the fact that the average distance of a secondary turn from the core will be reduced and its effectiveness increased. Any reduction of the distance of the secondary turns from the core is especially important in open magnetic circuit coils, such as used for spark production.

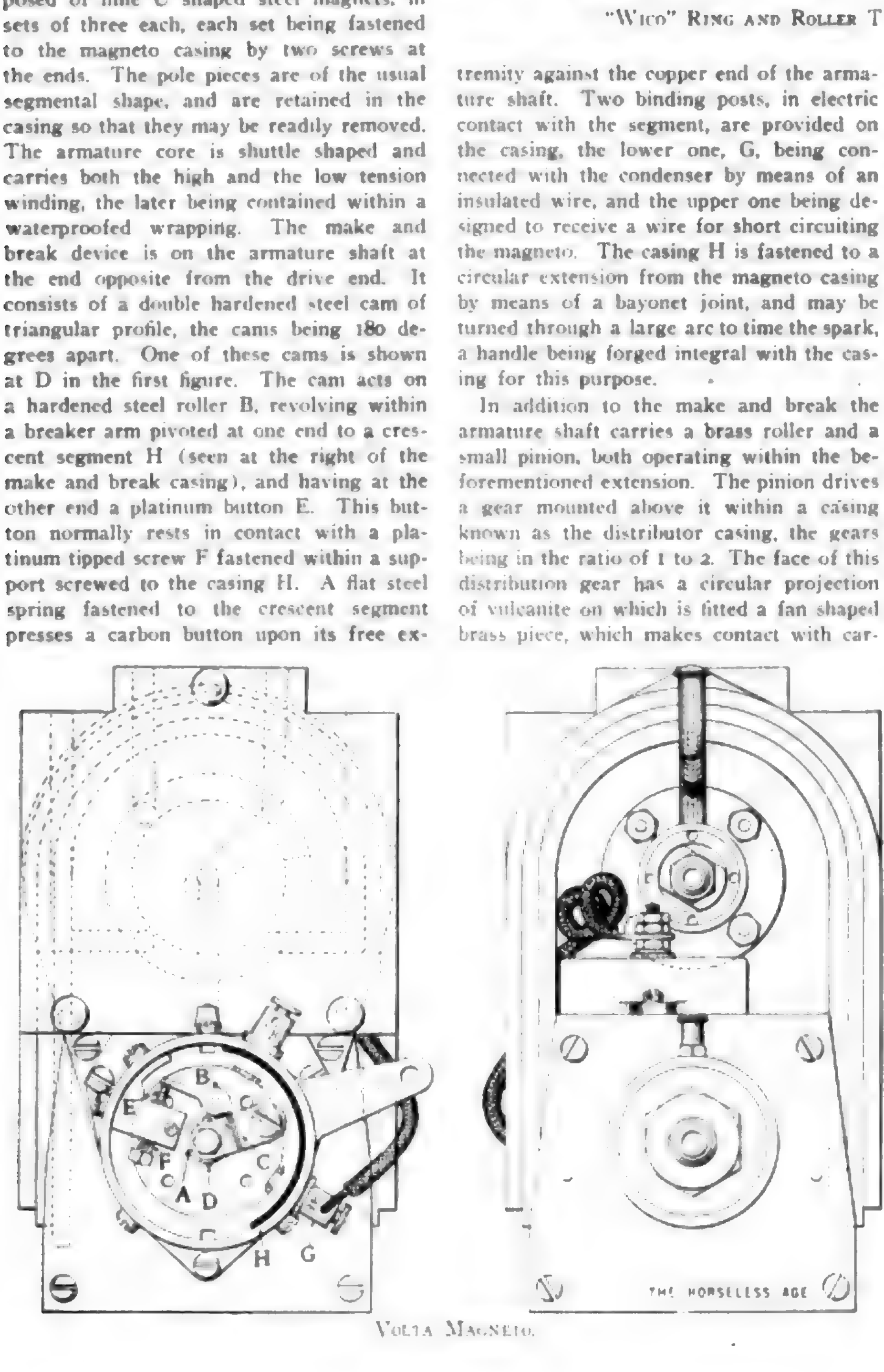
As the diameter of the conductor increases the space economized by the use of enamel insulation decreases progressively and becomes relatively unimportant when the large sizes are reached.

The Volta High Tension Magneto.

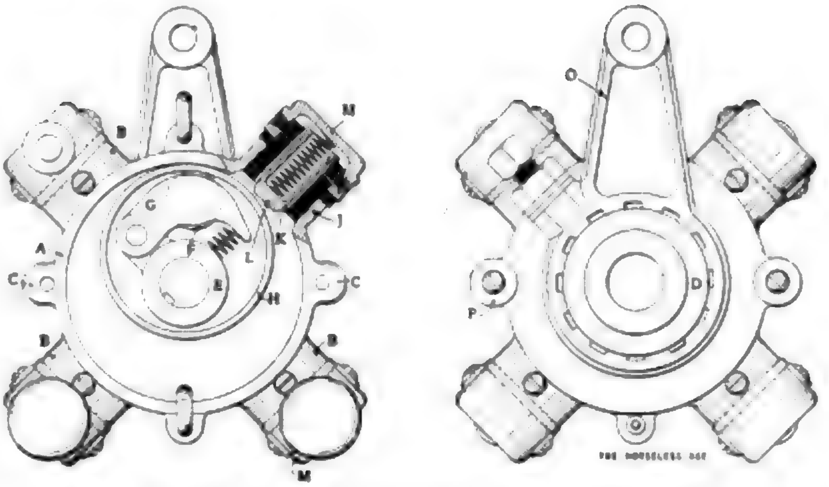
The Witherbee Igniter Company, of 1876 Broadway, New York, are putting out the Volta high tension ignition magneto for four and six cylinder motors. The cuts herewith serve to show the distinctive features of the magneto. The fields are composed of nine U shaped steel magnets, in sets of three each, each set being fastened to the magneto casing by two screws at the ends. The pole pieces are of the usual segmental shape, and are retained in the casing so that they may be readily removed. The armature core is shuttle shaped and carries both the high and the low tension winding, the later being contained within a waterproofed wrapping. The make and break device is on the armature shaft at the end opposite from the drive end. It consists of a double hardened steel cam of triangular profile, the cams being 180 degrees apart. One of these cams is shown at D in the first figure. The cam acts on a hardened steel roller B, revolving within a breaker arm pivoted at one end to a crescent segment H (seen at the right of the make and break casing), and having at the other end a platinum button E. This button normally rests in contact with a platinum tipped screw F fastened within a support screwed to the casing H. A flat steel spring fastened to the crescent segment presses a carbon button upon its free extremity against the copper end of the armature shaft. Two binding posts, in electric contact with the segment, are provided on the casing, the lower one, G, being connected with the condenser by means of an insulated wire, and the upper one being designed to receive a wire for short circuiting the magneto. The casing H is fastened to a circular extension from the magneto casing by means of a bayonet joint, and may be turned through a large arc to time the spark, a handle being forged integral with the casing for this purpose.

In addition to the make and break the armature shaft carries a brass roller and a small pinion, both operating within the beforementioned extension. The pinion drives a gear mounted above it within a casing known as the distributor casing, the gears being in the ratio of 1 to 2. The face of this distribution gear has a circular projection of vulcanite on which is fitted a fan shaped brass piece, which makes contact with carbon brushes conveying the current to the different spark plugs by means of leads. Another carbon brush bears on this brass piece at the centre of rotation of the distributor. All these brushes are kept in contact by means of springs and fitted within a hard rubber block screwed to the distributor casing. Another spring contact carbon brush is in communication with the centre brush and presses upon the brass roller upon the armature shaft, thus conveying the secondary current to the distributor from the winding.

The second figure shows the magneto from the drive end. The rectangular box above the magneto casing contains the condenser. The shaft for the distributor gearing is seen projecting above the condenser box. This, as well as all other shafts, runs in H.-B. ball bearings. Lubrication of this shaft is provided for by a long oil tube, whose end projects outside of the magneto, a spring cover being fitted to exclude foreign matter. A similar cup lubricates the armature shaft. The armature shaft is provided with a taper end for fitting on the driving gear or universal joint. The magneto casing is of brass, as are also the extension casing and make and break casing. Nearly all parts may be removed with a 3 inch screwdriver, and some with only the thumb and forefinger. The magnetos are made for either clockwise or counterclockwise rotation. All terminals are either of the push-in or spring binding post type, enabling the ready removal of connections.



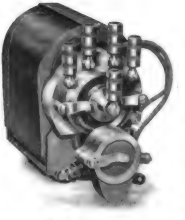
VOLTA MAGNETO.



"WICO" RING AND ROLLER TIMER—FRONT AND REAR VIEWS.

The Wico Ring and Roller Timer.

The Witherbee Igniter Company, of 1876 Broadway, New York, are turning out the "Wico" ring and roller" timer for one, two, four and six cylinder internal combustion motors, an illustration of which is here given. The timer differs from the ordinary roller type of timer in having a loose brass ring interposed between the steel roller and the contacts, thus providing a smooth path at all times for the roller. The casing A is a cylindrical casting, with integral bosses B B upon its exterior for the contacts and



REMY MAGNETO.

lugs C and P for the retention of the cover hooks and back plate screws. The casing is screwed fast to a back plate, which is also cast integral with a cylindrical portion D, which acts as the bearing for the driving shaft. To this driving shaft is attached a collar E having an arm which carries the roller F and roller carrier G. H is the brass ring. The bosses B B are fitted with hollow fibre collars J, within which are brass bushes K acting as bearings for the tool steel contacts L, which are kept in position by springs. The metal caps M are fitted with brass screw studs emerging from bosses thereon, and to these studs the plug leads are fastened by means of vulcanite screw caps. The brass cover hooks are spring retained and are seen in position in their bosses.

For varying the time of the spark an arm O, pierced for a clevis pin, is attached to the portion D, a square slot on the circular portion of the arm engaging with a feather on D. The entire inner circumference of this circular portion of O is so slotted, and the arm O may be adjusted to any position to suit the varying linkage on different cars. A set screw and lock nut retain the arm tightly when once adjusted. The whole timer may be rapidly dismounted by means of the fingers and a small screwdriver only. The four cylinder timer weighs only 20 ounces, the six cylinder being about two ounces heavier. The cover is of the same metal as the casting, or it may be of glass. Ball bearings are fitted throughout.

The Remy High Tension Induction Magneto.

Remy Electric Company, Anderson, Ind., have adopted the induction principle in the design of their new Type L magneto, which has no wires on the revolving part. Perhaps the main advantage of this construction is that no moving contacts are required for collecting the current generated. A single coil of No. 18 magnet wire is imbedded in the pole pieces of the magneto. The rotative part or inductor is a simple forging mounted upon a solid steel shaft. At each half revolution the direction of flow of the lines of magnetic force through the coil is reversed, inducing in the coil two electrical current waves or impulses for each revolution. The magneto winding is directly connected through the circuit breaker with the primary of the spark coil used with the magneto. The circuit is mechanically broken during the current wave which is of considerable duration (over 45 degrees of the inductor's revolution). The pole pieces and inductor are of such design, it is claimed, as to give a flat topped current wave with an abrupt rise and fall, thus permitting of considerably varying the sparking time without appreciably reducing the heat of the spark from the maximum. The timing of the spark is accomplished by shifting the circuit breaker around the armature shaft, to which is attached the circuit breaker cam.

For a four cylinder engine a distributor with a "two to one" reducing gear is used. It will be noted that both the inductor shaft and the distributor shaft are mounted in long, plain bearings with wick oilers. The inductor generates in the coil two impulses per revolution, and for a four cylinder four cycle motor the inductor must be driven at engine speed. With the two cylinder, four cycle, opposed engine, the magneto does not have a distributor, but is provided with a single cam, causing but one electrical impulse for each revolution of the inductor. The magneto must then be driven at the same speed as the crank shaft of the engine.

The special spark coil furnished with the magneto is fitted with a two point switch used to switch from the battery to the magneto, or vice versa, or disconnect from either to stop the motor. The switch is also provided with a push button for the purpose of starting the four cylinder or six cylinder motor from the spark by pushing the button when the switch lever is turned to the battery side. It is claimed that this system insures reliable starting without cranking for the reason that the coil is wound so as not to be injured by large currents, as would be the case with the ordinary battery coil. When the battery is in use with the coil, it furnishes an exceptionally hot spark.

To facilitate making correct connections, the binding posts on the magneto are marked in different colors, and the cables are of corresponding colors.

THE JENKINS BLOW-OUT SLEEVE.

The Jenkins Blow-out Sleeve.

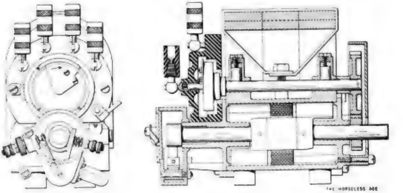
The Jenkins Specialty Manufacturing Company, Sumter, S. C., manufacture a blow-out sleeve for protecting weak spots in tires, as shown herewith. These sleeves are made of white comb leather, and the best grade of flush brass snaps are used. They are made to fit all sizes of tires.

Packard Light Car.

A news item of considerable interest is to the effect that the Packard Motor Car Company, Detroit, has completed an 18 horse power model to sell at $3,200, which will be manufactured for next season along with the 30 horse power $4,200 model. The new model is in general a reduction in size of the big car, and will also be fitted with a magneto. The bodies will be of sheet aluminum of any style from runabout to limousine. Full particulars are promised for August 1.

The German War Department is at present conducting a test of motor trucks offered the department for purchase by their manufacturers. The trial runs will be continued for three weeks, and comprise fourteen daily trips of about 70 miles each.

At the recent meeting of delegates of recognized national clubs in Dieppe the constitution of the federation was amended to the effect that a four-fifths vote is required to make a change in the club recognized in any country. The delegates of the A. C. A. were instructed to try and reach an agreement with the A. A. A. The A. C. A. delegates promised to enter into negotiations with W. K. Vanderbilt in regard to this matter, and were then given a vote of confidence. The next session will be held in Paris during the International Good Roads convention, October 7-12.



REMY MAGNETO.

COMMUNICATIONS

Ignition Query.

Editor Horseless Age:

I recently saw the following letter from a prominent manufacturer of automobiles:

"We have had a few complaints relative to the model skipping when the engine was running on the batteries. When running on the magneto the engine would not skip. Investigation developed the fact that these cars were equipped with storage batteries. The coils on these cars are not designed for use with storage batteries. If customers install a storage battery in place of the five dry cells which we furnished they do so at their own risk. A storage battery will not prove satisfactory."

I would like for you to explain in your next issue why a coil that is designed for five dry cells will not operate successfully on a six volt storage battery, as this will undoubtedly be interesting reading to your subscribers. E. C. Sawyer.

[We know of absolutely no reason why a coil designed for one of these current sources and operating satisfactorily thereon should not also work satisfactorily on the other. The kind of electricity furnished by the two is exactly the same, and the amount that flows through the coil during the period of contact depends largely on the resistance of the coil. Perhaps this was the best explanation of the missing that suggested itself to the manufacturer.—Ed.]

Too Much for the Money.

Editor Horseless Age:

At times singularly unbalanced, the automobile trade periodically makes policy moves as pernicious as they are ill considered. Having passed through the era of "little-for-much," the policy pendulum has swung back, crossed the meridian of common sense, and passed to its extreme in the other direction, with the result that there are many machines marketed today equivalent as regards specification to the automobile of double the price of a year ago. There can only be three possible reasons to justify such a break in prices with sustained quality, viz., inordinate profits heretofore, especially commercial designs, great improvements in the manufacturing field. Now we know that there have been no inordinate profits, for although the difference between the prime factory cost and the retail price may represent a substantial amount, the extraordinarily unbusinesslike sales methods of the majority ate into or entirely absorbed such balance. Specially commercial designs have not appeared, for not a few of the latterday cheap high class cars are even more elaborate in this respect than their previous high priced fellows. Manufacturing facilities remain approximately the same as for the past few years. How, then, are we to account for the maintenance of the specification with the drop in price? There are two theoretical explanations which are self evident—first, the sacrifice of quality in the materials and workmanship; secondly, the reduction of the profit margin.

To the engineer the fallacy of the first explanation is apparent, for the simple reason that any reduction of quality in material or workmanship will speedily revenge itself, and is therefore out of the question, so that we arrive at the actuating idea of the move—viz., small profits and quick returns.

Unfortunately an automobile salesroom is not a dry goods store; moreover, an automobile is a luxury. At the present time competition is so keen that automobiles have to be sold—not simply delivered to anxious buyers.

Let it be marked well, too, that even as no one would buy $20 gold pieces that were offered at a nickel apiece, so the public are suspicious of a too generous specification, and that consequently the move for cheapness is more than liable to defeat its own ends. It is difficult to discern how, where greater margins failed to return dividends, a living profit is to be secured from the new prices. Possibly, however, the now enthusiastic exponents of the high class cheap car are possessed of a novel arithmetic that permits these things to be done.

Engineer.

Converting a Road Hog.

Editor Horseless Age:

It is surprising how much good a little well placed kindness will do to convert a typical road hog into a respectable citizen. In one instance I know of a young farmer had the habit of pretending not to hear the horn of an approaching car until it was very close, and then grudgingly give up part of the road. This was very annoying, as we met him very often and had to come almost to a dead stop every time.

One day when going to town we overtook him walking along the road carrying a broken harness that he was taking to the village to be fixed. As we were in no hurry, and going in the same direction, we took him aboard. On the way to town he "entertained" us with a growling complaint against automobiles that caused so much trouble, tearing up good roads and scaring horses. In about fifteen minutes we had finished our errand, and in going past the harness shop ran across the same man just starting back again. On the return he seemed to get a little more used to the rapid motion, and on getting out actually had the decency to thank us. A couple of days later on a narrow road we came across a loaded hay wagon that turned out and gave us as much as possible of the road just as soon as the car came in sight. On passing the load I happened to look up, and to my surprise recognized the former road hog. Since then he has always shown this same care in giving automobiles even more than their share of the road. The moral of this little incident is I think very evident.

S. W. Cook.

Gasoline Price and Quality.

Editor Horseless Age:

Gasoline is being sold here at 15 cents per gallon. It comes in wooden barrels branded with the name of the largest corporation in the world, and tests 66 degrees. It is of such poor quality that spark plugs become fouled in 50 miles travel so badly that ignition is impossible.

I have been driven to another brand, but am informed the makers are only a tributary concern and that their product is controlled by the first indicated concern. I have to pay 23 cents for this, and it is a fine product, that tests fully 70 when freshly delivered.

The indications are that the cheaper brand is purposely so made as to be practically useless to the motorist, thus making a market for the more expensive article. There is no reason why either brand cannot be sold at 15 cents, as the requisite refining takes but a trifle from the finished product, and the refining costs practically the same for either brand. J. S. Corbin.

[If the 76° gasoline was sold for the same price as the 66°, there would probably be very little demand for the latter grade, which is much more plentiful.—Ed.]

Long Versus Short Valve Stems.

Editor Horseless Age:

Referring to the timely statement of John Gardiner, of Tucson, Ariz., on the subject of the long valve stem (one inch too long), I submit that I have had five years' experience in putting on new automobile tires, and if there is anything that is conducive to irreligious adjectives it is to put the valve stem in its place, all on account of its length. This difficulty would all be done away with if it were one inch shorter. I don't feel disposed to give the manufacturers "pointers" by telling them how to make valve stems, but I do want to say that I have never heard anything but condemnation of the long stem. Public opinion is not in every instance correct, and possibly the makers can inform us on this point. Autoist.

Accommodations for Steamers on the Kansas City-Denver Route.

Editor Horseless Age:

In answer to P. L. M.'s inquiry in your last issue regarding a trip to Denver in a Stanley, I would refer him to Mr. Jackson, of the Jackson-Walker Company (coal and building material), of Wichita, Kan. Mr. Jackson was one of our party to Denver last year in a gasoline car, and has just passed through here (Pratt, Kan.) on his way to Denver in his Stanley. He can be reached at any time through the company at Wichita through the kindness of Mr. Walker. The above address is not a good one I know, but it will serve the purpose nevertheless.

I have been over the road to Denver from here four times, and could give you data on same, but I do not know about the Knsaas City-Denver road other than from hearsay. E. W. Jones.

Maxwell-Buick Merger Rumors Persist.

Negotiations for the amalgamation of the Maxwell-Briscoe and Buick companies are evidently being continued, but have not yet been brought to a culmination. On Saturday several New York papers printed a dispatch from Detroit that the merger had been effected, and that the combination, which was capitalized at $10,000,000, would be financed by J. P. Morgan & Co. The latter firm, however, denied the report. No statement can be obtained from the Maxwell-Briscoe Motor Company. The most interesting phase of such a combination would be the attitude of the new organization toward the "Licensed" Association. It is well known that the Buick Motor Company is a licensed and the Maxwell-Briscoe Motor Company an independent firm, and no doubt there would have to be a considerable rearrangement of agency connections whether the combination joined the Licensed Association or not. In a recent issue of the Maxwell house organ, the *Co-operator*, President Briscoe replies to numerous inquiries received from agents consequent to the publication of the merger rumors. He admits that negotiations have been carried on, and asserts that the most important advantage aimed at is the possibility of purchasing raw materials on more favorable terms. The hint thrown out by the publicity department of the Licensed Association in connection with the announcement of the admission to membership of the Chalmers-Detroit, that this was only the beginning of a move to strengthen the association, might be taken to indicate that it was hoped to receive the Maxwell Company into the fold, but, of course, the cue is rather vague and uncertain.

Signposts for Californian Roads.

The A. C. of California is ready to proceed with the work of setting up signposts to guide motorists and other users of the State highroads of California. The posts are substantial, the standards being of 2½ inch galvanized pipe firmly set in the ground with heavy castings at the surface to keep them upright, and the signs are of heavy galvanized iron, painted white, with black letters. The club will erect 250 of these posts as an experiment for the purpose of ascertaining the cost of doing this work satisfactorily. The first roads to be marked will be from San Francisco to Santa Cruz, and from San Francisco to Del Monte. It is proposed to have the signs protected, and the supervisors of several counties have already said that they will pass ordinances making it a misdemeanor to damage the signs. The first sign will be set up at the entrance to the automobile boulevard leading south from San Francisco. As fast as one route is marked work will begin on another, until all the principal roads to the north of the region marked by the A. C. of Southern California are provided with signs. The officers of the A. C. of California are also getting out a series of maps on a large scale of the counties of the State. Before the maps are issued copies are to be sent to the supervisors and surveyors of each county for correction and revision.

Maryland to Start Road Building at Once.

Work in the construction of improved highways in Maryland, under the new law which makes an appropriation of $5,000,000 for the purpose, will be begun as soon as all the rights of way can be obtained, specifications drawn and contracts let. The Highways Commission has already decided upon the routes for two counties, and the State Engineer has received authority to begin surveying at once. It is expected that a good deal of work will be done before winter sets in, although the commission will not open the bids for several weeks after beginning to advertise for them. Next winter several trunk lines of highways through the shore counties and through western Maryland will be mapped out, and work on these roads will be started with the opening of spring.

End of New York-Paris Race.

The Protos car in charge of Lieutenant Koeppen arrived in Paris at 6:15 p. m. on Sunday. The long drive was concluded in front of the offices of *Le Matin* in the Boulevard Poissonière, but the German crew of the leading car received a very chilly reception. Hardly anything else could have been expected after the recent German victory in the Grand Prix race, which by many Frenchmen is regarded as an industrial Sedan. There was no official reception. Koeppen was simply congratulated by the proprietors of the *Matin*, and he then at once proceeded to his hotel. The *Matin* in fact came out with a statement that it considered that Koeppen's trip had concluded at Berlin, notwithstanding the fact that the run had always been spoken of as leading from New York to Paris, and that no change in the rules or itinerary had been announced. Perhaps the fact that of the four French cars which left Paris in February last for the round the world tour, all quit for one reason or another before it was half over had somewhat dampened the enthusiasm of the French paper which was responsible for the event. By reaching Paris first Koeppen wins the trophy offered by Grand Duke Vladimir of Russia, and it is possible that he will also get the prize of $1,000 offered by Jefferson De Mont Thompson for the car which should first carry the American flag from New York to Paris. The question to be decided is whether the fact that the Protos was shipped by rail from Pocatello, Idaho, to Seattle, Wash., deprives it of its claim to this prize.

The Thomas car arrived at Berlin at 8 o'clock on Monday morning, and is a sure winner of the event as a whole, it having been granted by the committee in charge an allowance of thirty days for its lead across the United States, and its trip to Alaska. It is scheduled to arrive in Paris this (Wednesday) evening. Of course it has been decided that in view of the forced abandonment of the Alaskan portion of the original itinerary the trophy originally offered will not be awarded, but instead cash prizes will be given to each of the first three arrivals. Besides the Thomas the Zust car is still on the road, and has been accorded an allowance of fourteen days over the Protos, but as it was last reported from Omsk, Siberia, it will probably have to content itself with third place.

Burnt Gases and Disease.

Some weeks ago a New York newspaper printed an argument against the motor car, that the fumes from the burnt gases caused laryngitis and bronchitis, and cited a certain policeman on a certain beat where many motor cars passed. A medical reader suggests that if an investigation were made it would be found that this policeman is afflicted with tuberculosis, and would have attacks of bronchitis whether he was assigned to a motor beat or a park beat, where motor cars are sometimes prohibited.

New Incorporations.

Foster Motor Car Co., Richmond, Va.—Capital, $10,000. Automobiles.

Baltimore Taxicab Co., Baltimore, Md.—(Under Delaware law.) Capital, $150,000.

Berliet Import Co., Chicago, Ill.—Capital, $2,500. To deal in automobiles, machinery and parts.

Goldberg Motor Car Devices Manufacturing Co., Chicago, Ill.—Name changed to Stromberg Motor Devices Co.

City Garage Co., Providence, R. I.—Capital, $25,000. Incorporators Guy Tillinghast, Fred W. Tillinghast and Arthur Andrew.

King Leather Tire Co., Milwaukee, Wis.—Capital, $20,000. Incorporators, Anthony J. Deuser, N. F. Oliphant and Herbert J. Piper.

Interborough Garage Co., Brooklyn, N. Y.—Capital, $20,000. Directors, John F. O'Donnell, Pierce W. Grace and Thornton J. Theall.

New York Auto Supply Co., Hempstead, L. I., N. Y.—Capital, $12,000. Directors, Benjamin D. Underhill, George H. Sprague and George T. Sprague.

Sanschor Auto Spring Co., St. Louis, Mo.—Capital, $20,000. Incorporators, C. E. M. Champ, C. A. Meredith and C. B. Richmond. To manufacture and deal in vehicles, etc.

Elite Motor Service Co., New York.—Capital, $100,000. Directors, William H. Barnard, 54 Howard street; Willis B. Troy, 262 West Seventieth street; Edmonds Putney, 2 Rector street, New York.

Manhattan Beach Transportation Co., Brooklyn.—Automobile and motor garage. Capital, $1,000. Incorporators, Charles F. Bott and Walter Weston, No. 1378 Bedford avenue, Brooklyn; Frank A. Bradford, No. 31 Union square, New York.

Commercial Applications.

Motor Trucks in Mount Vernon, N. Y.

There are two motor truck lines connecting Mount Vernon and New York city, the vehicles being garaged at Mount Vernon in both cases. The first of these is operated by J. Fitzgibbon, of 242 South Third avenue, the rolling stock at present consisting of two 5 ton Manhattan trucks; a third will be put into service in a short while. The vehicles are operated upon a regular schedule, leaving the office in New York at 6 and 8 a. m. and at 12:30 and 3:30 p. m. daily. The goods carried are for the most part vegetables, fruit crates, light machinery, etc., on the in trip, and various foodstuffs, dry goods and the like on the out trip. Moving of household goods within a radius of about 15 miles is also undertaken by appointment.

The Mount Vernon and New York Express, with offices at 210 Duane street, New York, operate three Frayer-Miller trucks, two of which are of 5 tons and the third of 3 tons capacity. Merchandise of all kinds is carried not only to the termini but to points off the line as well.

The Lenox Laundry Company, of North Third street, Mount Vernon, use a Reliance 2 ton truck for collecting and delivering large lots of laundry, such as from hotels, families and factories. These collections are made from Monday to Wednesday and deliveries during the latter part of the week. Small collections and deliveries are made in addition.

Automobiles in Municipal Service.

The fact that the commissioners of Marion County, Ind., of which Indianapolis is the county seat, have become disgusted with an automobile in their work has aroused considerable discussion as to why automobiles in municipal service in Indiana are not altogether satisfactory. After an investigation, dealers say that it is because no car is given harder service than that in municipal or county work. As a rule an experienced driver is not employed; cars are not limited in service to the work laid out for them in the beginning, politicians and officeholders' friends making use of them. A contrast is offered by the experience the Indianapolis police department is having with the three automobiles now in service. One professional driver was employed, and a second driver was sent to a factory several weeks for instruction. The two trained drivers succeeded in training several patrolmen as drivers, and as a result the cars are in service seven days a week and little trouble is experienced.

Commercial Notes.

A motor omnibus line is being contemplated at Council Bluffs, Ia., to connect the Iowa School for the Deaf with the centre of the city. The plan is to form a company capitalized at $10,000, and to purchase two large motor buses.

A taxicab service has been established at Far Rockaway, N. Y., with headquarters at the Savoy Boarding Stables.

W. E. Reilley, who has been conducting a motor livery at Greenbush, Minn., has engaged in a similar business at Crookston, Minn.

A project is on foot for providing New Haven, Conn., with a taxicab service. Among those interested in the project is Judge A. Heaton Robertson.

A stock company is being formed at Corydon, Ind., to operate an automobile bus line between that town and New Albany, Ind. George Straub, who operates the Corydon stage line, is interested in the enterprise.

The police commissioners of Hartford have ordered a new Pope motor ambulance for the police department. The ambulance is to cost $3,750, equipped with the latest improvements, and is to be delivered to the city on or before November 15.

The City Council of Alameda, Cal., has decided to purchase a Watrous motor fire engine at $8,000 if the company manufacturing the machine will submit it to tests prescribed by the department of fire and police, and will put up a bond to guarantee that the engine will do the work required.

On August 1 an automobile stage line, between Escondido and San Diego, Cal., a distance of 35 miles, will begin operations with three Pierce Arrow cars, which will make the trip in about three hours. The horse stage coaches at present in use take nine hours. Small quantities of freight will be carried as well as passengers.

The Calumet-Laurium Motor Car Company has been incorporated to operate a motor service between these two Michigan towns. Edward Ulseth has been elected president, Paul P. Roehm vice president, and Selden B. Crary, secretary and treasurer. Two twenty passenger motor buses have been ordered, and are to be placed in service on August 1.

The H. Lieber Company, Indianapolis art dealers, have purchased a motor delivery wagon with which they will make all of their Indianapolis deliveries in the future, displacing two horse drawn vehicles. The company made an extensive test of motor vehicle delivery before placing an order, fearing that such vehicles might be too rough for the fragile class of goods they handle.

The Baltimore Taxicab Company, which was incorporated in Dover, Del., on July 17, expects to have thirty taxicabs in operation in Baltimore by August 15. The rate of fare will be 30 cents for the first half mile, 10 cents for every quarter mile thereafter, and 10 cents for every six minutes waiting. The company is capitalized for $150,000, and the incorporators are George W. Knapp, Charles E. Ford, W. S. Belding, N. B. Lobe, Wilson J. Carroll, Charles Berg, of Philadelphia, and William I. Lofland, of Wilmington, Del.

The Gas and Electric Company, of San Rafael, Marin County, Cal., has bought a 36 horse power touring car for use in its business.

J. F. Robinson, of San Angelo, Tex., has established a motor service between Temple and Martin, Tex., which will be continued pending the installation of an interurban electric line. The two towns are only 35 miles apart in an air line, but a round trip by railroad takes a day and a half. Two 22 horse power touring cars will be used in the service.

The contract for furnishing a new motor patrol to the police department of Springfield, Mass., has been given to the Knox Automobile Company, of Springfield. The car will have a 40 horse power, four cylinder motor, and will be delivered about September 15. The Springfield police department now has one Knox motor patrol in service, which is said to have covered approximately 20,000 miles to date.

Boston's Taxicab Service.

Some delay was caused in starting the taxicab service in Boston, by the fact that it was necessary to first amend the hack regulations in force. Street Commissioner O'Meara last week gave a hearing at which cab drivers and public cab owners were given a chance to make complaint against the innovation, and at the conclusion of the hearing he decided that motor cabs might be operated in Boston, and accepted the schedule of fares submitted by the Taxicab Motor Cab Company, which has had twenty-five cabs ready to be placed in service for almost a fortnight. The schedule is as follows:

For three or more persons from one point to another point within that part of the city proper lying north or east of Massachusetts avenue:

	Cents.
First third of a mile or fraction thereof..	30
Each sixth of a mile thereafter..........	10
Each six minutes of waiting.............	10

For any number of passengers between any point in the city limits not covered by the above heading:

	Cents.
First half mile or fraction thereof........	30
Each quarter mile thereafter............	10
Each minute of waiting..................	10

The regulations provide that waiting shall include all the time the vehicle is not in motion, beginning at the time of its arrival at the place to which it is called. No charge is to be made for time lost owing to congestion of traffic, through mishaps to the vehicle, or for premature arrival if the vehicle is ordered for a certain time. If the vehicle is sent in response to a call a distance of less than 1 mile, no charge is to be made for the distance thus traveled, while for a greater distance a charge of 20 cents is made. There is also no charge for an empty return trip from any point within 2 miles from the start, while for the return trip from a more distant point a charge of 20 cents is made. There is no charge for hand baggage carried by passengers, while all ferry tolls must be paid by passengers.

LEGISLATIVE and LEGAL

The Correlative Right of Transit—Its Bearing on Automobile Legislation.

By Xenophon P. Huddy, LL. B.

When the American Automobile Association went to Washington to convince the Judiciary Committee of the House of Representatives that Congress possessed the power to relieve non-resident automobilists from the obligation of paying a tax or fee in order to motor through another State, such, for example, as the State of New Jersey now charges, interstate commerce was the sole subject of discussion. The A. A. A. through its counsel claimed that an automobilist who travels from State to State for pleasure is engaged in interstate commerce, and consequently the Federal Government has the exclusive jurisdiction to control such travel.

Personally, I have never believed that interstate automobiling for pleasure constitutes interstate commerce, although I have always been willing to be convinced. I would like to have it regarded as commerce, but only the courts can answer the question involved, which is exceedingly close. Under the circumstances my advice would be to quit the fight over the question of commerce, and turn to other constitutional grounds and objections which are more certain to destroy the alleged drastic legislation of the State of New Jersey.

There are certain vitiating defects in the New Jersey law sufficient to overthrow it, but the authority therefor has lain hidden in the United States Supreme Court reports for many years. Exhaustive research, hard study and work are necessary to make one's ground certain, if one expects to defeat the revenue tax of the New Jersey automobile law. The solution of the problem is hidden among fundamental principles of constitutional government as we have it in this country.

In a recent issue of The Horseless Age we considered the State's power to tax the privilege of entering its borders. What was said at that time is the law, and is clearly established by authority, which we will now consider more specifically.

Let it be said at the outset that even if the State of New Jersey possesses a law objectionable to a great many automobilists, the officials charged with the execution of that law, the higher officials, are men of extreme courtesy in their dealings with automobilists. To visit these officials at Trenton and discuss automobile legislation with them would almost make an automobilist forget his grievance against the State. New Jersey's Commissioner of Motor Vehicles, by his gracious manners and courteous treatment, does much to alleviate the harsh feelings which motorists might otherwise have against the State for charging them for automobiling within its borders.

The decision of the Supreme Court of the United States referred to before, and which I predict will be the basis on which the illegality of any charge above that required to pay for the issuing of a license to non-residents will be established, is an old one, but it is of the greatest importance. It probably has not been thought of for years, yet it is as much the law today as it was when the decision was handed down.

The case referred to is that of *Crandall vs. State of Nevada, 6 Wall (U. S.) 35.* This decision was handed down by the Supreme Court of the United States in 1867. The court held:

First—That the United States has a right to require the service of its citizens at the seat of the Federal Government in all executive, legislative and judicial departments, and at all the points in the several States where the functions of Government are to be performed.

Second—That by virtue of its power to make war and to suppress insurrection the Government has a right to transport troops through all parts of the Union by the usual and "most expeditious modes of transportation."

Third—That the citizens of the United States have the correlative right to approach the great departments of the Government, the ports of entry through which commerce is conducted, and the various Federal offices in the States.

Fourth—That the taxing power being in its nature unlimited over the subjects within its control, it would enable the State governments to destroy the above mentioned rights of the Federal Government, and of its citizens, if the right of transit through the States by railroad and other ordinary modes of travel were one of the legitimate objects of said taxation.

Fifth—That the existence of such a power in the States is, therefore, inconsistent with the objects for which the Federal Government was established, and with rights conferred by the constitution of that government and on the people. An exercise of such a power is according to law void.

This case alone should answer the question as to the validity of the New Jersey automobile law. This case establishes the proposition that transit cannot be taxed. Moreover, the decision covers transportation by the most expeditious modes and ordinary methods of travel. The automobile is certainly now one of the ordinary and most expeditious modes of travel; as much so as the steam railroad.

Mr. Justice Miller delivered the opinion of the Supreme Court in this case. He starts off by stating that the question presented to the court is one of importance. He says: "The proposition to be considered is the right of the State to levy a tax upon persons not residing in it, who may have occasion to pass through it." Here we are face to face with a situation similar to that created by the New Jersey automobile law.

The tax in question was one imposed by the State of Nevada upon proprietors of railroads and stage lines of $1 per head on every passenger carried. It was contended that the tax was upon the business and not upon passengers, but the court held that it was, in fact, a tax upon the passengers carried. The same reasoning may apply to the tax which is levied upon an automobile by the State of New Jersey. It may be argued that the tax is upon the motor vehicle, but such a contention is not maintainable, since the owner of the automobile is compelled to pay the tax, and he is the citizen who desires transit through the State. He is, therefore, taxed for such transit. The Supreme Court refused to decide the case in question on the ground that the tax interfered with interstate commerce, but placed its decision upon other and broader grounds. The opinion of the court is worthy of quotation, since it asserts those fundamental principles of constitutional government which control the question of validity of the New Jersey law. It would be well for all automobilists to read this opinion:

> The people of these United States constitute one nation. They have a government in which all of them are deeply interested. This government has necessarily a capital established by law, where its principal operations are conducted. Here sits its legislature, composed of senators and representatives from the States and from the people of the States. Here resides the President directing through thousands of agents the execution of the laws over all this vast country. Here is the seat of the supreme judicial power of the nation to which all of its citizens have a right to resort to claim justice at its hands. Here are the great executive departments, administering offices of the mails, of the public lands, of the collection and distribution of the public revenues and of our foreign relations. These are all established and conducted under the admitted powers of the Federal Government. That government has a right to call to this point any or all of its citizens to aid in its service, as members of a congress, of the executive departments, and to fill all its other offices; and this right cannot be made to depend upon the pleasure of a State over whose territory they must pass to reach the point where these services must be rendered. The Government, also, has its offices of secondary importance in all other parts of the country, on the seacoast and on the rivers it has its ports of entry. In the interior it has its land offices, its revenue offices and its sub-treasuries. In all these it demands the services of its citizens and is entitled to bring them to these points from all quarters of the nation, and no power can exist in a State to obstruct this right that would enable it to defeat the purposes for which the Government was established.
>
> The Federal Government has a right to declare and prosecute wars, and to raise and transport troops through and over the territory of any State of the Union.
>
> If this right is dependent in any sense, however limited, upon the pleasure of a State, the Government itself may be overthrown by an obstruction to its exercise.
>
> But if the Government has these rights on its own account, *the citizen also has correlative rights.* He has the right to come to the seat of Govern-

ment to assert any claim he may have upon that Government, or transact any business he may have with it, to seek its protection, to share its offices, to engage in administering its functions. He has a right to free access to its seaports through which all the operations of foreign trade and commerce are conducted, to the sub-treasuries, the land offices, the revenue offices and the courts of justice in the several States, and this right is in its nature independent of the will of any State over whose soil he must pass in the exercise of it.

The court goes on to say that these views are neither novel nor unsupported by authority. The case of McCulloch vs. Maryland was reviewed by the court, and the maxim promulgated by John Marshall, that "the power to tax is the power to destroy," was considered in connection with the State's right to tax transit of citizens through its borders. It is not the extent of the tax, but it is the right which the State claims to levy it, which is objectionable. The court expressly says in the opinion that if the State can tax to the extent of $1, it can tax to the extent of $1,000. If one State can do this, so can every other State. Of course the police power of the State is to be excepted. The court relied upon and cited the "Passenger Cases," 7 How., U. S. 283, particularly the following opinion of the Chief Justice:

> Living as we do under a common government charged with the great concern of the whole Union, every citizen of the United States, from the most remote States or Territories, is entitled to *free access* not only to the principal departments established at Washington, but also to its judiciary tribunals and public offices in every State in the Union. For all the great purposes for which the Federal Government was formed we are *one people*, and one common country. We are all citizens of the United States, and as members of the same community, *must have the right to pass and repass through every part of it without interruption*, as freely as within our own States. A tax imposed by the State for entering its territories or harbors is inconsistent with the rights which belong to citizens of other States as members of the Union, and with the objects which that Union was intended to attain. Such a power in the States could produce nothing but discord and mutual irritation, and they very clearly do not possess it.

Enough has been said, it is believed, to point the way for establishing the invalidity of State taxation on transit. No question of commerce is involved; therefore there is no need to raise any such question. In the past automobilists have proceeded upon the wrong theory in their attempts to defeat taxation of non-residents. Future action should be based upon the broader principle of the correlative right of transit. Congress may legislate, because United States citizens and State citizens possess the right of free access, and nullify State laws exacting revenue from non-residents. There is no need of compiling a voluminous brief on this subject, or of numerous citations of cases and authorities. The Supreme Court has spoken, and spoken for all time. Crandall vs. Nevada is the law that controls the right of a non-resident automobilist to travel not only to Washington, the seat of the Government, but to any part of the country. As stated by the Supreme Court of the United States, the right of transit is a correlative right belonging to citizens of the United States and of the State. The right to pass through New Jersey is a correlative right of every automobilist, and in the future the object should be to compel recognition of this correlative right. Let the byword be, "Allow us our correlative right of transit.

Lamp Makers Involved in Suit.

The Rushmore Dynamo Works, of Plainfield, N. J., have brought suit against Gray & Davis, of Amesbury, Mass., for $25,000 damages, alleging that libelous statements were contained in a pamphlet sent out by the defendant company to prospective customers of complainants on June 11. The pamphlet in question is entitled "Candle Power and Illumination Test of Gray & Davis and Rushmore Searchlights." The alleged test records, which are signed by George F. Sever, electrical engineering department Columbia Institute, and by Ralph R. Lawrence, electrical engineering department Massachusetts Institute of Technology, show a greater candle power for the Gray & Davis than for the Rushmore in every test run.

Allen Sues for Damages.

The Allen-Kingston Motor Car Company, of New York, have brought suit for $45,000 damages against the Consolidated National Bank of New York, Wm. O. Allison, Elverton R. Chapman and Thomas J. Lewis. In the complaint it is alleged that E. R. Thomas and O. F. Thomas, former directors of the Consolidated National Bank, guaranteed the delivery of 100 motor cars, mostly taxicabs, by the Kingston Motor Car Company, to Walter C. Allen. It is also alleged that Allison, Chapman and Lewis induced the complainant to transfer the contract to the New York Car and Truck Company by representing it to be a solvent concern. All of the complainants are claimed to have been interested in this latter concern, which failed on March 6 last.

Legal Notes.

The authorities of Monterey, Mex., intend to adopt regulations governing the use of automobiles on the streets of the city. There have been two serious automobile accidents in Monterey recently.

Suit was entered in the county courts at Indianapolis last week by Lucinda Shaw, Ida M Watson and Anna B. Cook against the Prest-O-Lite Company, each asking $10,000 damages, alleging that they were injured by being thrown to the floors of their homes during the explosion in the plant on June 6.

The fifty automobile owners of Brazil, Ind., have combined to fight the authorities of the little town of Seeleyville. Without taking the State law into consideration, which allows a speed of 15 m. p. h. in a town the size of Seeleyville, the authorities have decided that 8 m. p. h. is sufficient. Roads leading into Seeleyville have been posted to that effect, and a large proportion of Brazil's drivers have been arrested and fined.

The Supreme Court of the State of New York has decided that an automobile owner is not responsible for injuries inflicted on third parties by his chauffeur while the latter is out in the car for his own pleasure with the owner's consent. This decision was handed down in the case of George Cunningham against Burton S. Castle.

At a recent meeting of the French Council of Ministers, presided over by M. Fallières, it was decided that France should take the initiative in calling an international conference with a view to studying the means of facilitating the circulation of motor cars from one country to another. The conference will probably take place next October.

The new automobile law passed by the last Massachusetts Legislature went into force on July 15. Henceforth the non-resident tourist is exempt only seven days, and must drive his car himself if he wants to take advantage of the exemption clause. If he is convicted of violating the Massachusetts automobile law he must register at once. The new law makes the Highways Commission practically a court, empowering it to summon witnesses, administer oaths and take testimony.

The Indianapolis police are serving warrants on automobile owners who failed to comply with the city license ordinance last year. About twenty arrests have been made, and they will continue until 234 warrants in all have been served. In each instance Police Judge Thomas A. Whallon has assessed the minimum fine of $1 and costs amounting to $11. Many people did not pay the 1907 license fee as the ordinance was being tested in the courts at that time.

The validity of the Cincinnati licensing ordinance will be tested by the injunction proceedings method according to an agreement reached between an attorney for the local A. C. and city officials. A car whose owner has complied with all the provisions of the State law, but disregarded the municipal ordinance, will be run upon the streets, arrest will be threatened by the city officials, and the owner will then apply for an injunction restraining the city auditor from interfering with his operation of the car.

Coming Events.

August 14—Algonquin, Ill., Hill Climb of the Chicago Motor Club.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

September 14—Annual Economy Run, Chicago Motor Club.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

MINOR MENTION

The Rajah Auto-Supply Company has moved its office to its new factory in Bloomfield, N. J.

W. F. Polson, of Buffalo, N. Y., has arranged for a salesroom at 1773 Broadway, New York, for his wind shields, tire tools, etc.

The National Brake and Clutch Company inform us that half the cars which started in the Glidden Tour this year were equipped with cork insert clutches and brakes.

The Oakland Motor Car Company recently gave a demonstration of the hill climbing power of their car by ascending the Wayne street hill in Detroit with four passengers, with one of the two cylinders entirely cut out.

The Detroit retail branch of the Cadillac Automobile Company is said to be considering the plan of giving a month's free garaging with the sale of every car. One feature that recommends this plan is that in this manner the new owner is apt to learn the care of the car more thoroughly right at the start.

We have received from the secretary of the Scottish A. C. a copy of the official report on the recent Scottish reliability trials, of which a full account appeared in recent issues of The Horseless Age. The official report gives a complete list of the records made by each car day by day, and in the hill climbs, causes of delays, marks earned, etc.

Designer Bacon, of the Detroit Electric Vehicle Company, is making a trip in a specially constructed runabout from Detroit to New York. He left Cleveland on the morning of July 15. Up to that point his only trouble is said to have consisted in a number of punctures, though on the sand hills near Toledo the motor naturally got very hot.

The receivers of the Pope Company, Albert L. Pope and George A. Yule, have been authorized by Judge Curtis, of the Superior Court, to continue the business for four months from August 28. Attorney A. L. Shipman, counsel for the Connecticut receivers, assured the court that a reorganization of the company would undoubtedly take place in the fall before the four months' order expires.

A hitch in the preparations for erecting the new plant of the Reliance Motor Truck Company in Owosso, Mich., has been caused by the refusal of the Grank Trunk Railway to cut its main line for a switch to the site on which the plant was to be built, owing to the fact that this would necessitate slowing down of all of the trains at this point. The committee in charge of the negotiations is consequently looking for a new location. Some of the money necessary to secure the plant for Owosso was raised by selling lots in the vicinity of the site selected, and this money will now have to be returned.

The Iroquois Motor Vehicle Company, which recently moved from Syracuse to Seneca Falls, N. Y., has decided to move back to Syracuse.

Sayres & Scovill, motor truck manufacturers of Cincinnati, Ohio, are planning to erect a factory on a tract of land adjoining the B. & O. F. W. road, a short distance above Mitchell avenue.

Negotiations are said to have been practically completed for the sale of the W. F. Stewart body factory, Flint, Mich., to the Buick Automobile Company, whose main factory is located right opposite the body factory.

The Topeka Foundry and Machine Company, Topeka, Kan., has established an automobile shop at 318 Jackson street, in charge of John Broberg, formerly foreman of the assembly department of the Smith Automobile Company.

We have received a copy of a paper, "Seventeen Years of Experimental Research and Development," read by Edward Goodrich Acheson before the American Academy of Arts and Sciences on the occasion of the presentation of the Rumford medal to the author for his electric furnace products.

Frank Moore, of Glencoe, Ill., the policeman who recently shot at an automobile and injured one of the occupants, has been placed under $1,000 bond. At first he was allowed to come and go as he pleased, upon his promise to be on hand when wanted, but Secretary Gorham, of the Chicago A. C., protested, and Moore was placed under bond.

The E. R. Thomas Company, Buffalo, N. Y., have decided to discontinue their Chicago agency, formerly held by C. A. Coey, until they can appoint another agent. The reason assigned by the Thomas Company for the action is that Coey broke his agency contract by handling an unlicensed car, but it is said that there have also been other difficulties between the firm and its agent.

A. J. P. Bertschy, general manager of the Nevada Motor Car Company, and William Clifford, of Rawhide, Nev., are trying to interest Omaha, Neb., capitalists in a proposition to manufacture a large, low speed touring car said to be specially adapted for public service on the Western plains. The model car has been completed in Chicago. It weighs 5 tons, is equipped with a four cylinder, 85 horse power motor and geared to 25 miles per hour maximum. The wheels are solid wood discs, iron bound, and fitted with solid rubber tires. The car has been run on test from Chicago to Omaha.

The Standard Brake Company, formerly of 101 West Sixty-sixth street, New York, which has for several years assisted the National Brake and Clutch Company in negotiating licenses with automobile manufacturers to use cork inserts for automobile purposes, has retired from business owing to death, and all correspondence should in future be sent to the National Brake and Clutch Company, 16 State street, Boston.

The garage owners of San Francisco have formed an association for mutual protection against price cutting on supplies and sundries.

The Remy Electric Company, Anderson, Ind., have made contracts to supply their magnetos to the Buick and Overland companies for their respective 1909 outputs.

The E. L. Leinbach Auto Company, Baltimore, Md., have taken the agency for the Oldsmobile, and will soon occupy new headquarters in the vicinity of North avenue.

Fort Morgan, Col., business interests have decided to launch a campaign to make known the advantages which the town offers as a location for manufacturers, and particularly for automobile manufacturers.

We are informed that the George N. Pierce Company, of Buffalo, have decided to equip their 1909 output with Truffault-Hartford shock absorbers. They have furnished these devices as part of the equipment for a number of years.

The Buick-Waller Automobile Company, of Grand Rapids, Mich., has been taken over by the Buick Motor Company, of Flint. George W. Waller remains in charge as manager of the Grand Rapids office, which will be the western Michigan branch of the general office.

Charles F. Diggs has been appointed receiver for the Rock Creek Auto and Wagon Works 2611 Pennsylvania avenue N. W., Washington, D. C. The application for the receivership was made by the president of the concern, who claims that the assets are worth $26,000, while the liabilities are only $16,000.

The Bartholomew Company, of Peoria, Ill., have decided to open a branch office for their Eastern business in Philadelphia on August 1, in charge of O. Y. Bartholomew, the company's treasurer. It is stated that they produced 200 cars last year, and expect to increase their production to 350 the coming season.

It is announced from Hagerstown, Md., that the receivers for the Pope Manufacturing Company have decided to combine the business of the plants located at Hagerstown and Westfield, Mass., respectively, at the latter place. The Hagerstown plant, where at present about 200 men are employed, will be closed as soon as the cars now under construction are completed, and the buildings and ground will be sold.

The New York branch of the White Company will hereafter be known as the Eastern branch, and George W. Bennett will take the title of Eastern sales manager. The territory to be handled by the Eastern branch comprises New York State as far as Rochester, the eastern counties of Connecticut, part of Berkshire County, Mass., the entire States of New Jersey and Delaware, and the eastern half of Pennsylvania. The office of the White Company in Philadelphia becomes a sub-branch under the control of Mr. Bennett.

The effects of the Earl Motor Car Company, Kenosha, Wis., were sold at auction on July 25. None of the former officials were present to bid, but they are trying to effect a reorganization.

The Protos car, which was first to reach Paris in the New York to Paris race, is equipped with F & S ball bearings, and we are informed that these gave no trouble during the entire trip.

Deibler & Johnson, Berlin, Wis., who are assembling automobiles and manufacturing parts on a small scale, are organizing a stock company to go into the manufacturing business more extensively.

A. F. Rockwell, of the New Departure Manufacturing Company, of Bristol, Conn., is organizing the Bristol Engineering Company, to manufacture parts for motor taxicabs, and later the complete cabs.

It is reported that an order for $100,000 worth of automobile engines, which an Eastern manufacturer wishes to place with the Western Motor Works, of Logansport, Ind., is made contingent upon the defeat of Bryan in the coming Presidential election.

The Peerless Motor Car Company, in painting the three cars entered by them in the Glidden tour displayed a rather patriotic spirit. One car was painted red, another white and a third blue, and the effort was made to line them up at each night control in that order.

Arthur D. Truax has been appointed receiver for the Chelsea Auto Storage Company, 520 West Thirty-seventh street, New York city. Three of the directors of the concern, which was incorporated April 10, 1907, with a capitalization of $75,000, brought suit for dissolution. The directors are Arthur M. Von, Lester F. Albro and Clement L. Stephenson.

J. L. Barker, Racine, Wis., has perfected what is claimed to be a non-puncturable auto tire consisting of the regulation inner tube tire, with a casing of great strength which is slipped over the outer tube, and held in place by its own conformation when the tire is inflated. Inside the casing is a finely tempered steel band 3 inches wide, and of No. 20 gauge thickness.

Edward S. Bartlett, president of the Trebert Gas Engine Company, Rochester, N. Y., was killed at 1 o'clock on last Saturday morning by driving a new car occupied by himself and a young woman into the Erie Canal by mistake. It is thought that he mistook an alley for a main thoroughfare, and drove at full speed into the canal. It is said that Bartlett was known as a fast driver, and had been fined for speeding before.

It is reported that the Overland Automobile Company, Indianapolis, has under consideration the removal of its plant to some other city. No official statement on the subject has been made, however, but it is known that Anderson, Newcastle and Muncie would like to have the plant. The company was reorganized last year, and a temporary plant erected adjoining that of the Parry Manufacturing Company. This plant has proven inadequate for the needs of the company.

Club Notes.

The Long Island A. C. will hold a meeting today (Wednesday), at which the project of installing considerable new equipment will be voted on.

The Milwaukee A. C. has offered a reward of $50 for information sufficient to convict the persons who destroyed the tires and top on a machine owned by one of its members.

For the demountable rim contest, which is to be held by the Chicago M. C. on August 6 over a 100 mile circuit leading through Elgin and Aurora, the Fisk and Diamond companies had entered rims up to July 10, and several more entries were expected.

It is announced that the 250 mile race, which was to be held by the Lowell (Mass.) A. C. on July 4, and which had to be postponed because no sanction for the use of the State highway through Tyngsboro could be obtained, has now been set for Labor Day.

The A. C. of Englewood, N. J., is giving notice to motorists that the neighboring town of Tenafly is operating speed traps on Saturdays and Sundays, one of which is located on Engle street, from the borough line north to the main street leading to the station. The trap is operated from the shrubbery and is equipped with a telephone.

Hartford has a hustling automobile club, with headquarters at the Allyn House, the centre for traveling auto men and automobile tourists. W. F. Fuller is its president, and G. K. Dustin the secretary. The Automobile Dealers' Association met at the clubrooms, and voted to give an automobile show at Charter Oak Park during the week of the grand circuit races. The exhibit will be held in a tent covering 15,000 feet of floor space. The Hartford dealers have also selected the dates for their annual indoor exhibition at Foot Guard Hall. They are February 27 to March 6. The committee to have charge consists of F. W. Dart, S. A. Miner and E. G. Biddle.

The Chicago Automobile Club is at war with the officials of the suburb of Glencoe. Recently a member of the club, T. P. Henderson, passed through the village of Glencoe, when his car was shot at by Policeman Moore, and one of the occupants, Miss Buena Stribling, was injured. The club thereupon held a meeting and adopted a resolution in which they demanded that the policeman be prosecuted to the limit, and insinuated that the operation of speed traps in the village of Glencoe was for revenue only. Thereupon a mass meeting was held in Glencoe, attended by about 200 citizens, in which resolutions were passed condemning the insinuations of the Chicago club, and approving of the action of the village officials in their efforts to suppress speeding.

Garage Notes.

Ernest Klinkert, Corliss, Wis., will erect a garage at a cost of $5,000 adjoining his new hotel.

E. E. Sly has opened a garage and machine shop at 18 Woodlawn avenue, Norwalk, Ohio, under the name of the Norwalk Machine and Auto Garage.

The Crescent Auto Company, automobile and supply dealers, of Chattanooga, Tenn., have moved into a new building on Williams street, specially erected for the business.

The firm name of the Motor Car Exchange, Cleveland, Ohio, has been changed to the Brooks Motor Car and Livery Company. A. J. Brooks is manager of the company.

P. E. Coffee is contemplating the erection of a three story garage building, 132x132 feet, at Tenth and Walnut streets, Des Moines, Ia. No plans have yet been drawn.

Terry Stafford, formerly superintendent of the Smith Automobile Company, Topeka, Kan., has purchased the garage of Paul Mulvane, Seventh and Quincy streets, Topeka, Kan.

The McKeesport (Pa.) Automobile Garage and Machine Shop, formerly owned by Drs. I. L. Steele, Theo. Nason, V. W. Cowan and others, has been purchased by Richard J. Lane.

The Hubert-Levy Automobile Company, Louisville, Ky., have moved into their new headquarters at 650 Fourth avenue, opposite the post office. They handle the Buick and Franklin lines.

The Lakeshore Garage will be opened in Cleveland on August 1, at 475 East 105th street. The garage will be under the management of W. B. Pettibone, former instructor at the Y. M. C. A. automobile school.

J. O. Eddleman's garage at Newman, Cal., was set on fire on July 14, by a burning photograph gallery adjacent, and was entirely destroyed, the automobiles being saved. The loss on the garage is $1,500, with $1,500 insurance.

The Stoddard Dayton Auto Company has been organized at Minneapolis, with John Burmeister as manager and Arthur Kelley as sales manager. The company, which will handle the Stoddard-Dayton car in the twin cities, will have temporary quarters at 110½ Sixth street, S., and later will occupy a new garage now building on Hennepin avenue, near Lake street.

Frank J. Fanning has retired from the firm of Levy & Fanning, who handled the Autocar and the Lozier in Chicago last season, and has been succeeded by George W. Hipple, formerly agent for the Thomas-Detroit in Chicago. The change was consequent upon the admission of Chalmers-Detroit Company to the Licensed Association. The firm will henceforth be known as Levy & Hipple, and handle all three makes of cars.

Trade Personals.

D. K. Dickinson, formerly with the Hartford Rubber Works, has been appointed assistant manager of the Michelin Tire Company's branch in Cleveland.

C. E. Denzer has been appointed Western wholesale sales manager for the White Company, with office at Chicago, and James E. Plew has been placed in charge of the retail sales department at Chicago.

Charles W. Blackman, formerly connected with the Parish & Bingham Company, of Cleveland, has been appointed general sales manager of the Driggs-Seabury Ordnance Corporation, with headquarters at Sharon, Pa.

Percy F. Megargel, who has formerly been connected with the E. R. Thomas Car Company and the Reo Motor Car Company, has just accepted the position of advertising manager with the National Sales Corporation, of New York city.

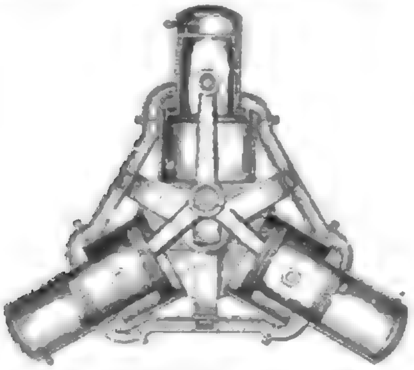
MOTOR VEHICLE PATENTS

Review of Specifications.

890,643. Two Cycle Internal Combustion Engine.—Herbert S. Hart, of Madison, Wis. June 16, 1908. Filed July 13, 1907.

This is a three cylinder, two cycle internal combustion engine fitted with differential pistons within correspondingly shaped cylinders. The cylinders are secured to a skeleton framework and rotate about a stationary crank shaft. This framework is hollow and forms the passages for the charges between consecutive cylinders. A common fuel supply chamber is fitted with communicating passages to the hollow framework.

The smaller cylinder of each unit acts as a working chamber, the working charge for it being compressed and delivered by the larger cylinder of the preceding unit. The passages formed by the framework communicate with the larger cylinder of each unit at one end by means of annular chambers and with the smaller cylinders of the succeeding units by means of ports. A triangular "manifold" communicates with these passages, and the initial charges are delivered to each branch in succession as the framework revolves by putting into communication corresponding ports in the supply chamber and branch of the manifold. The passages thus have two functions, admitting the charge to the larger cylinder to be compressed and acting as a conduit for the passage of the compressed charge to the working chamber of the cylinder next in succession. Ports are cored in each cylinder for exhausting the charge as in ordinary two cycle practice. The cylinders are cast smooth and are designed to avoid the use of special cooling means by reason of their revolving. They act as a balance wheel at the same time.



No. 890,643.

Patents Issued June 30, 1908.

891,841. Automobile Wheel.—Karl Kohlmann and Gustav Andree, Dane, Wis. Filed January 22, [illegible].

891,914. Transmission Gear for Motor Vehicles.—Russell Huff, Detroit, Mich. Filed February 16, [illegible].

891,936. Carburetor.—Antoine Jourdanet, Pierre Billet and Ferdinand Baron, Lyon, France. Filed June 17, 1907.

891,993. Flexible Piston Connection.—Henry Hess, Wawa, Pa. Filed July 27, 1907.

892,037. Sparking Igniter for Explosive Gas Engines.—Frederick A. Feldkamp, Newark, N. J. Filed June 25, 1907.

892,038. System for the Ignition of the Gaseous Mixtures in Explosive Gas Engines.—Frederick A. Feldkamp, Newark, N. J. Filed August 24, 1907.

892,049. Safety Crank for Internal Combustion Engines.—Noble W. Hartman, Toledo, Ohio. Filed September 3, 1907.

892,051. Vehicle.—Edward R. Hewitt, New York, N. Y. Filed October 1, 1906.

892,073. Power Transmitter.—Eddy T. McKaig, Chicago, Ill. Filed October 9, 1907.

892,075. Tire.—Arthur O'Brien, Chicago, Ill., assignor of one-half to Frank P. McGinn, Chicago, Ill. Filed May 23, 1907.

892,135. Resilient Vehicle Wheel.—Claude A. Conroe, Topeka, Kan. Filed August 10, 1906.

892,161. Shock Absorber for Vehicles.—Jesse J. Jennings, Chicago, Ill. Filed May 7, 1906.

892,253. Igniting Mechanism for Explosive Engines.—George B. Hakins, Norwood, N. Y. Filed February 5, 1906.

892,285. Sparking Plug.—Emile Moonen and Albert Dumaire, Paris, France. Filed December 7, 1906.

892,291. Vehicle Wheel.—James McIntyre, Boston, Mass. Filed April 13, 1907.

892,294. Vehicle Wheel.—Joseph Nicholson, Boston, Mass. Filed May 24, 1907.

892,296. Vaporizer for Internal Combustion Motors.—Friedrich Oberhänsli, Kesswil, Switzerland. Filed August 15, 1907.

892,323. Wheel.—Edwin Stancliff, New York, N. Y. Filed April 28, 1906. Renewed October 14, 1907.

Patents Issued July 7, 1908.

892,445. Electric Lighting System for Automobiles.—Frank L. Parrill, Vincennes, Ind. Filed October 19, 1907.

892,452. Spring Wheel for Motor Cars and Other Vehicles.—Emilio Rodriguez, Chiswick, London, England. Filed July 23, 1907.

892,481. Glass Front for Automobiles.—Julius Wieden, Los Angeles, Cal. Filed October 2, 1907.

892,569. Fuel Burning Apparatus for Motor Vehicles.—George E. Whitney, Boston, Mass. Filed February 18, 1901.

892,608. Electric Battery.—William Morrison, Chicago, Ill., assignor to George Rumrill Coryell, Chicago, Ill. Filed August 11, 1902.

892,609. Starting Device for Explosive Engines.—Lawrence S. Nash, Detroit, Mich. Filed July 31, 1907.

892,673. Wheel Tire.—Andre Michelin, Paris, France. Filed November 4, 1905.

892,853. Pneumatic Tire for Vehicle Wheels.—John R. Kline, Los Angeles, Cal. Filed February 20, 1907.

892,859. Speed Changing Gear.—Charles H. Lee, New York, N. Y. Filed June 21, 1907.

892,866. Roller Bearing.—Emile Moonen, Paris, France. Filed May 8, 1907.

Patents Issued July 14, 1908.

893,032. Worm Gearing.—Ernest E. Sweet, Detroit, Mich. Filed January 11, 1908.

893,058. Internal Combustion Engine.—Frank J. Crouch and Charles P. Church, Seattle, Wash. Filed June 12, 1907.

893,075. Wheel.—Ernest Hopkinson, East Orange, N. J. Filed October 16, 1906.

893,107. Automobile.—Charles Snow, San Francisco, Cal. Filed April 8, 1907.

893,144. Variable Speed Power Transmission Mechanism.—Herman Casler, Canastota, N. Y. Filed April 24, 1907.

893,241. Force Feed Lubricator.—Clarence B. Hodges, Detroit, Mich. Filed February 11, 1907.

893,270. Vehicle Wheel.—Uzziel P. Smith, Akron, Ohio. Filed September 19, 1906.

893,323. Explosive Engine.—Charles R. Greuter, Wilkes-Barre, Pa. Filed April 25, 1907.

893,333. Sparking Cut-Out for Internal Combustion Engines.—Frederick W. Leitenberger, Reading, Pa. Filed November 25, 1907.

893,400. Internal Combustion Engine.—John A. Torrens, Coleraine, Ireland. Filed May 15, 1908.

893,409. Power Transmission.—John L. Williams, Ellzey, Fla. Filed August 31, 1907.

893,455. Hydraulic Clutch.—Augustus C. F. Dann, Southsea, England. Filed August 3, 1907.

893,498. Motor Attachment for Vehicles.—John C. Higdon, St. Louis, Mo. Filed November 21, 1905.

893,502. Motor Vehicle.—Russell Huff, Detroit, Mich. Filed December 18, 1907.

893,549. Axle.—David E. Ross, Brookston, Ind. Filed September 11, 1906.

Patents Issued July 21, 1908.

893,655. Cushion Tire.—Charles L. Rempes, Akron, Ohio. Filed August 6, 1906.

893,656. Internal Combustion Engine.—Sigurd I. S. Ring, Stockholm, Sweden. Filed December 12, 1906.

893,668. Burner for Steam Generators.—Francis E. Stanley and Freelan O. Stanley, Newton, Mass. Filed October 28, 1902.

893,672. Tire for Vehicle Wheels.—Reuben O. Stutsman, Des Moines, Ia. Filed July 16, 1897.

893,675. Distributing Gear for Explosion Motors.—Max Thier, Erfurt, Germany. Filed March 28, 1904.

893,677. Resilient Wheel.—John C. Turnage, Richmond, Mo. Filed October 7, 1907.

893,685. Carburetor.—Walter C. Willard, Cleveland, Ohio. Filed November 19, 1906.

893,712. Starting Device for Explosive Engines.—Julian F. Denison, New Haven, Conn. Filed December 13, 1904.

893,715. Vehicle Wheel.—Ezra Fishburn, Overbrook, Kan. Filed September 10, 1907.

893,738. Two Cycle Motor.—Gotthold L. Langer, Stockton, Cal. Filed September 19, 1906.

893,798. Motor Plow.—Corda A. Hart, Danville, Ill. Filed April 20, 1908.

893,832. Tire.—Herman B. Baruch, New York, N. Y. Filed April 24, 1907.

893,867. Automobile.—Eugene S. H. Pereyra, Brooklyn, New York. Filed December 28, 1907.

893,955. Spark Plug.—Clarence T. Van Woert, New York, N. Y. Filed August 1, 1907.

894,000. Vehicle Running Gear.—Lewis B. Hart and Charles I. Dupont, Plaquemine, La. Filed October 10, 1907.

894,014. Rubber Tread or Tire for Wheels.—Edward B. Killen, London, England. Filed October 27, 1906.

894,029. Vehicle Brake.—John G. Miller, Burlington, Ia. Filed March 5, 1908.

894,052. Safety Device for Occupants of Vehicles.—Richard Radtke, Suhl, Germany. Filed March 16, 1908.

894,055. Automobile.—Cowan Rodgers, Knoxville, Tenn. Filed December 2, 1907.

894,060. Motor Vehicle.—Richard Ruemelin, Huntingdon, Pa. Filed July 1, 1907.

894,079. Tire Holder for Automobiles.—Frederic S. Suthergreen, Osterville, Mass. Filed May 16, 1907.

894,084. Tire Tread Chain for Automobile Wheels, Etc.—James C. Thomas, Corsicana, Tex. Filed March 22, 1907.

A motor truck contest is to be held in Switzerland during the spring of 1909. The contest will be in charge of the A. C. of Switzerland, but the regulations will be worked out by the Swiss Department of War, which latter agrees to purchase one or more of the winning cars. To cover the organizing expenses and provide substantial prizes the Swiss Parliament will be asked to appropriate 25,000 francs.

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Time Required and Cost of Designing a Three Ton Truck.

By Morris A. Hall.

A great many manufacturers are interested in the truck question right now, and would like to know what it would cost them to build one. The writer will not undertake to tell them, but will endeavor to make plain the time and cost of designing a 3 ton truck from figures of an actual design which was built and is now in successful operation.

To begin with, the drawing room force consisted of a chief draughtsman, a senior draughtsman or designer, a junior draughtsman able to do some designing, one or two detailers not too high priced to be used for tracing, one or two additional tracers and a boy to file drawings. Of course there was a blue print boy, but he was shared by three departments, no one of which kept track of his time, so it is impossible to give figures covering his work.

The routine of the work was about as follows: The chief draughtsman outlined the design and made the principal calculations. After being O. K.'d this design was passed along to the senior or junior draughtsmen, according to how far it was advanced, and also according to the other work on hand at the time. This man checked the previous calculations, made the necessary additional calculations, and finished the design under the chief draughtsman's supervision. Then the detailing was commenced.

DETAILING.

This work of detailing was managed in one of two ways. The first consisted of the designer making a design drawing of a group and thoroughly dimensioning it. These group designs were handed in, inspected and distributed to the other men, detailers, to work out the individual details. These detail drawings in turn were handed in, inspected and again given out to be traced. The alternate method was as follows: The designer made free hand sketches with all dimensions on special paper. These sketches were handed in by groups; that is, as a group was completed the bunch of sketches covering it was handed in. These were looked over and later distributed to be traced.

Whichever method was used, the finished tracings were handed in to the chief draughtsman, who checked the individual drawings for appearance and the whole machine for the ability to be handled in the pattern shop, foundry, machine shop and ability to be assembled. After checking, all tracings went to the filing clerk, who took out numbers for them, numbered the tracings and made out index cards. Then the rough, preliminary bill of material and all of the finished tracings were given out to be gotten into good shape and traced as a final bill of material

This having been checked, the chief draughtsman ordered the required number of blue prints on a special blank from, keeping a duplicate to insure the return of the tracings and of the blue prints in good time. These blue prints were then issued to the various foremen in the shop.

BLUE PRINT CHECKING SYSTEM.

This work of issuing was done by the filing clerk and consisted of making out two small cards, one on thin and one on thick paper. These were printed forms, with spaces for the blue print number, tracing number, date of issue, work issued for, issued by, and issued to whom, with spaces for the signature of the latter and the date of receipt. The thin slip was pasted to the blue print and became an integral part of it, while the thick card was signed upon receipt of the blue print, returned to the drawing room and filed for reference.

The drawing room was thus able to locate all outstanding prints from any one tracing, which was often necessary in cases of a big change on some standard part. This also insured the delivery of the blue prints at the time and place required, and the cards on file indisputably proved the delivery of the same.

DESCRIPTION OF TRUCK.

The truck was new throughout, except for the engine and clutch. The former was the firm's standard four cylinder engine and the latter was an adaptation of the high speed clutch from the firm's large, heavy planetary transmission. This was of the disc type, alternate discs of phosphor bronze and saw steel being used. The engine was 4½x4½ inches, mounted forward. The clutch mentioned above carried the power to the transmission, which was of the individual clutch type, using four jaw clutches and having three speeds forward and one reverse. The final drive was by double roller chain from a countershaft forming part of the transmission to sprockets on the rear wheels.

Between the clutch and transmission was an original design of a combination of universal joint and slip joint, very accessible and easily broken into by taking off two nuts, thus allowing either the engine or transmission to be readily removed without disturbing the other.

The truck had a 108 inch wheel base, 60 inch tread, channel iron frame, with angle iron sub-frame on which the engine and transmission were carried. The tires used were Diamond flat tread wire mesh, base 4½x36 inches single in front and 4 inch twin by 36 inches in the rear. The steering gear was of worm type, manufactured by Gemmer, using a 20 inch hand wheel. The axles were of Timken make, the front having an I beam section and the rear being square.

The driver's seat was over the engine, with oil, gas and water tanks and tool boxes in the seat. The body was 5 feet 6 inches wide by 12 feet 6 inches long, of the open stake type, easily removable from the frame by removing twelve one-half inch bolts.

The brakes were five in number, there being a large band brake on the main shaft to prevent spinning when changing gears, two internal expanding bands on the countershaft and two large internal expanding bands inside the rear wheel drums, the two latter being equalized. The total braking surface was 470 square inches, which is very liberal, considering that the pull which the driver exerted on the hand lever was multiplied over eight to one. The main shaft brake was operated by the clutch pedal being thrown on only when the latter reached its extreme position. This was the only pedal, as both sets of brakes were operated by long hand levers, the operation of the rear hub brakes serving also to throw out the clutch. All levers and the foot pedal were ratchet retained, so they could be left in any desired position. The usual spark and throttle levers were fitted.

The spring hanging was out of the ordinary, as there were no shackles. The front spring was fixed at its front end, the rear end bolt being guided but free to slide in a slotted hanger, the wear being taken by a removable hardened steel bushing or roller on the bolt. The front end of the rear springs had this same roller arrangement, but the rear end was simply guided, being free to slide over a hardened removable steel wearing plate. To preserve the rear axle position and the chain tension, unusually stiff heavy radius rods were fitted. Fig. 1 shows the assembly of the truck in two views.

TIME REQUIRED.

To come now to the time required, this has been put in tabular form for conven-

TABLE I.

Divisions.	Remarks.	Time.	Cost.	Per Ct. of Total Time.	Per Ct. of Total Cost.
Design	First Design	118 hrs. @ 56c. =	$66.08		
		38 hrs. @ 43c. =	16.34		
		264 hrs. @ 33c. =	87.12		
	Total	420 hrs.	= $169.54	25.6*	32.2*
	Second design	235 hrs. @ 33c. =	77.55	14.4*	14.9*
	Total, all designs	655 hrs.	= $247.09	40.0*	47.1*
Details		236 hrs. @ 33c. =	77.88		
	Second design only	15 hrs. @ 18c. =	2.70		
	Total	251 hrs.	= $80.58	15.4	15.3
Tracing		42 hrs. @ 33c. =	13.86		
		39 hrs. @ 22c. =	8.58		
	Second design and small part of first design	230 hrs. @ 18c. =	41.40		
		117 hrs. @ 17c. =	19.89		
		4 hrs. @ 17c. =	.68		
		14 hrs. @ 14c. =	1.06		
		446 hrs.	= $86.37	27.3	16.4
Checking, supervision, etc.	All designs	172 hrs. @ 56c. =	96.32	10.5	18.3
Filing, indexing, issuing, etc.	Second design only	109 hrs. @ 14c. =	15.26	6.8	2.9
	Grand total	1,633 hrs.	= $525.62	100.0	100.0
		Average rate per hour, 32.2c.			

* Percentages given twice.

ience in reading and is shown thus in Table I.

From this it will be seen that the work comprises two designs; in fact, the writer has simply put it this way for convenience, as there were several designs. It will be noticed, too, how high a percentage of the total time the total work of design occupied, viz., 40 per cent., which in the cost account rises to over 47 per cent., or practically one-half. Subdividing this into useless and useful designs (as viewed from the standpoint of results), we see that the first, representing 420 hours at a cost of $169.54, or 25.6 per cent. of the time and 32.2 per cent. of the cost, was simply wasted finding out what was wanted. After that it only took 235 hours, costing $77.55, to finish the real design. This is but 14.4 per cent. of the whole time and 14.99 of the cost.

The next subdivision of the work is detailing, which was but 15.4 per cent. of the time and 15.3 per cent. of the cost, and could hardly have been improved upon.

Passing to the next subdivision, tracing, we see that this totaled very high in hours, 446, or 27.37 per cent., but in cost it dropped to 16.4 per cent. It is only fair to say that some work is included here that was not used, as tracings made of parts belonging in the earlier designs and not used in the final design. Then the close checking required and the supervision over the whole job amounted to the very fair total of 172 hours, or 10.5 per cent. The cost of this rises somewhat above that figure to 18.3 per cent. Finally, the work of filing, indexing, issuing, etc., although 6.8 per cent. of the time, is but 2.9 per cent. of the total cost, showing that what is often called red tape work does not actually cost much money.

TABLE II.—ESTIMATE TAKEN FROM TABLE I.

Division.	Time. Hours.	Cost.	Per Ct. Total Time.	Per Ct. Total Cost.
Design	235	$78	21.4	24.8
Details	250	80	22.8	25.5
Tracing	400	80	36.5	25.5
Checking	110	62	10.0	19.7
Filing	100	14	9.2	4.5
Total	1,095	$314	100.0	100.0

A fair estimate of the time that would be required providing the manufacturer knew what he wanted at the start and pushed the job through the drawing room with all reasonable speed is given in a similar tabular form in Table II. This, being based upon the actual figures given in Fig. 2, does not by any means represent a wide guess. In fact, the writer believes this same work can be done in even less time and at a lower cost, but set the above figures to be conservative.

TABLE III.—MATERIAL COST.

Description.	Remarks.	Amount Used.	Price Per Unit.	Price.
Duplex drawing paper, details	36 in. wide.	35 yds.	12¼c. per yd.	$4.29
Duplex drawing paper, design	36 in. wide.	6⅔ yds.	12¼c. per yd.	.82
Imperial tracing cloth	37 in. wide.	36½ yds.	34c. per yd.	12.41
Keystone blue print paper (5 sets prints)	37 in. wide.	196½ yds.	7c. per yd.	13.76
Assorted pencils, 2H to 8H	Kohinoor.	3 doz.	$1.00 per doz.	3.00
Assorted leads, 2H to 8H	Kohinoor.	18	60c. per ½ doz.	1.80
Erasers	Both ink & pencil.	18	$1.00 per doz.	1.50
Thumb tacks	9-16 in. diam.	2¼ doz.	.50 per doz.	1.12
Black ink	6 large bottles.	6 large bottles.	$2.00	12.00
Red ink	2½ small bottles.	2½ small bottles.	.25	.03
Index cards	......	500	$2.00 per $1,000	1.00
Figuring pads	......	7	6c. per lb.	.42
Computation note books	......	2	10c.	.20
Pens	Lettering.	12	10c. doz.	.10
Total				$53.25

COST OF MATERIALS.

This is but the labor cost; the material cost will add quite a little to this total. There were, all told, 246 drawings on this job, divided as follows: 9x12 size, 198; 12x18 size, 34; 18x24, 7; 24x36, 5; 36x48, 1, and an odd size, 24x60, 1.

The paper and cloth used may be accurately reckoned from these sizes by figuring the most economical way of cutting in one direction and allowing a certain extra amount for waste in the other direction. Thus if we allow 10 per cent. waste for drawing paper, 15 per cent. for tracing cloth and 25 per cent. for blue print paper we will not be very far from the true amount used. The allowance for paper is the least because the details would be laid out closer together than the size of standard sheets upon which they would be traced. The large waste of blue print paper is figured because of the number of small sheets used, which were printed in sets of eight or ten at a time.

Passing on to the other materials, the records of these were kept on the basis of the weekly consumption, so to get the consumption for this design we must reduce the number of hours worked to the basis of the number of weeks worked.

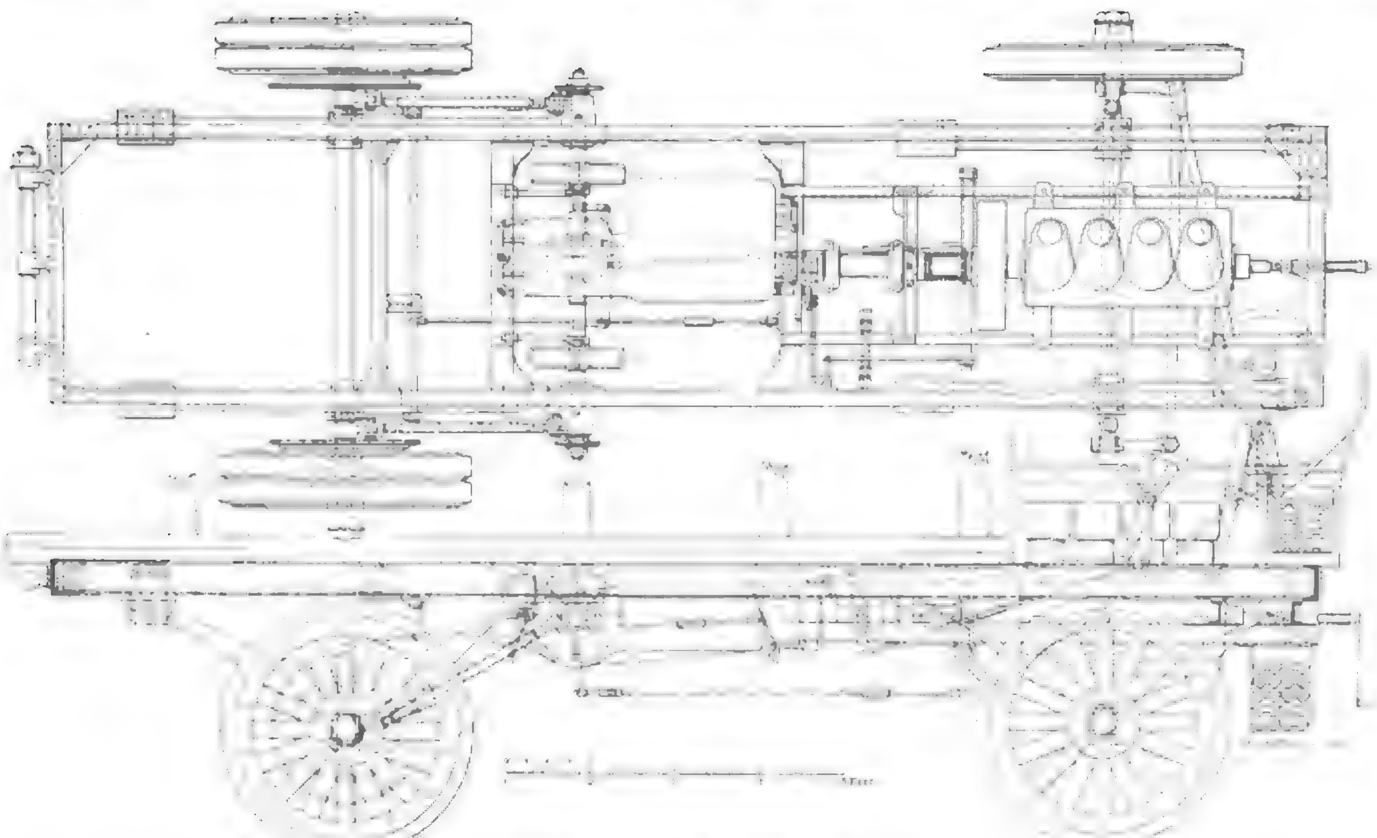
To do this we must estimate the average number of men working. From the time book for the nine months over which this design extended we find the average to be about five. The number of hours per day was 9 and per week 54, so the total hours per week were $5 \times 54 = 270$. Dividing the total number of hours worked, 1,633, by this, we get the average number of weeks worked, or $\frac{1633}{270} = 6+$, or say 6 weeks.

Now multiplying the weekly consumption by six we get the total amount of material and the cost, as shown in tabular form in Table III.

It will be noted that paper is allowed twice, the extra amount being the paper used for the master layouts, of which there were four, the allowance being 36x60 inches each. Furthermore, it will be seen that five sets of blue prints are provided for. These were distributed as follows: One to machine shop for the workmen's use, one to the machine shop for the foremen's office file, one to the assembling department for the workmen, one to the assembling department's foreman's file, one record set kept on file in the drawing room. The pattern shop used the drawings from the latter set, and when the work was finished returned the prints. The inspectors used the assembling department's set.

TOTAL COST.

We now have our total cost, consisting of $525.62 work and $53.25 material, a total of $578.87, or in round figures $580. By



Plan View and Elevation of Motor Truck Chassis.

our estimate of time wasted (see Fig. 3) we reduced the drawing cost to 60 per cent. Similarly reducing the material cost would not be fair, as the cloth, blue print paper, ink and the larger items will be the same; but we can reduce this to, say, 80 per cent., which would give $42, and a total estimated cost of $356.

The figures given above being from actual work, need no comment except to repeat to manufacturers using them the caution given once before: Make sure you know just what you want before starting work, as in this case one-fourth of the time and one-third of the cost were thus wasted.

Automobile Drawing Room Practice.

By John Coapman.

In most automobile factories, and especially in shops manufacturing accessories and parts for automobiles, insufficient attention is paid to the details, and oftentimes the falling off in orders may be traced directly to this cause. Undoubtedly the cause to a large extent is the fact that poor layouts are made in the beginning; sometimes nobody but the draughtsman understands the matter, and then when the details are to be drawn up the little things are quite often omitted, and when no assembly drawings are made it is impossible to catch these little things until the parts are being machined or assembled.

One draughting room with which the writer is acquainted has a system in operation with regard to the production of drawings which has many good points in its favor. When a car is to be designed the first thing is to find out the general ideas which are to be incorporated in the new model. An assembly drawing is then made to about one-quarter size, this to only give the general appearance of the car. The next thing is to design the component parts, and assemblies are made to scale, and these answer the same purpose as a layout, only they have the further advantage of giving the ideas more plainly, and oftentimes it is found by this method that ideas which appeared all right in the beginning will not do, as possibly some obstruction is found which might otherwise be unnoticed; or, again, the drawings might be made with the consolation that a way will be found out of that afterward, and then, time being short, a poor job is done.

When the detail drawings are made they are drawn up on standard size sheets, and they contain every dimension necessary for pattern maker and machinists. However, as is often the case, were all these dimensions upon the blue prints many errors would result, owing to the machinist becoming confused. All dimensions that are not necessary to the machinist are underlined with red pencil, and these dimensions are not traced. After checking the tracings up the pencil drawings are sent to the patternmakers, if a pattern is necessary, and blue prints are then made from the tracing. After the pattern is completed it is turned over to the draughting department with the original drawing to be checked. If found correct, the pattern is then sent to the foundry, and the original drawing is filed away for future reference.

If at any time it is necessary to use a drawing of this article in the draughting room, the draughtsman does not use the tracing or a blue print, but this original drawing, and there is then no necessity for hunting up a lost tracing at any time, as the tracings are supposed to be kept in the filing cabinet for that purpose. I think that this method is simpler than making two sets of drawings, one for the machine shop and one for the patternmaker, as there is less opportunity for errors in drawing.

Standard parts are drawn up on sheets for that purpose, and it is the endeavor to use these parts wherever possible. This is the practice in most of the large firms, I believe.

After all detail drawings have been made the assembly is then finished. If it was found necessary to make some slight changes in the details the assembly is made up to date. Each piece is then given its number on this drawing, and the sheet number is directly below the part number, so it is possible to tell at a glance on the assembly just where to find the drawing of any piece in that assembly. These assemblies are divided up into groups, and parts of other assemblies, which it is advisable to show in order to show the relation, are drawn in dotted. Specification sheets are then gotten out to enable the foreman to requisition the parts and necessary material when the order is received and not wait until the car or cars are nearly completed and then find that some parts were not ordered and none are in stock, thus delaying matters. Wherever possible details are drawn full size and one item to a sheet.

The Necessity of Cheap Fuel for Commercial Cars.

By G. S. Granlund.

One difference between the pleasure car and the commercial vehicle is that, whereas the former is comparatively high in first cost and upkeep, and depreciates so rapidly as to be a liability rather than an asset, the latter's initial cost must be low, and depreciation, fuel and repair bills must be as small as possible; in fact, all of these items must be proportionately as low as for a steam locomotive. A common mistake made by commercial car manufacturers has been to take a pleasure car power plant and a body for the carrying of goods, and then place a motor truck on the market, evidently forgetting that there is no similarity whatever between the service to be rendered. The "life" of a commercial car must be ten years in order that the item of depreciation may be kept within reasonable limits. The change speed gears should have more than three-quarters of an inch width of face, and the connecting rods of the engine should not be so short as to wear the cylinders elliptical after a few months' service. A few pounds' additional weight in a commercial car cannot do much harm, as it is not necessary to travel over the roads at a 60 miles per hour clip. It is the failure on the part of designers to pay close attention to low depreciation and maintenance that has caused many users of commercial cars to abandon them in favor of the horse. The horse vehicle affords a very reliable form of transit, even though it may be slower than a power wagon; but if the latter has to spend half its time in the repair shop all of the advantage is lost.

It is cheaper to have a spare engine or transmission ready to put in place in eight or ten hours than to keep the car in the shop for two weeks while a new piston or gear is being made.

HEAVY FREIGHTING.

For very heavy work traction engines with large, wide steel tires, such as used in England, would be found satisfactory owing to their substantial construction and to the fact that they keep the roads in excellent condition. All parts for these engines are interchangeable, reducing the time spent in the repair shop to a minimum. The first cost of the tractors is not as much as that of a first class gasoline truck, though the load hauled is three times greater. The trailers are cheap and substantial. One of the advantages of this system is that if the tractor becomes unserviceable for want of repairs the rest of the train can be kept coupled up to another engine and kept on the road constantly. Some may claim that the enormous weight concentrated on a single pair of driving wheels is a disadvantage. The wheels must be of large diameter and have about 24 inches face. It has been found that many a rough road has been worn smooth due to the road roller effect of these large wheels and the weight carried. The chief disadvantage is the smoke given off from the coal used. The question of using fuel oil will be considered later.

A system of multiple unit control has been described in The Horseless Age. But this requires a very elaborate power plant, including engine, dynamo, motors and control system. The interest and depreciation must be very high, and the system possesses the great disadvantage of using gasoline as fuel. Were it possible to use a gas producer the fuel item could be brought down within reasonable limits. It would be far better to eliminate the gasoline engine and dynamo from the tractor and, placing a pantagraph trolley on the tractor, take current from the wires of street railways, as it would not only simplify the transportation problem but also reduce the expense for power, street railways furnishing power for less than half the cost of the gasoline-electric. In fact, this would be but another variation of the trackless trolley system.

The question of the gas producer for traction purposes arises quite frequently, and at first sight this system would seem to be ideal. When we consider the low calorific value of the gas we see what an enormous engine we must have in order to get the same results as with gasoline. In stationary practice great weight is immaterial, if we obtain economy of operation, or if waste products can be utilized, as, for instance, gas from blast furnaces which would otherwise be wasted. Again, the gas producer must be of such design that the car or tractor need not be stalled for hours while the driver is trying to locate the trouble. Light weight and simplicity are essential to keep down the items of first cost and cost of operation, as interest and depreciation are always greater than the fuel item. All of these conditions must be considered before designing a car.

The Diesel engine uses fuel or crude oil, and attempts will undoubtedly be made to place an engine of this type on a power wagon. In order to secure perfect combustion the piston speed must necessarily be slow, and thus our power plant will be ponderous to obtain the necessary tractive effort. Considerable time would be lost in cleaning the cylinder of carbon deposits.

INFLUENCE OF FUEL COST ON RUNNING EXPENSES.

Let us assume two commercial cars, each costing $4,000 and having a carrying capacity of 5 tons. The one uses crude oil at 4½ cents per gallon and the other gasoline at 13 cents per gallon. Assume that the cars are in operation 275 days per year, and that they have an average daily mileage of 50, the first doing 6½ miles on one gallon of crude oil and the other 8 miles on one gallon of gasoline. Then our running expenses per year may be summed up as follows:

	Crude Oil.	Gasoline.
Depreciation at 10 per cent...	$400.00	$400.00
Interest at 5 per cent........	200.00	200.00
Fuel	95.20	223.44
Repairs	100.00	100.00
Lubricating oil and sundries..	40.00	40.00
Wages of driver..............	780.00	780.00
Housing of car...............	35.00	35.00
Insurance	10.00	30.00
Totals..................	$1,660.20	$1,808.44

By using crude oil a saving of $148 could be effected, enough to pay for the repairs, housing of the car and insurance. There being no increase in the visible supply of gasoline throughout the world, we may expect (according to the rate of increase in price during the last ten years) that the cost of this fuel will prohibit its use for commercial cars within a few years.

The writer has followed with interest the use of fuel oil on the Union Pacific Railroad and the experiments in the United States Navy. In view of the marked success of the fuel oil burning locomotives it may be well to touch on the mechanics of combustion of liquid fuel.

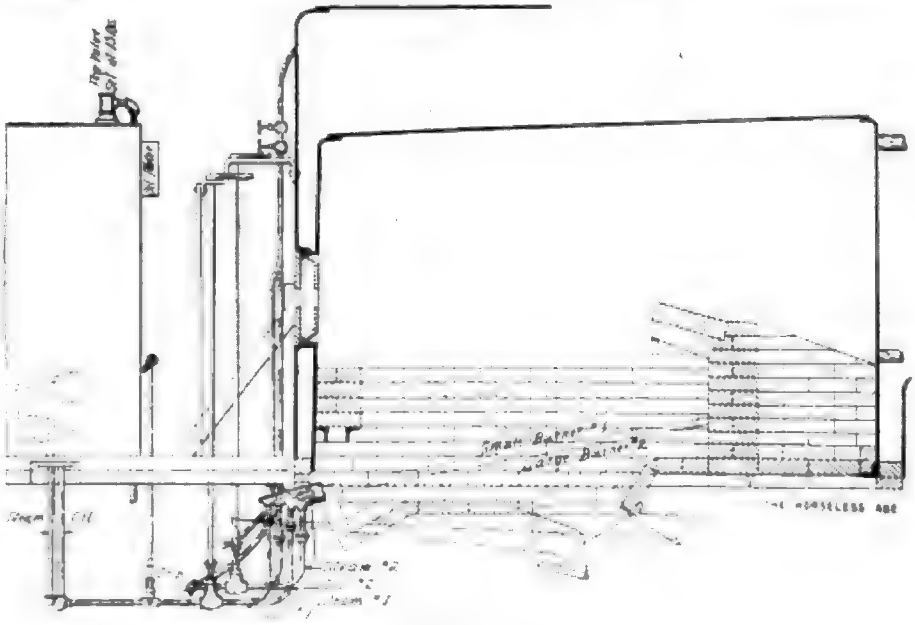


Fig. 1.

With a charcoal or coke fire it is possible to maintain very intense combustion within a comparatively small space and with very little smoke. This sort of fire was used by the smelters of the bronze age, and is in use today in blast furnace operations where concentration is necessary. The explanation is that the fuel is solid even at the highest temperature. Solid particles are given off in the smoke, but whether they are ash or unconsumed carbon, they are exceedingly small, as shown by the bright blue color of the smoke. Carbon leaves this hot bed of coals as a constituent of CO or of CO_2. In either case the combustion will be free of soot or smoke, both gases being transparent and colorless. If the carbon goes up the stack as a constituent of CO it carries with it two-thirds of the heat that it was primarily capable of yielding up. It is only in respect to the possible formation of CO instead of CO_2 that a charcoal fire fails to give perfect results, and were it not for this possibility there would be no reason why a charcoal fire should need more space than is sufficient to contain the fuel itself. Even if we were to increase the supply of oxygen by passing a greater quantity of air through the bed of coals it would not prevent the formation of CO. Experience shows that even if the amount of oxygen is twice that requisite for complete combustion of the carbon some of the carbon still leaves the furnace in a partly burned condition

The only way in which this carbon can be completely burned is by subsequent diffusion of the gases whereby each molecule of CO sooner or later meets with an atom of free oxygen and thus becomes CO_2. This diffusion requires time, and as the gases are constantly cooled as they are carried along it may happen that they will be cooled below the ignition temperature before union takes place.

The boilers on heavy commercial cars must be as small as possible, and it becomes almost impossible to secure a smokeless fire when coal is used as fuel, the fire box being limited in its dimensions and the proper space and time cannot be allowed for proper combustion. Complete combustion requires that for every atom of carbon and for every two atoms of hydrogen there shall be at least one atom of oxygen brought in close proximity and subjected to a temperature sufficient for ignition. It is doubtful if a mere mechanical mixture could ever be perfect enough to bring about the desired result. It is only by virtue of the property of diffusion that a sufficiently intimate mixture is obtained. As to the nature of diffusion, it is known that at ordinary temperatures the particles of oxygen in the air are moving about in every conceivable direction at velocities averaging 1,600 feet per second. Any one atom moves only an inappreciable distance before being arrested by collision with another atom. It thus takes considerable time for a particle to travel even a moderate distance. It is this time element that constitutes the great stumbling block when the attempt is made to burn a large amount of combustible in a small space.

COMBUSTION OF HYDRO-CARBONS.

In the combustion of hydro-carbons we have the following conditions: The fuel is already on its way to the chimney before it is even partially burned. The first effect is to disassociate the carbon from the hydrogen. Whether or not the latter unites with the oxygen does not affect the soot or smoke question, since the constituents and also the products of combustion of hydrogen are alike transparent colorless gases. The carbon, in any case being left alone in the form of an impalpable dust, is much less favorably circumstanced than that in a charcoal fire. It is carried along by the current of gases and unless given plenty of time before being cooled it will be left alone as a particle of soot. The luminous part of a flame is caused by the white hot particles of carbon. These particles have been robbed of the hydrogen with which they were formerly associated and they have not yet met the oxygen necessary for complete combustion. This process for finding or combining the oxygen and carbon requires time, and if the temperature falls below that of ignition before the process is completed the carbon will be deposited as soot or else go up the stack as smoke.

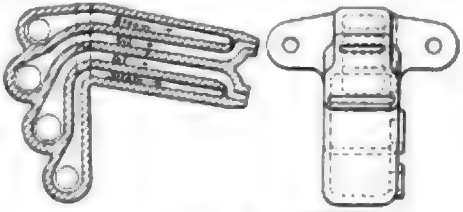

THE HORSELESS AGE

FIG. 2.

Conditions necessary to produce shortness of flame are:

1. Pure carbon fuel, because the fuel cannot leave the firebox until it is at least burned to CO.
2. Intimate initial mixture of oxygen with the fuel, since the more intimate the mechanical mixture the less time it will take the gases by process of diffusion to become thoroughly mixed.
3. Initial heating of the air as the rate of diffusion increases with the temperature.
4. Large surface of fuel presented for impact of oxygen.

From the above it becomes obvious that we need a larger combustion chamber for fuel oil. For a successful application to a commercial car the firebox would have to be materially increased in size over that using coal as fuel.

During the process of diffusion heat is being liberated at all points throughout the combustion space. Hence all parts of the space are being traversed by heat rays emanating from every other part of the combustion chamber. The temperature withiin this space must under these conditions increase with the volume to an extent limited only by the transparency to radiant heat and by the temperature of dissociation at which, necessarily, heat ceases to be liberated. Since the transparency of the combustion space is diminished by the presence of solid carbon (for whether black or incandescent it is in any case opaque), it follows that the increase of temperature with a given increase of volume will be less in a space filled with luminous flame than in one filled with burning hydrogen or CO.

This question of the proper size of combustion space is further complicated by the presence and condition of the solid walls of the furnace, whether, for instance, they are themselves incandescent or merely black absorbers of heat. There seems to be no reasonable doubt that incandescent walls will hasten diffusion, and hence shorten flame. The most successful internal combustion engines using crude petroleum have either a retort attached to the cylinder head heated to a high temperature by an outside flame or else the cylinder head is heated by the ignited charge. The head in the latter case is made in such form as to give the largest surface.

Where it is possible for the diffusion to be completed before combustion begins, as in the Bunsen gas burner, the difficulties naturally disappear, and there is readily obtained a very short flame which is incapable of depositing soot even on a cold surface.

In the case of a liquid fuel which is incapable of vaporization the diffusion and ignition must occur simultaneously. With such a fuel there is bound to be considerable flaming. Another difficulty arises with this sort of fuel from the action of capillarity or surface tension. No matter how finely the liquid is pulverized, each tiny drop assumes a spherical shape, and so presents the least possible surface for the impact of oxygen atoms.

The primary requisite of combustion space is volume, and that alone, provided all parts of it are traversed by the same quantity of gas in a given time; in other words, provided the gases are not short circuited through or across some parts of the space to the detriment of the others. The relative dimensions—length, breadth and depth—of the combustion space are of minor importance. If a current of gas flows through a cubic foot of space at the rate of one cubic foot per second, each particle of gas will spend one second within the space, regardless of whether the space is long and narrow or short and wide. In a long and narrow space there is less chance of the gases taking a short cut. Since the resistance that the draught pressure must overcome is proportional to the square of the velocity of flow and to the length of the passage, it follows that for a given volume of combustion space the draught resistance will be proportional to the cube of its length. The advantages are, therefore, in favor of the combustion space of large cross section and short in the direction of the flow of the gases.

A primary requisite for the successful burning of a non-volatile liquid fuel is the exposure of the fuel to the heat of the furnace in such a form that it presents the largest possible surface for the impact of the atoms of oxygen. Oil in bulk has practically no surface. When broken up into fine drops the surface is the aggregate surface of all of the drops. The smaller the drops of oil the more perfect the spheres. Thus drops of oil one one-thousandth of an inch in diameter are known to assume the spherical form with a rigidity comparable to that of a steel ball one inch in diameter. The work necessarily performed by the atomizing agent is simply the work of stretching the surface.

WORK REQUIRED FOR SPRAYING.

Petroleum whose density is 0.92 has a bulk of 30 cubic inches per pound. When broken up into drops the surface of a pound of oil is $190 \div d$ square inches, d being the diameter of the drops expressed as a fraction of an inch. The work required to stretch the surface of petroleum is .0000151 foot pound per square inch. From these facts we can compute the work done against surface tension in forming spray. This work is $0.00272 \div d$ foot pounds per pound of oil. Thus for drops 0.0001 inch in diameter the work is 27.2 foot pounds per pound of oil.

The only obvious way of stretching the surface of a liquid which, like petroleum, is incapable of being drawn into a thin film is by opposing force to change the momentum, and this necessitates imparting to each particle a velocity and hence a kinetic energy.

The diameter of a gravity drop of oil (a drop which is broken off from a larger mass by the force of the weight of the drop itself) is about 0.15 inch. From this data we can derive an expression connecting the diameter of the drop with, for example, the diameter and the number of revolutions of a circular disc from the periphery of which the drops are thrown off by centrifugal force. Such an expression is:

$$N\,D\,d = 10.570,$$

where N = revolutions per minute.
D = diameter of disc in inches.
d = diameter of drop in inches.

The drops are thrown off with a velocity equal to the peripheral speed of the disc. The kinetic energy represented by this velocity for petroleum, having the assumed density of .092, will be $0.00311 \frac{D}{d}$ foot pound per pound of oil. This kinetic energy added to the energy required to stretch the surface of the oil gives us $\frac{0.00272+0.00311D}{d}$ foot pound per pound of oil as the total energy required to spray the oil by this method. The kinetic energy is 1.14 D times the energy required to overcome the surface tension. Suppose the drops are 0.0001 inch in diameter and the disc is 8 inches in diameter. The work of stretching the surface will then be 27.2 foot pounds, and the kinetic energy will be 248.8 foot pounds, making a total of 276 foot pounds per pound of oil.

When oil is sprayed by a steam jet one-half pound of steam per pound of oil, or 5 per cent. of all the steam generated (evaporation 10 pounds of steam per pound of oil), is considered fairly economical. But in a moderately economical steam engine—i. e., one giving a horse power for 34½ pounds of steam per hour—one-half pound of steam yields 28.700 foot pounds, which at 252 foot pounds per pound of oil is capable of spraying 104 pounds of oil into drops 0.0001 inch in diameter. The steam jet is therefore only about 1 per cent. as efficient as is theoretically possible. In commercial vehicle installation it would, therefore, be preferable to use a simple mechanical burner and to use the steam jet burner only as an auxiliary.

TYPES OF BURNERS.

There are many localities in the world where fuel oil is cheaper than coal, the calorific value per pound being considered. In Russia and in the Western sections of the United States fuel oil has long been used on locomotives. The naval powers, especially the United States and England, have numerous warships of all classes burning fuel oil. In consequence thousands of inventors have produced new types of burners, most of which, however, are of no value. In Fig. 1 is shown a type of burner suitable for traction engines and road rollers having the locomotive type of boiler. The burner is of the duplex type, having two spraying nozzles, one for light and one for heavy firing.

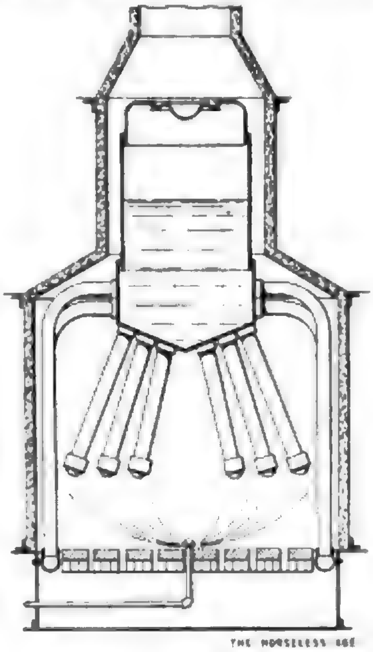


FIG. 3.

Fig. 2 shows a burner of this type in detail. It has been used successfully on the Boston & Maine Railroad on locomotives hauling trains through the Hoosac Tunnel.

The most practical burner for commercial car purposes will probably be of the type shown in Fig. 3, which is a burner applied to the United States naval launches. Owing to lack of space a boiler of the vertical type is more adaptable in traction service.

CONCLUSIONS.

That the commercial vehicle business will be an immense field if the proper vehicles are produced goes without saying. But the service of a commercial car is a very exacting one, and flimsy construction, delicate adjustments, etc., have done much to retard the industry. Not all of our cities have asphalt streets, and many of these cars must run on the roughest country roads, where even pneumatic tires would not save the machinery from rapid destruction. It is safe to assume that the commercial car of the future will have very robust parts.

It is also safe to assume that the commercial car of the future will use some other fuel than gasoline, which is ever increasing in cost. In all likelihood it will be fuel oil, and in all probability two types of cars will be produced—one using the fuel oil internal combustion engine and the other a steam car utilizing fuel oil. The most successful of the two will be the one that has the lowest fixed charges and maintenance expense.

Austrian Commercial Vehicle Trials.

A meeting was held in Vienna on the evening of July 13 between officials of the Austrian A. C. and representatives of the national automobile industry to discuss details of the proposed commercial vehicle trials. The dates were provisionally set at October 24-31. The route is to be more closely laid out later, but will lead through the manufacturing district of Bohemia, Moravia and Silesia. The vehicles will be exhibited at one of the commercial centres passed through for one day. The time allowance for each day's run will be eight hours. Cars with rubber tires will be required to travel 75 miles per day and cars with iron tires 50 miles. The following minimum speeds are required: Delivery wagons of a load capacity of 1,760 pounds, 11 m. p. h.; light trucks up to 3,000 pounds load capacity, 9.4 m. p. h.; for trucks up to 4,400 pounds load capacity, 9.4 m. p. h. if fitted with rubber tires and 7.5 m. p. h. if fitted with iron tires; for trucks up to 6,600 pounds load, 7.5 and 5.6 m. p. h. respectively; for trucks up to 8,800 pounds load 7 and 5 m. p. h. respectively, and for trucks up to 11,000 pounds load, 6¼ and 6.4 m. p. h. respectively. The entrant of each car finishing the trial in conformity with the rules will be awarded a certificate stating the main facts concerning the run.

The Austro-Hungarian Ministry of War offers a special prize to that car competing in the trials which, being suitable for army purposes, makes the best record in a test of some kind yet to be determined, which is to be held at the conclusion of the trials.

The Ministry of Commerce has also donated a prize, which will be awarded to the car which, while complying with all the other regulations, makes the best record in the economy competition to be held on one day, in which contest the useful load, the speed and the cost of the fuel consumed will be taken into account. A braking contest will also be included in the trials, and will probably be held in the Rotunda in Vienna, where the trials will come to an end.

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The New English Patent Law.

Great Britain has recently so amended her patent laws that hereafter it will be necessary for foreign inventors taking out British patents to work them in that country, or at least to make efforts to work them there, within a period of four years. Otherwise the patent will lapse, if application is made to that effect by an interested party.

Although this "working clause" is not a new institution, and is also incorporated in the German patent law, for instance, its adoption by the British Government has caused considerable uneasiness in other industrial countries, because of the fact that it bids fair to partially close the wide open doors of free trade with Great Britain and reduce the importations of patented articles into that country. It can hardly be denied that the measure was adopted by the British Government in order to somewhat mitigate the effect of its free trade policy.

As far as our automobile trade with Great Britain is concerned it is not likely to be much affected by the new law. Although patents on automobile parts and devices have been issued by the thousands, few of them are of any great value, and it is quite possible to build a complete car without infringing any patents, except perhaps one, the validity of which is, however, in question. Whatever market the American manufacturers have secured in Great Britain has not been secured by reason of patents but by reason of superior manufacturing facilities. We are now referring more particularly to gasoline cars. We believe that most of the American manufacturers of such cars who do a considerable export business to Great Britain have no patents there at all, and where patents exist they relate to details of construction and by no means cover the whole machine. There is, therefore, no danger that the market for these cars will be closed by the lapsing of patents and British manufacturers bringing out copies of the machines and supplying the home demand.

The situation is an entirely different one, however, with respect to fundamental inventions for which so called master patents are issued, and which often give rise to an important industry. The owner of such a patent would be obliged to work it in Great Britain within a few years after its issue, for native manufacturers would certainly not hesitate to make application for the annulment of the patent upon the expiration of the time limit, if the owner attempted to supply the British market from outside the country. But as no such inventions are likely to be made in the automobile line we can dismiss the matter. It is interesting to observe in closing that already a bill in the nature of a retaliatory measure, making compulsory the working of United States patents issued to foreigners, is under consideration by a Congressional committee.

Operation of Automobiles for Hire.

Aside from the taxicab boom perhaps the most remarkable development of the automobile business during the past year has been the great extension of the motor livery business. It is not to be understood that numbers of big motor livery establishments have been founded during this period, but numerous parties have gone into the business on a small scale. The upheavals consequent upon the financial depression of last fall have thrown many men out of employment, who have been forced to seek new fields of enterprise. Also some of the garages are finding business rather slow this season, and are occasionally using their demonstrating cars or old cars taken in trade for livery purposes. Thus in some of the fashionable New York suburbs, where on the arrival of commutation trains a considerable number of private automobiles may always be seen standing along the station platform, livery cars with "For Hire" signs exposed are now becoming a familiar sight. Advertisements of automobiles for hire are now also frequently met with in the local papers of these suburbs. The movement is, however, by no means confined to these suburban towns. In most towns of any size in all parts of the country automobiles can now be hired for special business trips or for pleasure jaunts. In the West, where the transportation facilities are often very poor, motor services are springing up at a rapid rate, and in Western cities there also seems at present to be quite an activity in what is locally referred to as the sightseeing business, but what is essentially a branch of the motor livery business, the cars used being regular touring cars and trips being made only when customers are at hand. The number of men making a living by the operation of automobiles in such enterprises must already be quite large.

Practice in "Block" Engine Design.

Most of the designs for four cylinder block motors have contemplated the casting of the four cylinders integral with their valve chambers and heads, and frequently with the gas and water passages in part cast therein. A variation from this practice is to be noted in a recent design, in which the four cylinder barrels, valve seats and the main portions of the water jackets form a single casting, and the four water jacketed cylinder heads form another unit which is bolted to the main cylinder structure.

Certain advantages appear to result from this construction, while in the main the good features of block construction are retained. The detachment of the common head casting and the breaking of its single water connection allow of the removal of any piston and connecting rod for the purpose of decarbonizing the same, or refitting rings or bushings. With ordinary block construction it is necessary to remove the entire cylinder unit and to break a large number of pipe connections in order to remove a piston or to scrape its head.

Casting the heads as a separate unit calls for the machining of the abutting surfaces of this part and of the main cylinder unit, and for the provision of gaskets or some other means of securing a reliable joint. Gasket joints, as now made, are by no means the bugbear that they once were, and can be made so as to prove almost perfectly satisfactory. A caged valve construction is not applicable to this design, and it may be said that the accessibility of the valves is somewhat sacrificed, as the detachment of the entire head seems to be required in order to remove them.

Casting the cylinder barrels and the heads in two separate units would seem materially to reduce the complexity of the foundry work, as compared with that called for in the usual practice, and should reduce the percentage of wasters and the total money loss from this cause. The cylinder barrel unit can be finished rather more satisfactorily in this design, as the boring tools can be run clear through. Furthermore, the combustion space can be finished if the expense involved is warranted.

None of the specific advantages of block construction are sacrificed by this method of construction. The same degree of compactness is maintained and little if anything is added to the total weight. There is no sacrifice of the excellent degree of rigidity which characterizes the block construction. The cylinder unit itself can still be bored at one series of operations in a quadruple spindle boring mill.

It would seem that the main objections to the design lie in the necessity for extra machine work in finishing the somewhat complicated joint between the two castings and in a lesser degree of valve accessibility. The main advantage to the user is in easier access to the reciprocating parts and the probability of less expensive replacements being required in event of a "freeze up."

The relative advantages of separate and integral cylinder heads have often been discussed in the past, as pertaining to separately and twin cast cylinder units, and the balance of favorable opinion seems to rest upon the integral type. The block casting of four cylinders modifies the argument somewhat and may perhaps open the question for a rehearing.

Double Lubrication Systems.

Duplicate systems of lubrication are beginning to be talked of more or less in connection with some of the models very recently brought out.

As the public is very familiar with the duplicate principle as applied to ignition, and regards it with high favor, it is likely enough that double systems of oiling may come to be popularly demanded. The desirability of having at command two methods for performing the same function, one of which will be effective in the event of the failure of the other, is dependent upon two considerations, namely, the liability of a failure occurring and the seriousness of the consequences which such failure entails.

The likelihood of the failure of the lubrication function in a good modern car is, as a rule, much less than that of a failure of the ignition, but on the other hand the consequences attendant upon a cessation of lubrication are infinitely more serious, often involving the wearing out of important parts and the total disablement of the car. The consequence of an ignition failure is seldom more than a delay. This idea of supplying the wearing parts with oil from two separate sources is not entirely a new one, designers having in many instances had in mind the provision of an alternative supply of oil for certain bearings in the event of a failure of the regular source.

Engines supplied from a force feed oiler, with leads to the various points of wear, quite frequently will keep their bearings and cylinders fairly well supplied from the crank case splash for a considerable length of time in the event of the failure of the supply from one or more leads. An engine which has a separate oil feed to each important point of friction, and at the same time full splash lubrication, may be said to be provided with a double system of lubrication, which will be effective so long as a proper oil level is maintained. A combination of self contained crank case pump, and the usual passages for oil distribution, with a force feed oiler with tubes to the cylinder walls, and important bearings can doubtless be so arranged that either system might become inoperative, and yet sufficient lubrication would be received by all moving parts, so long as there was a sufficient supply of oil on board the car. The duplicate oiling system is also applicable to the bearings of the gear set. These may be so arranged as to receive a supply of oil through strainers from the gear case splash, and also from special force feed leads.

Considering the number of cars which are damaged or temporarily put out of service through lubrication failures, and considering the large aggregate cost of repairs and replacements attributable to this cause, and the loss of use of the vehicle thus damaged, some considerable initial expense is warranted in insuring as nearly as possible absolute certainty of lubrication. It may be worth the while of designers in general to devote more thought than heretofore to the provision of an alternative oil supply for each important wearing part, so that the accidental breakage or clogging of an oil pipe may not disable an otherwise perfectly fit car.

Body Construction.

While the design of the mechanical parts of automobiles is rapidly advancing, it would seem that body construction is for the most part standing still. True, many body designers are giving a good deal of thought to improvements in appearance and to comfort, but the almost equally important work of obtaining sufficient strength with light weight seems to be utterly neglected. The average body maker appears to have no conception of the strains to which an automobile body is subjected if one would judge by the make-up of the framework usually employed.

At no distant day some bright mechanic, who does not believe in the sacredness of precedent, will develop a system of diagonal bracing which will not depend upon the tightness of a few joints to make the body stiff. He will build a body which is stronger and lighter than those made by the old plan, and consequently will corner a good part of the high class trade.

Although it has little to recommend it the wood body still holds its own so far as numbers are concerned. With the rapidly advancing price of wood it has been a question for some years past how long this inflammable material would continue to be popular for automobile bodies, but apparently the labor cost has been reduced faster than the material cost has risen. Some very good work is being done in pressed steel, but apparently only a few body companies have the necessary knowledge of this branch of construction to make a success of it.

These facts have caused a number of automobile companies to put in body shops of their own, and other companies are contemplating doing so. In many cases it will cost them more to build their own bodies than it would to buy them, but they can be sure of getting the work done as they want it, which is something they cannot get at many body factories.

If the A. A. A. expects to manage next year's reliability contest it will have to first reorganize its touring committee.

The Automobile in New Mexico.

By E. Dana Johnson, Albuquerque.

The automobile is fast coming into popular favor in New Mexico, as well as in other portions of the great Southwest. Swift motor cars are rapidly displacing the lumbering stage coaches, which are still in many sections the only means of transportation to the outlying mining camps and ranches. Five years ago the automobile in the desert and mountain country was an untried novelty that was looked at askance by the prospectors and cow punchers, and viewed as an expensive toy in a country where the bronco has from time immemorial been the alpha and omega of overland travel. Today it is becoming indispensable to mine owners and cattlemen, homesteaders and farmers, and is playing a most important part in the development of the vast resources of the "land of sunshine."

Automobiles of Torrance-Roswell Line in Roswell.

At first glance it would appear that the automobile would be entirely out of its sphere in a country of volcanic rock, cactus grown mesas, rugged canyons, sand dunes and treacherous arroyos where road building is in a primitive stage of development, and the distances are interminable.

It is rapidly being demonstrated, however, that the motor car will eventually find its greatest utility as a vehicle of business and pleasure in this part of the country, and the introduction of gasoline transportation has had much to do with strengthening the good roads sentiment which has already worked a revolution in the overland highways of New Mexico. The automobile easily adapts itself to the unusual conditions. Probably nowhere has it been put through severer tests than in the desert country. That it has "made good" is shown clearly by the rapid increase of the sale of autos in New Mexico in the past five years. Albuquerque, as the chief shipping point and the largest city in New Mexico, can testify to the extent of the automobile invasion.

MARKET DEVELOPING RAPIDLY.

"There are just five times as many automobiles being sold in New Mexico as there were five years ago," said one well known agent and garage proprietor in this city. "The firm I represent has sold sixteen automobiles in this city this season, and the demand is getting bigger every day. There are now between thirty-six and forty machines here. In Roswell, over in the Pecos Valley, a town of some 10,000 people, there are sixty machines. Five years ago there were perhaps three or four.

"Cars selling at from $1,000 to $1,600 are the best sellers, although there are many of the most expensive machines manufactured to be found in the territory."

A well known citizen who has been an automobilist here for three or four years gives it as his opinion that the 20 or 30 horse power machine of medium weight is better adapted for all around work in this section than the heavier and more powerful touring car, which meets with more trouble in negotiating the deep sand and the high centre roads, which are the chief difficulties of the motorist in New Mexico. At least a 12 inch clearance is needed. The chain drive is by all odds superior to the shaft drive for conditions here, the latter being in the opinion of many practically out of the question. Repair bills are heavy here, as the wear and tear on the machine is much greater than in the East. Mud, however, at most seasons of the year is a negligible quantity, and chuck holes are scarce. The altitude and climate make little difference, although, of course, it is necessary to adjust the carburetor to the rarefied atmosphere.

EXTREMES IN ROADS.

New Mexico probably supplies some of the best and some of the poorest automobile roads in the country. On the level mesas there are miles and miles of smooth, cementlike thoroughfare over which the cars may be driven at great speed. Then there are other miles of bottomless heavy sand, which often reaches the hubs of the wheels; deep rutted roads where a 12 inch clearance is hardly sufficient, and granite ribbed roads where automobiling is like riding over a pile of bricks. It has been fully shown, however, that a little systematic road improvement will make New Mexico the ideal speeding ground of the motor car. Unsatisfactory train service in the rich and fertile Pecos Valley, the richest section of the Territory, has turned the farmers to the automobile, and besides the sixty machines in Roswell every small town in the valley has a large quota of cars. The automobile has made a hit with the Pecos Valley farmers from the start, and has had much to do with the constructing of the splendid system of public roads for which the Pecos Valley counties are famous. A big trade excursion of several hundred business men from this city some months ago was taken all over the valley for hundreds of miles in automobiles, with relays at the various towns visited. The roads in this section are as good as can be found in the United States.

The Automobile in Camp, New Mexico.

That the worst roads in the Territory, however, are no bar to the use of automobiles was shown a few days ago when a roadster made the trip from Albuquerque to Cabezon, a native town 60 miles in the interior, in four hours and five minutes, through a notorious stretch of sand which for miles reached the hubs of the wheels. The passenger, a ranchman living near Cabezon, was so pleased with the performance that he bought the machine the same day.

Albuquerque A. C. Run on a Mesa Road.

Albuquerque Motorists on Mesa Near City.

N. M. STATE ASSOCIATION.

The first organization of automobilists to be formed in New Mexico was perfected in Albuquerque this year, and is known as the New Mexico Automobile Association, with a charter membership of some thirty men, representing nearly forty machines. The association is growing rapidly. It is to be the nucleus of a Territorial organization, and already subsidiary clubs are being formed elsewhere in the Territory. The aims of the club, as stated, are to promote the sentiment for good roads in New Mexico; to secure the formulation of proper rules governing the use of automobiles; to secure rational legislation concerning automobiles, and to encourage prudence and care in driving automobiles. The club so far has held two runs, the first one of 45 miles into the Sandia Mountains east of this city and back, and the second a gorgeous illuminated night parade about the city. Some thirty-five machines entered in the latter event, ranging from 60 horse power touring cars of the latest make, with six cylinders, to a puffing little one cylinder runabout developing 10 horse power. The club is preparing for an automobile show and racing program to be held at the Sixteenth National Irrigation Congress and International Exposition in Albuquerque the first week in October. It is expected that many outside concerns will exhibit machines, and quite a number of auto owners will make the trip to the exposition from points in the Middle West in their own cars. Numerous manufacturers will send displays.

RESORT SERVICE.

The automobile can do great things for New Mexico. There are, for instance, many beautiful mountain resorts which at present go begging because it is so hard to get to them. Persons are now figuring on starting a line of motor cars to the Jemez Hot Springs in a magnificent mountain canyon 70 miles from Albuquerque, springs said by experts to be equal to the Hot Springs of Arkansas, but whose patronage has been limited on account of their inaccessibility. An automobile service to this beautiful resort, with a six hour schedule, supplanting the exhausting twelve hour stage ride, would make it one of the most popular recreation spots and health centres in the Southwest. The proprietor of the Faywood Hot Springs resort near Silver City has materially increased his business by installing an automobile line to the railroad station some miles away, and others are following suit.

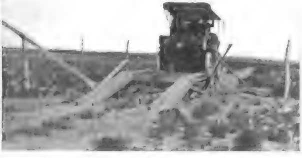
The Scenic Highway, now under construction through the fastnesses of the Pecos Forest reserve, will connect the cities of Santa Fé and Las Vegas by a perfect mountain road, with easy gradients, splendid surface, strong bridges and abutments, penetrating into the wildest parts of the Santa Fé range amid scenery whose rugged grandeur is unsurpassed on the continent. The road, which is being built by convict labor, is about half completed, and will be between fifty and one hundred miles in length, reaching at times an altitude of over 10,000 feet. It will be one of the finest automobile roads in America, and will form a link in "El Camino Real," the great highway which will ultimately connect Denver, Col., and El Paso, Tex., a distance of nearly a thousand miles. Much of this road has already been built in Colorado.

MAIL CARS.

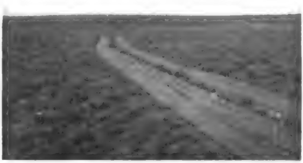
The advantages of the automobile as a mail carrier in New Mexico have been recognized by the Postal Department, which has given token of its high appreciation of the Torrance-Roswell motor line, the latter holding the world's record for carrying the mail. The Torrance-Roswell line, with a route of 111 miles, delivered the mail at either end for seven months and sixteen days without a single delay. The company has the mail contract between Roswell in the Pecos Valley, and Northeastern Railroad to Torrance on the El Paso and Southwestern. The best time made between the two points so far is three hours and thirty-five minutes, the usual running time being between five and six hours. Six or eight cars are in commission, preference being given to the Buick Model F 22 horse power car. The company also operates two cars of its own manufacture, large and powerful, and particularly adapted to traffic in this country. One of these, a seven passenger car, has been christened the "Yellow Kid," and is a great favorite with the traveling public; the other, the "Hulda," is used for both freight and passenger service. A relay car is kept continually at a half way station in case of emergency. The trip has been made successfully through snow 4 feet deep in places, and the record of "on time" for seven months in all weathers is a phenomenal one. The maintenance of this road shows how cheaply and effectively a good automobile road may be kept up in the mesa country. Skeleton bridges over arroyos and fences reduce the necessity of slowing down or stopping to the minimum. This line has all the business it can handle, and has been a money maker from the start. An extension of the service to Albuquerque doubling the length of the line is being planned

MOGOLLON MOTOR LINE.

One of the most successful automobile lines in New Mexico is that of the Mogollon Motor Road Company, which operates from five to eight machines over a 90 mile route from Silver City, the centre of the rich Grant County mining district, to Mogollon and Cooney and other camps of the Mogollon district. Heretofore it has been necessary for travelers to that remote section to make the trip by stage, fourteen or fifteen wearisome, nerve racking hours on a jolting mountain wagon. Smooth running automobiles now make the trip easily and comfortably in seven hours each way daily, leaving Silver City at 8 a. m. and arriving at Cooney at 3 p. m.



How Fences Are Crossed on the Plains.



Typical New Mexico Mesa Country.

Besides the passenger cars, heavier motors carry baggage and express exclusively, while others are used for the transportation of mine supplies and other freight. Such heavy cargoes are carried through in a day where it took the old time freighters several days. Lack of quick transportation has always handicapped the development of this mineral district, one of the most promising gold and copper fields in the Southwest.

The Ernestine Mining Company and the Mogollon Gold and Copper Company are the leading companies operating here, but the great treasure house of the rugged Mogollon range is attracting new capital rapidly, particularly since the auto has made it possible to reach it comfortably. This trip takes the passenger through splendid scenery, Cooney Canyon being comparable to the Grand Canyon of Arizona, although on a much smaller scale. En route the automobile with its cargo is swung across the roaring rapids of the Gila River on a dizzy aerial tramway suspended from a cable, a cement ford on the bottom of the river being used when the water is low. It was found impracticable to build a bridge across this treacherous stream without great expense. The crossing is made at old Fort West; Reo touring cars and White steamers are used on this route, with made to order cars for the heavier work. While prospecting for the new line last year T. W. Carter, of the Ernestine Mining Company, got mired in the quicksands of the Gila in a heavy automobile, and it required the services of four horses and twelve men to get him out of his perilous position. This is one of many instances where the unwary motorist has come to grief in the quicksands. The two chauffeurs who made the trip from ocean to ocean in a Reo Mountaineer some years ago attempted to ford the Rio Puerco 20 miles west of Albuquerque, and were several days digging their machine out of the river bottom.

OTHER LINES.

Other auto lines have been established from Silver City to the adjoining mining camps. Machines owned by the proprietoress of a hotel at Santa Rita daily make the rounds to Hanover, Fierro, Central City and Copper Flats, the whole trip taking an hour and a half. In the camps mentioned from 2,000 to 2,500 miners are employed.

The automobile now penetrates into the farthest sections of both Grant and Socorro counties, the largest counties in the Territory, and possessing the greatest undeveloped resources, often hundreds of miles from a railroad. The cowboy's dream of the time when he may be superseded by a "puncher" mounted on a curveting touring car seems about to materialize.

So pleased was Uncle Sam with the handling of the mail by gasoline on the Torrance-Roswell route that he is trying out the automobile in various other parts of the Territory. Final arrangements are now being made to install a motor service between Gallup on the Santa Fé Railway, 100 miles west of Albuquerque, and Farmington, San Juan County, in the northwest part of New Mexico, the distance being 117 miles. The route leads mostly through the heart of the Navajo Indian reservation. At the instance of the Post Office Department a number of Territorial officials and business men recently made a motor trip over the proposed route. They spent five days on an inspection tour, examining all the roads thoroughly, and their report was entirely favorable. It is planned to make the run daily and handle the mail in seven hours, or ten at the most. Between the Santa Fé road at Gallup and the Denver & Rio Grande at Farmington there is no railroad, and none nearer than 100 miles east or west. Leaving Farmington for the south, the men who made the inspection found a 42 mile straightaway stretch over the level mesa without a single arroyo, where the speed will be limited only by the capacity of the car. Midway of the route it is planned to divert the road 8 miles to a big spring at Tsaye, or Shawver's trading store. Sixteen miles from this point are the famous ruins of Pueblo Bonito, relics of a mysterious and long vanished race antedating the Indians and of immense archæological value. By a two day side trip from Tsaye these ruins may be visited, in auxiliary machines to be stationed here for the purpose. En route to the ruins the road passes through "Kim-bi-ni-ola"—the "House of the Winds." Richard Wetherill, a veteran frontiersman and Indian trader, has offered to build and maintain the branch road to Pueblo Bonito.

The trial trip over the route, following the inspection, was made in nine hours' running time. The effect of the automobile on the Indians, most of whom had never been near a sizable town, was laughable. They viewed the suspicious looking vehicle with curiosity liberally mixed with apprehension, and several times brawny braves fled precipitately in sheer terror when the machine approached. This automobile route follows roughly the line of the proposed Colorado, Columbus & Mexico Railroad, capital for the building of which is said to have been secured. Five autos will be placed in commission.

IN NEIGHBORING ARIZONA.

Just out of New Mexico on the western boundary, and in a country which is largely tributary to Albuquerque in northern Arizona, the automobile has again invaded the wilds. The Arizona Transportation and Automobile Company has been organized to establish a daily motor service between

Holbrook, on the Santa Fé Railway, and Fort Apache, the military post which has often figured prominently in the accounts of Indian uprisings. Thirty thousand dollars has been raised to improve the roads between these points. The itinerary will take in Snowflake, Showlow, White River and Cooley's, the latter a resort in the lovely region of the White Mountain Apache Reservation, a land of tall timber, wild game and trout streams. The distance of over a hundred miles will be covered in six to eight hours. The auto line will make it much easier for patients to reach the White Mountain Tuberculosis Sanitarium, an institution ideally located in this region of high altitudes, enchanting scenery and perpetual sunshine. There will also be a forty-five minute service from Holbrook to the petrified forests of Arizona, and routes from Holbrook to St. John's, Springerville and other settlements far from the railroad.

ALBUQUERQUE-ESTANCIA LINE.

Some months ago the Albuquerque-Estancia Automobile Company was organized, and now operates a line of cars over a distance of 75 miles, connecting Albuquerque with the many growing towns of the Estancia Valley, through the narrow pass of Tijeras Canyon in the Sandia Mountains, a tortuous defile 20 miles in length. The regular schedule is five hours, the fastest time yet made being three hours and fifty-five minutes. The service makes it possible to reach the Estancia Valley towns from five to eight hours quicker than by the railroad connections. It has been a boon to the valley farmers and the business men of this city.

In the extreme eastern part of the Territory the Tucumcari-Amarillo Automobile Company runs five new 20 horse power machines between Tucumcari, N. M., and Amarillo, Tex., maintaining a double daily service with two additional machines posted at the half way station for use in case of need. This is another of numerous instances where the automobile has satisfactorily bridged the gap between railroad connections.

TOURING.

Long distance automobiling is becoming a fad in the Southwest, and frequently Albuquerque is visited by motorists en route from Denver to El Paso, Kansas City to Los Angeles, or on some equally lengthy jaunt. R. E. Putney, of this city, a prominent member of the Automobile Association, recently completed a trip from here to Buffalo, N. Y., in a 60 horse power car. His greatest troubles were encountered in the Middle West, where the heavy rains had made many of the roads impassable sloughs. Mr. Putney had an unusual experience in Colorado when an angry milkman with a six shooter made the touring car stay behind him for several miles while he jogged leisurely along.

Lieut. T. N. Gimperling, Twenty-first Infantry, U. S. A., recently passed through here in a touring car en route from Denver to Fort Huachuca, Ariz., his progress down the Rio Grande from here being one continuous series of misfortunes. Gimperling was laid up times without number by sand, impassable streams and similar difficulties. The motorist in this case made the mistake of traveling in the valley instead of on the higher mesa roads.

One automobile milk wagon has been placed in service in this city, and the use of the motor car for delivery purposes bids fair to become popular.

Last year a party of local automobilists made the trip to the Indian pueblo of Acoma, 50 miles away, the sight of the puffing vehicle at the base of the immense Rock of Acoma, on which the village is perched, being a most novel one to the Indians, who peered fearfully down at the machine from their safe eyrie on the 500 foot rock.

Automobiling in the Southwest possesses a particular zest not found anywhere else in America. There is a fascination about the immense distances, the purity of the air, the splendor of the scenery and the beauty of the coloring of desert, mesa and mountain, which at no time exercises a more potent charm than when one is viewing it from behind the steering wheel, with the exhilaration of power and rapid motion and unlimited ozone. While the coming of the automobile is gradually working a revolution in transportation conditions, it is likewise furnishing the pleasure seeker in New Mexico with a source of amusement and recreation whose possibilities are endless.

Novel Accessories Recently Developed.

By Albert L. Clough.

Devices are constantly being invented and put upon the market which are designed to minister to the comfort or convenience of the motorist, or to increase the usefulness of his car. The average owner takes pleasure in adopting such accessories and fitting them to his car. These devices are generally applicable to cars of nearly all makes and models.

DOUBLE SPARK PLUGS.

A great many cars have been equipped by their owners with a reserve ignition system separate from that originally installed upon the vehicle. One difficulty frequently met with in the installation of such an auxiliary system is that there is no suitable location for the separate spark plugs required by the reserve system. If they are placed in the exhaust valve cap they are not in contact with so clean a charge, and thus are likely to fire less reliably; they are exposed to greater heat, and hence are more liable to crack and to cause premature ignitions, and are far more prone to become short circuited by carbonized oil. It is of course sometimes possible to locate both plugs in the inlet valve cap if a new cap is made for the purpose, but this involves some expense, and cannot always be successfully accomplished. A double spark plug has recently been placed upon the market which seems to overcome this difficulty. It has two binding posts and two separate live spark points, the two live portions of the plug being fully insulated each from the other. The plug screws into the regular plug hole over the inlet valve, and connection is made to one of its binding posts from the high tension wire of one system, say the magneto, and to the other post from the high tension lead of the battery coil system. While a double plug like this does not afford quite the security that two entirely separate plugs offer, it should be of advantage where there is no practical method of locating two distinct plugs.

COMBINATION PLUG AND COCK.

A large number of vehicle engines are in use, which are fitted with no relief cocks. In order to prime the cylinders, to inject kerosene or to compare the compressions of different cylinders, the spark plugs have to be disconnected and removed.

There is now to be had an ingenious form of combination spark plug and pet cock, which is also claimed to be self cleaning. The plug is bored throughout its length, and is fitted with a hand operated valve, which opens and closes this channel. There is also a priming cup at the top through which gasoline or a decarbonizing fluid can be let into the cylinder. A small test wire, which moves with the insulated handle of the cock, is so arranged as to short circuit the plug and cut off ignition when the valve is fully opened. Under these conditions the unexploded mixture violently passing between the spark points, when the engine is running under the power of the other cylinders, tends to clean the plug end of any accumulations. The test wire also serves the purpose of cutting out a cylinder to locate missing, for which a screwdriver or other tool is generally used—a practice which is often productive of startling electrical shocks.

ACCESSIBLE TIMERS.

One make of popular priced runabout, which has been built in very large numbers, and possesses many admirable qualities, has the disadvantage of a very inaccessibly located timer. One should not expect "all the comforts of home" at the price this little car sells for. Anyone who owns one of these runabouts can secure a vertical shaft, with a timer most accessibly mounted thereon a bevel gear pair, a supporting bracket and dustproof housings for the gears, all ready for attachment to his car. The installation of this outfit will bring the timer into a most convenient position, and prevent the necessity of "mixing up" one's hands with the flywheel, whenever there is timer trouble, and of working in a very cramped space at an annoying disadvantage.

(To be continued.)

Autogenous Welding and Its Applications to Automobile Construction.

(Paper read by E. S. Foljambe before the Society of Automobile Engineers at Detroit.)

In dealing with the possible application of autogenous welding to the construction and repairing of automobiles I fully appreciate that the subject is so comparatively new that its practical field of usefulness has not yet been clearly and definitely defined. It would seem from the applications of the process and the extensive experiments which have been carried on abroad and are now being conducted by a few in this country that autogenous welding supplies the workers of metal a means of accomplishing many results which have heretofore been either impossible or only achievable by costly and difficult methods.

The process consists of welding, or, more correctly speaking, melting together metals by means of the oxy-acetylene flame, the temperature of which almost rivals that of the electric arc, being 6,300° Fahr. The facility with which it can be handled as compared with most other methods makes its commercial application comparatively simple. The possibilities attendant upon the use of a flame of such high temperature can be realized when it is remembered that the melting point of steel is about 2,570°, and that of platinum, one of the most refractory metals, is only 3,227° Fahr. Its chief field of usefulness is in combining such metal parts as would ordinarily be riveted, in welding small parts together, in repairing broken or defective castings and for cutting metals.

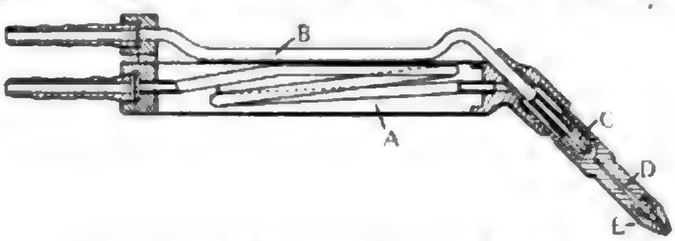


Fig. 1—Section of Fouche Welding Burner.

WORK OF FOUCHE.

Unquestionably the combination of acetylene and oxygen was first suggested by the familiar oxy-hydrogen blowpipe, but it was only after exhaustive experiments on the part of the noted French chemist Fouché that in 1901 he was enabled to produce a successful burner using this highly explosive combination. He was led to use these two particular gases by his calculations, which showed the extremely high temperature that would be generated by their union. In 1902 he patented his first cutting and welding burners. In 1905 he took out additional patents, and Fig. 1 shows a section of this later welding burner, the principle of which has not up to the present time been appreciably altered or improved. Since his introduction of a successful burner the development of the oxy-acetylene process has been principally in connection with the best and least expensive methods of producing these two gases.

The most economical method of producing oxygen in commercial quantities is by means of distillation of liquid air, the cost having been reduced to something less than a cent per cubic foot. However, the familiar laboratory method of heating black oxide of manganese (MnO) and potassium chlorate (K_2ClO_3) is largely used in this country, on account of the relatively low cost of the plant, although oxygen produced in this manner can hardly be sold for less than 2 cents per cubic foot.

THE BURNER.

The principal difficulty in designing a burner is to prevent the flashing back of the flame at the nozle, which might cause an explosion. Even several wire screens have been proved ineffectual preventives, as the intense heat of the flame instantly raises the fine wires of the screen to a red heat. The method employed by Fouché consisted either in using a small bore tube of great length coiled into the cylindrical part of the burner, A, Fig. 1, or of packing this space with mineral wool or asbestos through which the gas could freely pass, but which successfully prevented the firing back of the mixture. As the tube is not of capillary size, it causes less resistance to the flow of the gas than the asbestos, and is therefore preferable. In a welding burner oxygen under about 10 pounds pressure per square inch is admitted through the small tube B, and after passing out of a fine tipped nozzle C mixes in the injectorlike chamber D, and carries along with it the acetylene which has passed through the coil in cylinder A. The mingled gases burn, not at but beyond the tip E, due to the pressure, so the tip itself is not subjected to a high temperature, and can be made of brass or even copper. In the welding flame the acteylene is only under a pressure of three-quarters to 2 pounds per square inch, and the oxygen, 10 pounds. For cutting, the same combination flame is used, but in addition a third tube for pure high pressure oxygen is provided, and so located that the oxygen strikes the heated metal just to the rear of the combination flame. The oxygen for the cutting burner is under about 150 pounds per square inch, and the acetylene 10 pounds.

OPERATING THE BURNER.

In operating the burner the acetylene is first ignited and the flame regulated by means of a valve at the end, so that it does not leave the tip. The oxygen is then turned on, the pressure being maintained constant by means of a reducing valve on the tank. The acetylene is then regulated until just sufficient passes to produce complete combustion, giving practically a nonluminous flame, in the middle of which, however, near the tip, a slightly luminous cone is seen, the point of which is the hottest part of the flame, and the burner is usually held in such a position that the tip of this cone touches the work. If an excess of oxygen is present the metal will very soon scintillate, showing that it is being burned. This, of course, has reference to the welding flame alone, as the cutting action is entirely due to an excess of oxygen.

The extreme localizing of the heat makes it possible to use the flame in close proximity to soldered or brazed work without causing a separation of the parts thus united. On certain classes of work where it is desired to make ordinary brazed joint, the flame can also be used to advantage in heating the parts and melting the spelter.

CUTTING.

When cutting the combination flame is first turned on and used to bring the edge of the piece of metal to be cut to a bright red heat. Then the pure oxygen stream is turned on, and the highly heated metal instantly combines with the oxygen, forming Fe_3O_4 in the case of iron, and a path is almost instantly melted out as the flame is moved across the piece. The amount of metal burned away depends upon the width of the zone heated by the fore flame and the volume and pressure of the oxygen. The complete localizing of the heat is a peculiar and surprising feature, for, although the metal for about an eighth or three-sixteenths of an inch is actually running out of the cut like water, the adjacent metal is not heated to a dull red for more than half an inch on each side of the cut. For cutting thin metals oxygen under such high pressure is not as essential as when the work is thicker, and it has been found that after the melting process caused by the pure oxygen stream has started, it is almost unnecessary to have the combination flame carried ahead of the stream of oxygen, as the heat is so intense that the action after once started can be continued. This has been shown by using simply the flame from a welding burner to heat the edge of the piece to the melting point, and then suddenly turning off the acetylene, allowing the oxygen jet alone to impinge upon the heated metal. This is rather difficult, however, for if at any time the metal cools even slightly below the welding point, the oxygen acts as a draft to cool it, and the melting ceases.

WELDING.

In uniting the edges of a sheet rolled to form a cylinder, or wherever the pieces do not lap, the edges are beveled so that when brought together a V shaped groove is formed, the width at the top of the groove being about the same as the thickness of the metal. This rule applies to metals up to half an inch in thickness. The flame is directed into this groove, first melting the thin bottom edges; at the same time a piece of wire of the same material as that of the parts to be joined is held in the edge of the flame, and thus kept at a bright red heat until the metal of the parts begins to flow, when the wire is immediately plunged into the flame, and being instantly melted drops into the groove, uniting with the metal at the bottom. This process is continued, thus building up the metal until slightly more than sufficient is placed in the groove to fill it, so the piece can afterward be dressed to make the surface of the joint flush and invisible. Even dissimilar metals can be perfectly united, and such combinations as copper, brass, cast or wrought iron to steel, or brass to copper, are possible. Aluminum can also be worked successfully. The parts so united form one homogeneous piece, but with this distinction, that while the metal of the original sheets has a grain due to rolling, the built up material of the joint has a structure similar to puddled metal. This is probably one reason why test specimens do not show a tensile strength equal to that of the original. However, as shown by the following report of the South Chester Tube Company on wrought iron pipe material welded by the American Ferrofix Brazing Company, the relative strength is very high, being about 95 per cent. of the original piece, which is much higher than can be obtained by riveting. It is even possible to increase this to 100 per cent. by simply heaping up the metal at the joint until the cross sectional area is somewhat larger than that of the original, but the elongation is noticably decreased:

REPORT OF SOUTH CHESTER TUBE COMPANY.

	Ultimate Strength. Lbs. Sq. In.	Elongation. Per Ct.	Elastic Limit.
No. 1—Original bar...	49,580	11	......
No. 2—Welded bar...	43,040	5	38,700
No. 3—Welded bar...	46,600	8.5	35,800

APPLICATIONS.

Although the cutting-off flame is of especial interest, its applications to automobile construction are much more limited than are those of the welding flame. In Paris the flame has been used successfully on work as large as 6 inches in thickness, but so far as I am aware no cutting has been done in this country on work over 2½ to 3 inches thick. Although the intense heat of the flame has a slightly injurious effect on the alloyed steels, particularly if applied to sheet metal or comparatively thin work, still it is possible to rapidly cut out gear blanks without injuring the metal to any considerable depth. It seems that when it is desired to form crank shafts from a slab or billet, it is possible to do this with the cutting flame in a very small fraction of the time now consumed by those few makers who employ the slab method.

The chief interest, however, of the oxy-acetylene process at present is confined to welding, which can be used in innumerable ways in connection with the construction of automobile frames and engine parts. It is probable, for example, that nearly all of the riveted joints in frame construction can be eliminated, and the pressed steel cross frame members, gusset plates and sills be united by the welding flame, so as to form practically one solid piece. Pressed steel, drop forged or wrought iron step hangers, brackets for jack shafts, springs, guards, etc., can be neatly and rapidly made one with the frame. Drop forged or cast steel spring horns can be firmly united to the pressed steel side members of the frame, and wherever cracks or unsightly joints might ordinarily be left, these can be completely filled and dressed off, making a much more finished job than by the usual methods.

At the same time the structure is materially strengthened. Many parts, such as steering arms, pedals and levers, which are now either pinned and brazed, keyed or screw and nut retained, can be made to form one solid piece by a brief application of the welding flame. Parts which require mild steel centres, but should have high carbon steel rims, as in the case of gears or gear sectors, can be built up by the use of this process. Brass handles can be joined to steel shanks, or brass heads be put on screws which need steel shanks for strength. Nickel steel or cast iron valve heads can be fixed to carbon steel stems, and many other possibilities will suggest themselves to the minds of those actively engaged in automobile construction. I do not state that all these suggested uses will be found more economical, but this is a matter which will adjust itself in practice. In the construction of radiators and tanks and the attaching of pipes to similar or dissimilar metal tanks the oxy-acetylene process will doubtless find large application, as by this means absolutely seamless tanks can be formed which are actually stronger at the united edges than at any other place, owing to the filleting with additional metal.

Automobile construction has shown a steady but gradual increase in the use of pressed steel parts, and it is but natural to suppose that by means of such a process as autogenous welding the applications of pressed steel will become even more numerous. In Germany patents have already been granted for making light crank shafts from two similar pressed steel halves, united by the oxy-acetylene flame, and attempts have already been made to form axles in a similar manner, but I believe thus far the work has only been of an experimental nature. The following is a suggested method of forming a light pressed steel piston. The walls of this piston consist of a rolled up sheet of metal, grooves or depressions for the piston rings in the same being produced by dies or rolling, while the free edges are united by the flame. In the same way a disc head, which may be drawn to form a convex surface, and also drawn bosses, can be welded in place, giving an extremely light, rigid construction. Of course it is understood that a slight amount of turning and finishing of piston ring grooves, holes for the wrist pin and external grinding will be required. Light, stiff pressed steel connecting rods could also be made in a somewhat similar manner.

FOR REPAIR WORK.

As it is possible to unite many dissimilar metals, and with a heat so localized that neighboring parts are not affected, autogenous welding has already found an extensive application in automobile repair work. Broken crank cases or other parts can be united and made practically as strong as new. The method of holding the pieces of a broken aluminum case, for example, is to clamp them into position temporarily while clay is packed around the parts and heated sufficiently to drive out the moisture, thus forming a solid support for the parts as well as a kind of mold. A series of holes are usually drilled at the crack, or the edges of the pieces are roughly beveled, so, as previously explained, the metal can be built up from the bottom. In some instances lugs or peculiar shaped projections may have been completely worn off or destroyed when it becomes necessary to build up new ones with additional metal. In repairing a cracked water jacket, after the edges of the crack have been prepared, it is customary to use copper instead of iron wire for the filling metal, as it flows at a lower temperature and adheres very positively. In case there is danger of warping, due to local expansion, the entire cylinder is heated before operating upon it. This preparatory heating process is also used on large parts, whose mass is sufficient to conduct away the heat so rapidly that it would otherwise be impossible with a flame of ordinary size to bring the parts to the melting point. In fact, the heat conductivity of large masses of metal is really the limiting factor in determining the size of work upon which the flame can be employed. Defective castings which ordinarily would immediately be consigned to the scrap heap can be made as good as new. Blowholes and other imperfections in large work can be easily filled, either with iron, brass, bronze or aluminum, acording to the nature of the casting. With such a process perfected, there is almost no excuse for any metal part of a machine being discarded.

The cost of oxy-acetylene autogenous welding depends, of course, upon the size of the work, the price of the gas, and in no small degree upon the skill of the operator, so that very little can be definitely stated in regard to it. It is claimed that the expense of uniting sheet metal can be compared with riveting as follows: Up to one-quarter inch in thickness it is cheaper than riveting; one-half inch about the same, while above five-eighths inch it is more expensive, the cost increasing approximately as the cube of the thickness.

The time required for cutting different thicknesses of metal from experiments made by the Baltimore & Ohio Railroad Company is as follows:

CUTTING RECORDS.

A section 13½ inches was cut from a ⅜ inch flat in 1 min. 10 sec.

A section 12 inches was cut from a ¾ inch flat in 1 min. 25 sec.

A section 11 inches was cut from a ½ inch plate in 2½ min.

A section 33 inches was cut from a 15 inch by 50 pound beam in 3 min.

The consumption of acetylene and oxygen by burners suitable for different thicknesses of metal are given in the appended table:

No.	Acetylene. Cubic Feet.	Oxygen. Cubic Feet.	Thickness of Metal.
1—100 litres....	3½	4¼	1-32 in. to 1-16 in.
2—150 litres....	5¼	7	1-16 in. to 3-32 in.
3—225 litres	8	10¾	3-32 in. to 1-8 in.
4—350 litres	12¼	16½	1-8 in. to 1-4 in.
5—500 litres....	17½	23	1-4 in. to 5-16 in.
750 litres....	26¼	35	5-16 in. to 7-16 in.
1,000 litres....	35	47	7-16 in. to 1-2 in.

For ¾ inch metal a special tip of a capacity of 52 feet, or 1,500 litres of acetylene and 71 feet of oxygen is required.

Status of the Austrian Automobile Industry.

The Vienna Chamber of Commerce and Industry recently submitted to the Department of Commerce a report on the status of the automobile industry in Austria. As regards gasoline vehicles, attention is called to the fact that four entirely new factories have been established, partly through local business interests and partly with the assistance of banks, while four existing factories have been materially enlarged. If Austrian purchasers were already in position to buy a first class Austrian car, it should now not be long before the Austrian industry will have sufficient capacity to completely supply the home market. However, it is to be remarked that the tariff rates set down in the new schedule are entirely insufficient for the protection of the home industry. Certain types of Austrian cars, especially light cars, are beginning to find a market outside of the country. The manufacture of electric vehicles continued to develop uniformly. The city of Vienna introduced motor omnibuses on several lines in a tentative manner. As a technical and commercial innovation the electric omnibus service deserves mention. The report further points out that the formation of the Austrian Automobile Manufacturers' Association has been of the greatest benefit to the general interests of the Austrian automobile industry.

The stockholders of the Argyll Motor Company, which about two years ago completed magnificent new works in Alexandria near Glasgow, have consented to the liquidation of the company. The assets are estimated at £761,000 and the liabilities at £952,000.

Maintenance and Repairs

Overheating and a Cure.

By "OWNER."

Overheating of an automobile engine may be caused by many things, such as pump troubles, clogged pipes, too rich a mixture, running with a retarded spark, etc., but as a rule such causes are easily ascertainable and quickly remedied, and it is when we are sure these details are correct and yet the trouble continues that the case begins to be interesting.

It has been the experience of the writer that if the pump is circulating the water through the water system, no matter how slowly, the engine will not materially overheat. The radiator may get very hot, some steam may appear at the filler cap, especially on stopping the engine, but no fear need be felt unless the motor refuses to stop on cutting off at the switch.

In a certain car the engine had begun to overheat and gradually grew worse until it was impossible to go more than a few miles without the radiator steaming violently. The piping was examined and cleaned out, the radiator and water system generally were cleaned and flushed by a strong force of water. The top was taken off one of the cylinders, and while the water jacket was rusty, as was expected, there seemed plenty of room for proper circulation.

Now the pump was examined and the vanes were considered worn, so a new wheel was inserted, but there was no material change except for a short while.

When you have a good car that is able to go at a good pace, and take you there and back with certainty, it is most annoying to have such a thing as this happen. You feel that it is a shame to drive the car, that you are abusing it, although you know that as long as you keep the water from the actual steam point you can keep on. It is somewhat of a disgrace to have a plume of steam shoot up from your radiator cap when you stop in a crowded village. And again when you are as near the boiling point as that, the direction of the wind makes an appreciable difference. A good strong headwind keeps the radiator fairly cool, but turn and sail with it, and up flies the steam, and if the day is hot you are brutal if you continue.

The overheating on the car continued for some time, and attention was given to the circulation system generally, with a view to a different arrangement so that the water would flow directly from pump to engine, instead of from pump to radiator and thence to engine, but the system worked properly once, and it was decided unwise to make any change in this direction.

The carburetor was examined for defects, although as far as power and speed were concerned no fault could be found with it, but having eliminated all the other alleged causes we were forced to fall upon this as the cause of all our troubles.

Now it seemed to us that the only way a carburetor could cause overheating was by it furnishing a mixture too rich in gasoline, and as this carburetor had a fixed spray opening we adjusted the float so that the level of the gasoline would be lower than formerly, but without avail. We next inserted a new spray nozzle of a slightly smaller opening, but no change was apparent. The extra air valve was adjusted by loosening the spring, and even putting in a lighter one, but the overheating continued more or less than it was before, but the effect either way was of no consequence.

While making these changes in the carburetor we found that the throttle valve was rather loose; in fact, there was considerable play between the valve and the sides of the passage. The throttle valve is operated by a spindle or rod which passes through a plate or cover on the front part of the carburetor, and the hole through which this spindle worked was badly worn also.

These things were remedied by inserting new parts; the valve was a tight fit and the spindle fitted snugly, since which time the water has never boiled, neither has it reached a very high temperature except on one warm day.

It is difficult for one to arrive at a satisfactory explanation of this occurrence, but there can be no doubt that the looseness in the rod had a considerable effect upon the mixture by permitting air to enter at a point other than originally intended, and that the change caused a richer mixture to enter the cylinder, causing overheating.

Additional air as a rule has the effect of thining the mixture, but additional air entering at the forward end of the carburetor, while the original air inlets and spray nozzle are at the other end, perhaps changed the ratio of suction so that liquid gasoline was taken into the cylinder directly, creating the over-rich mixture which was the cause of the trouble.

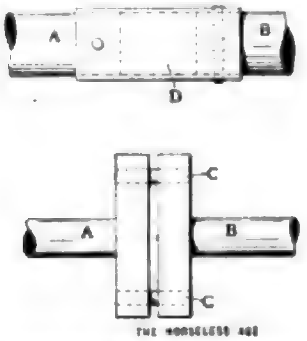
However, the trouble is remedied, which is the main thing; nevertheless it would be interesting to have the phenomenon explained by competent authority.

Loosening Refractory Nuts.

There are two methods of loosening nuts which stick to their bolts on account of rust or dirt. The first of these is the well known kerosene method, which consists in moistening both the nut and the bolt with the oil. Unfortunately it takes about half an hour before the nut can be loosened in this way. The second method is as follows: Take a socket wrench adapted for use upon the nut and heat it until it is almost red, then apply it to the nut, thus heating the nut and loosening it without heating the bolt. The nut may then be removed with another wrench. When the nut has been warmed by the application of the hot socket wrench it may be further loosened, if necessary, by tapping it with the pein end of a hammer, when it may be readily removed.

Pump Drive Connections.

Despite the use of gauze screens in the water circulation line foreign matter sometimes enters the pump and edstroys it or disables it. To prevent such an occurrence where a positive drive, such as a universal joint, is used, a flexible connection should be inserted between the shaft from the drive gear and the pump drive shaft. Two of these are illustrated herewith. The first consists of a cylinder of spring steel D, which is pinned to the ends of the shafts A and B, the drive shaft and pump shaft respectively, by means of two pins of steel wire inserted at right angles to one another. Should an obstruction be found in the pump the coupling D would bend or shear and thus relieve the pump. The second connection is a design borrowed from marine practice. Two flanges, A and B, are fitted to the drive and pump shafts respectively, and holes are bored in these flanges for the insertion of wooden pegs, or plugs of babbitt metal, as at C. These plugs or pegs will shear off in case of an obstruction in the pump. A coiled spring might also be used in place of the pegs between the flanges, or attached by pins to the shafts themselves.



PUMP DRIVE CONNECTIONS.

Seating a Driven-in Valve Guide.

In replacing a damaged valve guide which is retained by driving it into a coned seat in the cylinder casting, it was found next to impossible to drive it in from below without dismounting the push rod guide, and there was no room between the crank case and the end of the guide to swing a soft hammer to give sufficient blow for the purpose. As a quick job was essential the repair man in an uptown garage, the West End, made up the following apparatus: A rod of slightly smaller diameter than the valve stem was cut with a screw thread running its entire length. Two nuts were then provided to fit the rod and a plate of steel, three-eighths of an inch thick, was cut so as to rest over the valve chamber opening, a hole of slightly larger diameter than the threaded rod being drilled through the plate. The apparatus was rigged as in the cut, B being the threaded rod and G the valve guide placed upon it, the nut C holding the same in position. The guide was placed in position by hand, and the rod B passed through it, and through the hole in plate E, nuts A and C being then put on. Upon screwing down A the guide was forced home, when by removing nut C the apparatus was removed by lifting it out. D is the push rod guide, F the valve seat and H the chamber to the manifold.

Bushing Worn Holes on the Road.

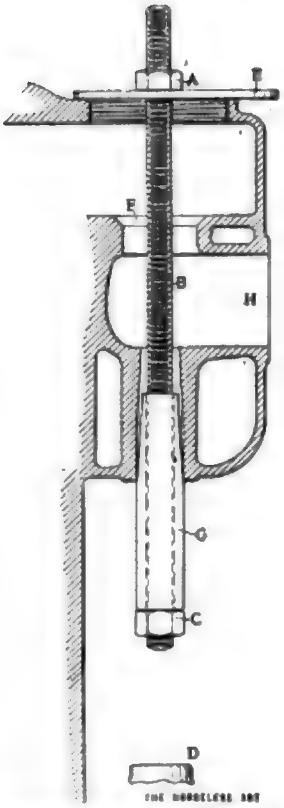
By G. S. G.

It frequently happens that troubles on the road are due to lack of close inspection before leaving the garage, the driver trusting to luck that no trouble will occur. The writer experienced trouble with the bolts and transmission brake drum, which latter also has part of the universal joint cast upon it. As shown in the sketch, the holes for the bolts had been worn elliptical by the constant strain in starting and stopping, the bolts being three-eighths of an inch in diameter. Having a breast drill and a piece of copper tubing in our tool box, we decided to bush these holes on the road and stop the disagreeable noises coming from the universal joints.

I placed the drum between two short pieces of 1 inch board and squeezed these together with a pair of clamps. Then by putting my foot on the board I drilled very slowly, and after half an hour I had all the holes drilled to one-half inch diameter. Then the drum was bolted on to the flange of the transmission shaft by three bolts, and with the holes already drilled as guides each hole was drilled in succession. Pieces of copper tube were cut off with a three cornered file and smoothed in our primitive vise. The tubing was one-half inch outside by three-eighths inch inside diameter, and made a light driving fit in the drum and for the bolts. The car has now been running four months, and the roadside repair shows no signs of having to be repeated.

Drop in French Exports.

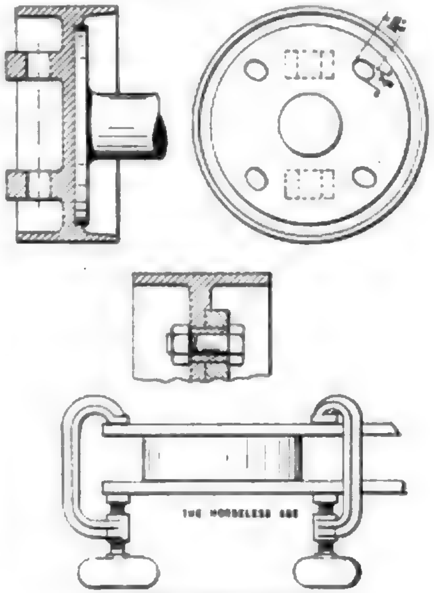
The French automobile exports during the first six months of the current year suffered a decline of 12,019,000 francs, as compared with the corresponding period of the previous year. Only the exports to Algiers and Russia showed an increase, while the exports to the United States, England, Germany, Austria, Italy, Belgium, Switzerland, Brazil and Argentina showed a decrease. The total value of the exports for the first six months of 1908 was 61,151,000 francs, as compared with 76,573,000 francs for the corresponding period of the previous year.



REPLACING A DRIVEN-IN VALVE GUIDE.

In order to provide an adequate number of motor trucks for army purposes in the event of war, the administration of the German army has worked out a plan to encourage the use of motor trucks in commercial enterprises. It will pay a yearly subsidy to owners of such trucks for a period of five years, and special premiums for the use of native fuels, such as alcohol. The plan further provides for the purchase of these trucks at the price of $1,000 each, in the case of a national necessity.

The French-American Automobile Sales Company in Paris has decided to send the two Lamberjack brothers, Emile and Dominick, to South America to make arrangements for the sale of French cars, particularly in Brazil and Argentine.

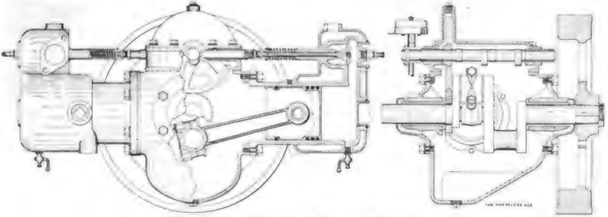


BUSHING WORN HOLES.

NEW VEHICLES AND PARTS

The Grabowsky Power Wagon.

The Grabowsky Power Wagon Company, of Detroit, Mich., are preparing to market the commercial vehicles described below. The first sizes to be manufactured will have capacities of 1 ton and 1½ tons respectively, but 3 and 5 ton vehicles will be produced in the near future. The following description applies to the two smaller sizes.



Two Sectional Views of the Grabowsky Motor.

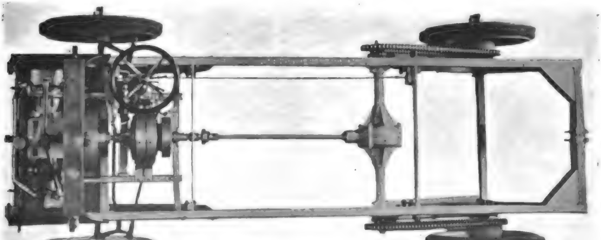
These vehicles were designed by Max Grabowsky, who originated and developed the well known Rapid machines. Their mechanical features are thus of interest as representing the latest thought of one of our few experienced commercial vehicle designers.

Each distinct part of the mechanism, such as motor, change gear, countershaft, etc., is designed as a unit, and each unit is so placed in the frame as to be easy to remove without disturbing any other part. An unusual feature of this "unit" construction is that each unit is very accessible for small adjustments.

The motor is an opposed cylinder, and, as may be seen in the illustrations of the chassis, is placed crosswise of the frame under a short hood, at the very front of the car. It has a 5¼ inch bore and 5 inch stroke. The crank shaft is of chrome nickel steel, 1⅞ inches in diameter. And the cam shaft is of similar material with integral cams. The connecting rods are drop forged. Their crank end bearings are 1⅞x2¼ inches, and the wrist pin bearings are 1¼ inches in diameter.

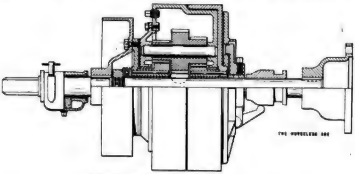
The valves have securely attached cast iron heads, and both valves and push rods have exceptionally long guides. All engine bushings are of Parsons white bronze. A pump driven from the cam shaft forces oil to all of the engine bearings. Sight feeds are provided at the points where the oil enters the cylinders, so that this supply can be very accurately regulated. It will be noted that the construction of the engine, with bearing plates and cylinders recessed into the crank case, and large passages for returning the oil to the case, will prevent oil dripping. A large inspection opening, 3x8 inches, is provided at the top of the crank case, and its cover may be removed without disturbing any other part. All screws, units and bolts used in the engine are hardened. Thermo-siphon circulation is employed, the radiator being located directly above the engine flywheel. The water connections are made by special joints with mutilated threads, so that a partial turn is all that is necessary to loosen the connection, the water being retained in the radiator by shut off cocks. The engine is supported on a subframe, which forms a kind of track, so that by loosening four connections and removing two bolts the motor may be slid forward on to a folding carrier. As it is neither raised nor lowered during this operation one man can do the job easily.

Ignition is by means of a jump spark coil

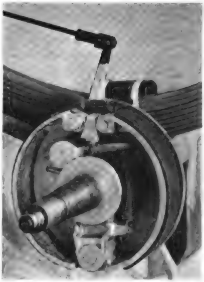


The Grabowsky Truck Chassis.

and storage battery carried under the seat, where the 18 gallon fuel tank is also located. Spark plugs and timer are very accessible. Owing to the closed hood and under pan the motor is well protected from dust. A strong and simple "all spur" planetary change gear is used. The high speed clutch is of the plate type, and the low and reverse are obtained by bands faced with a composition of fibre and copper wire. This case is also practically oil tight.



THE CHANGE GEAR.



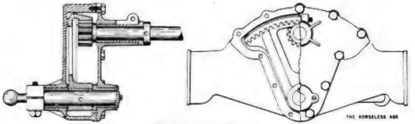
THE HUB BRAKE.

The bevel gear reduction is considerable, so that only a small reduction is needed in the sprockets. This permits the use of large front sprockets, so that there is little wear at this point, consequently the chains are quiet. Both axles are forged, with rectangular sections, 1½x2½ inches. Tapered roller bearings are used in the wheels and countershaft.

Pressed steel wheels are used, those for the 1 ton vehicle being 32 inches in diameter with 3½ inch solid rubber tires, while for the 1½ ton machine the front wheels are 32 inch and the rear 34, both being shod with 4 inch tires. Wood wheels are furnished as an option.

Semi-elliptic springs are used in front and full platform in the rear, each 44x2 inches.

The frames are made from channel section pressed steel; $\frac{3}{16}$x2x4 inch for the 1 ton and ¼x2x4 inch for the 1½ ton. The gusset plates are ¼x6 inch. All frame riveting is done hot. The wheel base is 102 inches for the 1 ton and 127 inches for the 1½ ton truck.



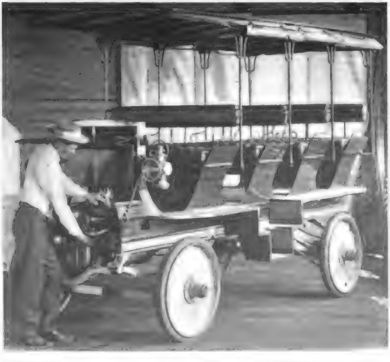
THE STEERING GEAR.

Steering is by a spur pinion and internal sector, fully enclosed in a well supported oil tight case. Eccentric bushings provide means of adjusting for wear.

Three brakes are provided, viz., a contracting brake at the rear of the change gear, and expanding brakes in the rear wheel drums. These drums, by the way, are provided with pressed steel liners which can be cheaply replaced when worn out. The hub brakes are expanded by a wedge which is pressed between two rollers. All brake linkage, steering connections and similar parts have hardened steel bushings and can be rebushed at a very small expense.

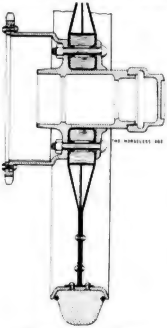
The spark and throttle are controlled by levers under the steering wheel. Low speed, reverse and the propeller shaft brake are controlled by pedals. Pushing the hand lever forward throws in the high speed; moving it back applies the hub brakes.

Any style of body which the purchaser wishes will be supplied. The method of securing bodies to the frame is novel. By loosening six attachments the body may be slid backward. No part of the chassis is



GRABOWSKY CAR, WITH PASSENGER BODY, SHOWING ACCESSIBILITY OF ENGINE attached to the body, and as it does not have to be lifted it may be removed by one man.

It will be seen from the foregoing that all parts of these trucks are made accessible, and that the details are so designed as to be cheap to replace when worn, little labor being required and the cost of the new part being small. These features account for the novel policy of the company, which consists in putting out their vehicles under a maintenance guarantee. That is, for a certain monthly sum they will keep the vehicle in good running order. This maintenance system is possible only where there are quite a few cars to care for. It will first be inaugurated in Detroit, and shortly after in other cities. The monthly charge per car maintained will of course vary with local conditions.

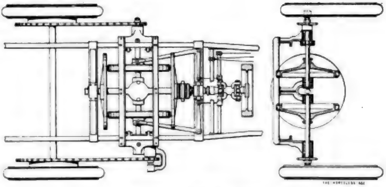


GRABOWSKY REAR WHEEL.

The Plymouth Truck.

The Commercial Motor Truck Company, of Plymouth, Ohio, are at present working on a new convertible truck and omnibus. The firm also makes cars for truck service alone and for passenger service alone. The motor is a four cylinder Continental, rated at 40 horse power. The Wright radiator with 2 inch tubes is used. The engine is supported in four points, and is placed well forward, directly below the driver's seat. The power is transmitted through double friction discs and two driving wheels, one to each rear wheel, there being no differential, so that each rear wheel is at all times receiving all the power from its particular drive wheel.

Since the paper faced wheels are moved equally and simultaneously to or from the centre of the discs, the pressure is at all times the same, and as one disc is used for the forward drive and the other for the reverse, the work is equally divided, so that each wheel and each disc has only half the work to do, thereby prolonging the life of both.



PLYMOUTH FRICTION DRIVE.

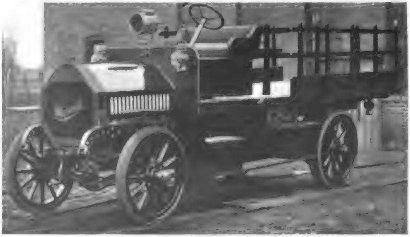
The linkage to operate the discs consists simply of levers and latched pedals, one pedal for the forward movement and another for the reverse. The pedal ratchet teeth are closely spaced and the pedal is simply pushed forward till the friction is sufficient to drive the car. The speed lever is a vertical outside latched lever at the driver's right hand, which traverses the paper faced wheels equally through the intermediary of an armed rocker and two bell cranks.

On cars built for passenger service alone the speed lever and the steering wheel are placed at the extreme right hand, the same as on all pleasure cars, but on the convertible and truck types they are placed in the centre. The friction drive wheels are swung on a swivel joint, allowing for self adjustment on uneven roads.

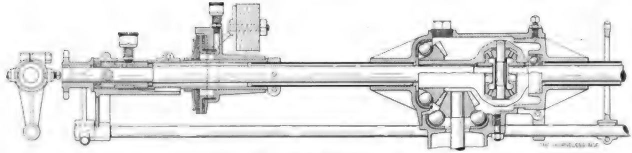
The flanges to which the discs are bolted are forged integral with the drive shaft and are large, lending support to the discs and doing away with keys. The discs are 20 inches in diameter and are geared to give up to 30 miles per hour. The universal joint between the engine and the disc shaft is of the ordinary link and pin type, of extra weight. The end thrust of the driving shaft is taken care of with a large double thrust bearing with three-quarter of an inch balls.

The steering gear is of the screw and nut type. The wheel base is 103 inches, and the wheels are 34 inch front and 36 inch rear, wood or indestructible steel wheels being optional. The brakes are double acting and operated by a pedal through an equalizer. The drums are 2½x16 inches and are attached to a sixty tooth sprocket on the rear wheels. A 1¼ inch Whitney chain with three-quarter inch rollers is used to connect the rear wheel sprockets with twelve tooth sprockets on the drive shaft.

The front axle is a Timken I beam with roller bearing steering pivots. The front wheels have Timken hubs and bearings. The rear axle is a 2½ inch square steel forging, and the rear wheels run on plain roller bearings. The front springs are half elliptic, 38x2½ inch, having nine leaves tongued and grooved. The rear springs are platform, 48x2½ inch, with ten leaves, the cross member being 34 inches long, shackled to the side springs at their rear



PLYMOUTH TRUCK.



Differential Assemble.

F F. As these grooves are left hand, while I I are right hand, it will be seen that moving A toward the clutch discs will revolve G to the right, and that this will cause rolls H to force G against the clutch discs, bringing them together.

In all three clutches the leads of the spiral slots are so arranged that all that is required of the operator is to bring the discs into contact, after which the clutch is self applying.

The spur gear differential has been replaced by a neat bevel gear arrangement, and the entire mount and casing has been redesigned. It will be noted that the bearings for the driving bevels have very large diameter balls, and that these bearings may be adjusted from the outside of the case.

The Brush runabout was designed with the idea of producing a two passenger machine sufficiently powerful and speedy for the average business user, and which could be operated at a minimum cost. The motor is a single cylinder, vertical one, so placed under a hood in front as to be exceptionally accessible. It has a 4 inch bore and the same stroke. Owing to its very light reciprocating parts and to a well designed automatic carburetor placed close to the cylinder this motor is free from vibration, has an unusual range of speed, and is very responsive. The fuel is pumped to an overflow chamber in the carburetor from a gasoline tank hung below the frame.

Hickory is used for both the front and rear axles, the wheel spindles being of the usual construction, firmly secured to the wood.

The springs are helical, permitting large deflection, and their action is dampened by shock absorbers similar to the Truffault-Hartford type, which also serve to keep the axles in alignment. White ash is used for the frame.

The wheel base of this little car is 74 inches, and either 56 or 60 inch tread is furnished. The regular tire equipment is solid rubber on 34 inch wheels, but 28x3 inch pneumatics will be furnished at a slightly higher price.

The new body has a divided seat, and the sides of the foot space are low, so it is easy to get in and out. A large carrying space is provided at the rear. Indeed, there is more room for parcels in this little car than in many more pretentious machines.

The Holsman No. 4 Runabout.

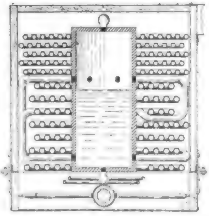
The Holsman Automobile Company, Monadnock Building, Chicago, have brought out a lower priced model ($550) of their well known high wheeled car, known as Model No. 4. The motor is exactly the same as that used in their higher priced cars, and many other features also are identical in the two models, but the construction has been somewhat simplified, and a different line of accessories is furnished with the cheaper car.

The car weighs 800 pounds, and is fitted with a 5½ gallon gasoline tank. The wheel base is 65 inches, and any tread from 56 to 62 inches can be provided to suit different local conditions. The body is 32x64 inches, the seat 19x38 inches on top of the cushion, the space in front of the seat 29x31 inches, and the carrying space in the rear 18x31 inches.

The Walker Semi-Flash Steam Generator.

The accompanying illustration shows a sectional view of a new semi-flash steam generator manufactured by the E. C. Walker Manufacturing Company, of Louisville, Ky., and which they especially recommend for Stanley, Locomobile, Mobile and other steamers now using fire tube boilers, where a non-burn-out boiler having reserve capacity is desired. The Walker semi-flash steam generator is claimed to combine all of the good features of the flash boiler with the only virtue of the fire tube boiler, i. e., reserve capacity. It consists of a central drum or standpipe, to which are connected the water preheating coils, the steam making coils and the superheating coil. The five coils at the top are the water preheating coils. The cold water from the pumps enters the topmost coil and flows down coil by coil until it reaches the fifth coil. By this time it is raised in temperature almost to the boiling point, and in this process these water preheating coils have absorbed a great amount of heat that would otherwise be passed off to the atmosphere and wasted. The waste gases

Holsman No. 4 Runabout.



Walker Semi-Flash Steam Generator.

from this boiler are said to be very low in temperature, about 300° Fahr.

From the fifth coil from the top of the boiler, or the bottommost coil of the water preheating coils, the water is delivered into the bottom of the central drum or standpipe, and from this drum the boiling water enters the six flash steam generating coils, placed one below the other, directly beneath the five water preheating coils. Each of these steam flash generating coils is independently connected to the central standpipe. In shape these coils are volute. The outer terminal of each of these coils is connected to the bottom of the central drum and below the water level, while the inner terminal is carried up and connected to the drum at a point above the level to which the water in the central drum ever rises. By this plan the hot water which the preheating coils deliver into the central drum is forced to rapidly circulate through these coils and is flashed into steam, which is collected in the top of the central drum. From the top of the central drum the steam is drawn off and carried down to the very bottom of the generator and passed through a superheating coil located directly in the fire.

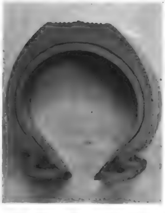
All of the coils are made of seamless steel tubing. The manufacturers of this boiler state that they have repeatedly heated these boilers cherry red and then deliberately pumped cold water into them without the least injury to the boiler. Every boiler is tested to 1,200 pounds cold water pressure. The water preheating coils are made of one-quarter inch seamless tubing, while the flash steam making coils and superheating coils are made of three-eighths inch tubing. Since the coils are wound volute in shape all of the bends are easy curves of large radius, thus affording no resistance to free and rapid circulation. The large calibre of tubing from which the coils are made also contributes toward free circulation.

All of the coils are connected to the central drum by means of right and left couplings, so that the only tool required for taking out a coil and replacing one is an ordinary pipe wrench. These generators are double jacketed, with galvanized steel, insulated with thick asbestos lining between the walls.

The Ruff Reinforced Tire.

F. A. Ruff, 447 High street, Newark, N. J., has applied for a patent on a tire cover, which he claims is practically proof against blowouts. The tire casing is composed of two parts, an inner and an outer one. Certain layers of the fabric are treated before the tire is vulcanized in such a manner as to cause them to separate after the vulcanization has taken place. By having the walls of the tire in two parts, each of moderate thickness, the bending strains are relieved. It is claimed that the outer envelope may be cut entirely through, and still the tire would not blow out as the inner envelope is sufficiently strong to hold the pressure of inflation. It is also claimed that all friction is taken care of on the smooth anti-friction surfaces between the two parts of the cover, and that in consequence there can be no chafing of the inner tube. On account of the layers of fabric, and the fact that when a puncturing instrument strikes the inner layers these will slightly give, the tire is said to be practically puncture proof.

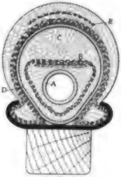
The inventor informs us that he has made a 34x4½ inch tire, which he has used since May 8 on a car weighing 3,300 pounds, and carrying seven passengers. An accident caused by chains having been put on too tight resulted in the rubber being cut through at a number of places, and in one place several layers of fabric also, but the tire was nevertheless run for two weeks after the accident. Then it was retreaded, and it is now expected to last through the season.



The Ruff Reinforced Tire.

The "Tire Life" System of Tire Filling.

The Tire Life Company, of 66 West Forty-third street, New York, are manufacturing the resilient chemical tire filling compound known as "Tire Life." The compound is of a gelatinous nature and is reddish in color, being firm and quite elastic when cooled. The application of the "Tire Life" system to tires is as follows:

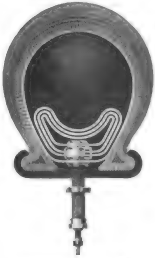


"Tire Life" Filled Tire.

A thick walled rubber tube, varying from three-quarters of an inch upward, is surrounded by a triangular wall of "Tire Life" and the whole then bound about with canvas. This triangular construction is then placed in the inner tube to be treated, and the compound is injected in a warm fluid state into the tube and allowed to set. The result is a very elastic inner tube with a small air tube, this tube being placed so that it is close to the rim, thus protecting it. Owing to the presence of the compound the tire cannot collapse if the air tube becomes deflated, and thus insures against carelessness or oversight of the driver in not pumping up the tube. The compound will not liquefy nor disintegrate, but will retain its form and not leak through a cut in the tire, it is said. A tire with the compound therein weighs from 10 to 25 pounds more than with air. In the figure A is the air tube surrounded by the compound; B, the canvas wrapping of the triangular section; C, the compound filling the inner tube D, and E, the shoe.

The Guaranteed Faultless Auto Tube.

The Guaranteed Faultless Auto Tube Company, 104 West Forty-second street, New York city, have placed on the market what is perhaps most fitly described as a multiple concentric tube. There are four tubes in all, always one within the other, and each tube is connected to a valve with several outlets at its inner end. Ordinarily only the outermost tube is inflated. Should this become punctured the valve is turned one notch to the left and the pump applied, when the second tube is inflated. Should this also become punctured the third tube can be inflated, and so on. The cut shows the arrangement plainly. Such a tube should be especially valuable on a long tour, as it would seem to eliminate all chance of delay from punctures.



Faultless Auto Tube

COMMUNICATIONS

Overhead Valve Gear versus T Motors.

Editor Horseless Age:

For some time the writer has been giving the matter of cylinder design on four cylinder motors some study, but theory and practice do not seem to be running hand in hand.

There is one point especially on which there seems to be considerable doubt, and that is the construction of cylinders with valves in the head and an overhead cam shaft. Of course, the overhead cam shaft is simple enough, and there is no reason why this should cause any more difficulty in the operation of the valves than is experienced with the cams located in any other place, as this is simply a draughting room proposition.

What prompts me to write you is that my attention has been drawn to the fact that the majority of Grand Prix racers use motors with the valves in the head, namely, Mercedes, Fiat, Clement-Bayard and several others. These well known automobile manufacturers have used this valve in the head construction on their racing motors for some years, but, strangely enough, on their stock cars which they deliver to the public they stick to the T type of construction. Why is this?

If the valve in the head motor is more efficient and more powerful for the same size cylinder, as it would naturally figure out theoretically—and this must be the belief of these manufacturers, or they would not use it for their races—why do they not give the public the benefit of this construction in their stock motors? Or is it that, while the valve in the head construction is more powerful and more efficient, it is subject to ailments which could not be fathomed by the ordinary user of an automobile, and hence it is only serviceable in the hands of an expert driver or mechanic?

It is very simple to figure out that thermodynamically a valve in the head motor is probably 10 per cent. more efficient than the T type construction. What, then, are the drawbacks that preclude its general use, if there are any drawbacks, and especially why this inconsistency on the part of the judges and most celebrated manufacturers in the world, who are using this construction only for their racers and adhere to the T form for public service?

Joseph Griffiths, M. E.

[The first company to adopt the "valve in head" type of motor for racing cars, while retaining the T form of motor for stock cars, was, so far as we are aware, the Fiat Company, of Turin, Italy. Enrico Giovanni, the chief engineer of the Fiat Company, gives the following two reasons against the adoption of the "valve in the head" type of motor for stock cars: "In the first place," he says, "such a motor is less flexible than a T motor with the spark plugs in the inlet chamber, for the reason that with the valves in the head the incoming charge always mingles with the remanent gases in the combustion chamber, and when the engine is throttled down low the charge in the surroundings of the spark terminals is so much diluted as to fail to ignite, while, on the other hand, in a T motor where the spark terminals are located in the inlet valve pocket they are practically always surrounded by pure charge. Consequently the T motor is more flexible than the 'valves in the head' type of motor." This point is no advantage in a racing motor, where the fact that in a hemispherical combustion chamber a pressure ratio of 5.2 before and after explosion respectively is obtainable, as compared with about 4.2 in a T type combustion chamber, is a very important consideration in favor of the "valve in the head" type of motor. The other reason advanced by Signor Enrico against the overhead valve arrangement is that it entails greater mechanical complication, and also that the cooling of the exhaust valves is rendered more difficult.—Ed.]

Long Valve Stem—Square Dry Cells.

Editor Horseless Age:

W. McD. McAllister very correctly points a remedy for the nuisance of the long valve stem: Spend about $100 to accommodate a 25 cent valve stem. If Mr. McAllister will show the use of that long stem I will join him in the detachable tire. I did not take this matter up as a personal matter; if I had not known that it affected over 50 per cent. of those running automobiles I would not have mentioned it.

There are many small matters about automobiles that need weeding out, and the way, as I take it, is to call attention to them.

One other of these is the round dry cell forever working around and breaking connections. I may be recommended to use a storage battery because it is square, but why should not the dry cell be made square, so that it can be set into a box and remain where it is placed? It may cost more to make dry cells square; they would certainly be worth more.

John Gardiner.

Graphite Lubrication.

Editor Horseless Age:

Will you kindly grant me a little space in your valuable journal to state a few facts and conclusions on the use of Oildag in an automobile engine? I believe I am warranted in asking this courtesy because of the general interest that has been aroused on the subject of the employment of graphite as a lubricant, and the many communications we have already received from your readers.

The Acheson Oildag Company make the broad claim that the advantages secured by the use of Oildag as a cylinder lubricant are that it

1. Increases the available power.
2. Prevents pitting of valves, and
3. Reduces oil consumption.

If these three claims be made good it is self evident that Oildag must be of great value to the automobilist, and if that be true I think the user of this product will unquestionably be interested in how these several effects are produced.

I know from my own personal experience, which now amounts to the operation of a Packard "30" automobile, or rather two of them, over a total mileage of approximately 14,000 miles, that the statements are true, and I shall now endeavor to give a short explanation, but in so doing I will have to make some assumptions which may or may not be true.

The increase of available power in the automobile engine as the result of using Oildag is due primarily to an increase in the compression with the cylinders, and this is the result of the filling up of all the irregularities of the metal surfaces of the interior working portions of the cylinder and the piston rings, and giving them a veneer of graphite. This effect is accumulative—a growth—requiring considerable time and the consumption of oil. An automobile having four cylinders with 5 inches bore and 5½ inches stroke has a wearing surface in the cylinders of 345.56 square inches, and if, in filling the irregularities of the wearing surfaces and producing a veneer of graphite on these surfaces, an amount of graphite is used equal to a layer of one-thousandth of an inch over this total area, we would consume in doing this 0.35 of a cubic inch of solid graphite. If the graphite used in accomplishing this result is introduced in the form of molecules suspended in oil, we would expect only part of the total graphite used to become attached and permanently fixed to the metal surfaces, that part which comes into intimate contact with those metal surfaces, and it would scarcely be possible that more than one-fourth of the graphite suspended in the oil would come into this relation; and, assuming that this is correct, we find that the amount of oil, which is carrying as Oildag 0.35 of 1 per cent. of its weight in graphite, which would have to be consumed, and in this process of consumption pass by the piston rings, would be no less than 4.2 gallons, in order that so little as the one one-thousandth of an inch layer of graphite would be fixed to the total area of metal surfaces.

If the engine is using, as suggested by some builders, 1 gallon of oil to every 200 miles covered, this would represent a run of 840 miles. In practice, however, the increase of compression is an accumulative effect, and by the time 4 gallons of oil have been used considerably more than 200 miles to the gallon will be covered. Thus in my own machine—a 1908 Packard 30 which I am now operating—which has now covered 5,000 miles on its own power, the consumption is only 1 gallon for 670 miles of run against the 200 miles as advised by the Packard Motor Car Company, its builders. In the Packard 30, Model 1907, which I operated last year and left in storage in Los Angeles last winter, like effects were obtained, the car having covered a total of over 9,000 miles. Of course, not having had any actual measurements made on a dynamometer, it is not possible to assert absolutely how much increased power these machines are developing, but I believe they would show on a dynamometer not less than 25 per cent. increase over that intended by their manufacturers.

In first introducing Oildag into an automobile engine it is not wise to reduce the oil consumption to what it would be after having run 2,000, 3,000 or 4,000 miles, as, for instance, was done by the chief engineer of one of our large automobile manufacturers, who, before he had used even so much as 10 gallons of oil, reduced his oil feed down to less than one-third that formerly employed, and as a result he had a pitting of his valves and consequently a loss of power, as usually occurs in all automobiles when not using Oildag. If the oil supply had been kept up to a higher point so as to permit of some quantity of the oil and its associated deflocculated graphite getting into the combustion chamber, the graphite on expulsion through the exhaust valves would have become embedded in the metal of the valves and effectually prevented any future pitting. Why, I am unable to say, but such is absolutely the fact.

In using Oildag it is well for the user to reduce his oil feed to the crank case at such rate as will hold the oil level constant to that originally set by the manufacturer, and if this is done he will find, if his experience is similar to mine, that by the time he has covered 5,000 miles he will be using less than one-third of the amount of oil that he did before introducing Oildag.

The statements that I have seen as to the amount of carbon found in the combustion chamber by some of your correspondents are not to be explained by the graphite in Oildag, as I am satisfied that not one user of Oildag, outside of my own case, has used sufficient Oildag in his engine to produce the carbon spoken of. In fact, in many cases the amount used has been so trifling as to really make it look ridiculous. Had they consumed 3 gallons of oil and succeeded in retaining in the cylinders, and, in fact, on the heads of the pistons, the entire graphite content of those 3 gallons, they would have an amount equal to 1 cubic inch distributed over their surfaces, and as the total area of the piston heads would be approximately 80 square inches, there would be a graphite deposit of 0.0125 of an inch in thickness.

As the results of my own experience in an automobile of a high class and the scientific determinations made by Professor Benjamin, dean of the engineering schools of Purdue University, there can no longer be any question as to the future use of a pure graphite as a lubricating body. Our fathers used animal fats to meet the requirements of lubrication; we have used and are now using mineral oils; but it is safe to predict that our children will be employing a solid lubricant in the form of graphite, the oil only acting as a carrying medium to introduce the deflocculated graphite.

Edward G. Acheson.

Concerning the Cause of the Marmon Penalization in the Glidden Tour.

Editor Horseless Age:

On page 121 of your issue of July 22 in the special telegram from Rangeley, Me., the following appears:

"It was stated by the observer on the penalized car that the rear brakes had heated up and bound, and as a result of this the engine was badly overheated."

The trouble was not with the motor, but with the brakes in the left rear wheel. If the observer made the statement to your representative that the motor was badly overheated it was a misstatement, for at no time on the tour did either one of the three Marmon motors become the least bit overheated. In fact we were entirely free from motor trouble until the last day, when a water connection on the motor of Marmon car No. 23 broke, permitting the water to escape and the engine to become heated before the difficulty was discovered. The trouble with car No. 22 entering Rangeley Lakes was entirely with the brakes, as stated, and we regret to see the statement made that the trouble was largely due to an overheated engine, which was not the case.

Nordyke & Marmon Company.

Status of the Two Cycle Scavenging Engine.

Editor Horseless Age:

I would like to have you settle an argument in the columns of your paper as to the relative value of a car equipped with a two cylinder, two cycle engine as compared to one equipped with a four cylinder, four cycle of the same bore and stroke. These two motors develop the same horse power at the same speed, and are equally flexible. The two cycle has the advantage of weighing one-third less, of being valveless, better balanced and more economical in fuel at all loads, and especially at light loads, due to the fact that all burned gases are expelled by a charge of pure air previous to the incoming charge of gas, and the compression remains constant. These refinements of course entail extra cost of manufacture that will amount to about 20 per cent. over the ordinary three port engine, but as regards simplicity it is equal to a three cylinder, three port. Now a manufacturer tells me that a car equipped with this engine would have to be rated in the same class of the two cylinder, two port car. It seems to me it should bring a better price than a four cylinder, four cycle car. Your opinion on this proposition will be highly appreciated.

E. C. Richard.

[We believe it will show the impossibility of giving a definite answer to your question when we state that four cylinder, four cycle runabouts sell all the way from about $600 to about $4,000. It is not so much the type which determines the value of a car as the details of design and construction. We can only say that the four cylinder, four cycle type is very much in public favor, and except for small cars it would be difficult to convince any number of buyers that a two cylinder, two cycle motor was as good. We are somewhat skeptical regarding the greater fuel economy as compared with the four cycle engine; three port, two cycle engines are admitted to be about 10 per cent. less economical in fuel than four cycle engines, and though the scavenging may have a tendency to increase the economy, much of this effect would be counterbalanced by the loss of power required for working the scavenger. We also fail to perceive why the two cycle should be better balanced than the four cycle. We cannot form an opinion of the relative value of the motor simply from the fact that it is a two cylinder, two cycle scavenging engine.—Ed.]

Substitution in the Oil Trade.

Editor Horseless Age:

The evil of substitution is felt in every line. A manufacturer devotes time and brains to develop some article, and then spends money to make his product favorably known. When he achieves success, it is only to find that he has a host of imitators who are ready to trade on his name and reap the harvest that justly belongs to him.

This latter class has no reputation to maintain, and usually markets products of very inferior quality. The tendency to substitution is very great in the oil business. Today the manufacturer of a standard brand finds it almost impossible to protect himself and his customers.

The average automobile owner is largely at the mercy of the dealers in the matter of lubricating oil, because there is no other accessory about which so little can be determined, except by actual test in a car.

Were all lubricating oils sold only by the gallon or five gallon can it would be a comparatively easy matter for the manufacturer to protect himself, and this we have done by adopting a special can with a sealed spout, which insures the consumer that the oil contained is "Panhard oil," and not a substitute on which an unscrupulous dealer can make a larger profit.

Unfortunately much oil is sold in barrel or half barrel lots, and the dealer's word is practically the only assurance the consumer has that he gets what he pays for. Most of the leading brands of cylinder oils retail at approximately the same price, but of late there has been a flood of cheaper oils, and the car owner is the one that gets the worst of it.

Few motorists realize the importance of proper lubrication and the havoc which is wrought by using an inferior lubricant. Many buyers are influenced by the matter of price, without considering quality, or are guided by the advice of a man who is interested in selling the goods on which he makes the greatest profit.

Much has been written recently as to substitution and the tests which a satisfactory cylinder oil should stand. Some of this has entirely missed the point. The tests for the flash point, gravity and viscosity, while interesting to the practical chemist, are unnecessary as far as the motorist himself is concerned. The manufacturer of the several standard grades on the market would be glad to furnish these tests on application.

The determination of the amount of free tarry matter in the oil is the real factor which governs the amount of carbonization to be expected. The catch phrase, "Color Test for Carbon," has even been adopted by some manufacturers, meaning that lightness of color indicates freedom from carbon.

This plausible argument, convincing to the unskilled user, has arisen from the misinterpretation of the word "light" as applied to oils. While it is true that lightness of gravity is of the greatest importance, it is also undeniably true that lightness of gravity and lightness of color are not necessarily correlative.

An almost white oil may be of a much heavier gravity and contain more free carbon than another oil many shades darker in color. Filtration, while removing the color, may if carried to excess remove the lubricating properties of the oil, while bleaching with acid, though having no effect on the lubricating qualities of the oil, may leave an acid residue, injurious to cylinders and pistons.

The consumer should therefore be guided by the reputation of the manufacturer, and not be influenced by a few cents a gallon saved, which may mean many dollars spent later for repairs.

It often occurs that a car owner will condemn a certain brand of oil which another motorist finds entirely satisfactory. This is because different motors require different grades of oil.

H. E. Haws.

Change Gears for Bad Roads.

Editor Horseless Age:

I have been more or less interested in automobiles since the World's Fair at St. Louis, and while there have been big improvements in many of the different makes, I don't consider that there is a good, reliable, easily controlled system for changing speed on any car. The friction drive idea is all right for good roads, but is not worth anything in our rough, sandy, muddy and hilly country. We must have something more positive than friction; at the same time we need a speed control through the gear box by which we can go from zero to the maximum without a jar. If you know of anything on the market I would be glad to see it through your paper. You will readily understand that anyone driving a car on good roads does not need this arrangement nearly as much as we who are in the country. I am sure you have quite a few writers who know what the roads are between Suffolk and Richmond, Va. Out of 3,600 miles we have run less than 100 miles was better than the road between Suffolk, Va., and Richmond, Va.

G. B. Robertson.

[Of the automobile speed changing gears now on the market all those which are continually variable, or, in other words, give an infinite number of gear variations, depend upon friction in some form. At one time what is known as the roller ratchet and variable crank device was exploited to quite an extent, but it seems to have proven impracticable, as it has been lost from sight in recent years. All positive change gears give only a small number of possible variations of gear (up to four forward and one reverse), but for heavy road conditions some sort of positive driving gear is undoubtedly to be preferred to all others.—Ed.]

Business Opportunity.

Editor Horseless Age:

We have an inquiry for an automobile chassis without the seats and motor, which our client has already bought. The motor is a Beilfuss 20 horse power, which is to be used with the chassis. The idea of not buying the complete automobile is that our customer wants to build one for himself suitable for rough roads, as most roads are in Mexico. If you can offer anything as stated in these lines kindly favor us with your reply.

S., N. & Co.

[Any replies will be forwarded.—Ed.]

New Highway Through New Jersey Meadows.

The long discussed plan of a highway from Jersey City to Newark through the Hackensack meadows seems now to be nearing realization. Counsel for the Hudson County (N. J.) freeholders announces that the estimated cost is $1,000,000, and that the plans are so far advanced that contracts can be let next fall. The Public Service Company of New Jersey will lay tracks for its street cars on the road, and in payment for this privilege will bear one-quarter of the cost of construction. Essex County pays five-eighths of the remainder and Hudson County three-eighths.

The new road will follow the line of the Newark plank road, which is now in such bad repair that automobiles wishing to reach Newark from Jersey City or vice versa usually take a very much longer roundabout route. It is thought that the construction of this road will cause many factories to be located in the Hackensack meadows, and that the taxes that will be derived from these new industries will quickly repay the counties their original outlays for the road.

Convict Road Building to Be Continued in Colorado.

Owing to the fact that the funds appropriated by the Colorado Legislature for the construction of the State highway by convict labor have been exhausted, it looked for a while as though the work would be discontinued and the convicts returned to the penitentiary at Canon City. This eventuality has now been happily averted by Acting Governor Harper and Attorney General Dixon assuming the responsibility for any deficit that may be incurred. The Trinidad (Col.) Chamber of Commerce, and Arthur C. Jackson, president of the National Good Roads Congress, share in the credit for the continuance of the work.

New Mexico will shortly begin work on a State highway to connect with the Colorado State highway at the line, and run to Raton, a distance of 9 miles. Governor George Curry, of New Mexico, visited the place recently, and on his return to Santa Fé announced that eighty-four prisoners would be sent to Colfax County at once.

"Sounding" the American Market for Light Cars.

That European motor builders recognize the coming demand for small light cars in America is evident from the sudden appearance of a number of light cars of French and Italian make upon the streets of New York. Formerly the cars imported all ranged in horse power between 28 and 70, and the presence of 8 and 12 horse power cars of 1907 and 1908 models indicates that foreign builders are recognizing that the large imported car has but a very limited market, and these light cars are brought over as "feelers." It is very questionable, however, with the large number of popular priced cars to be turned out by Ford, Maxwell, Buick, etc., whether foreign builders will have any market at all, considering the duty, shipping charges and other items which must be added to the cost price. It is rumored that a well known New York politician, who has lately taken up the taxicab, is backing this move on the part of European motor builders.

Correction.

In the caption of the cut of the Rapid truck which appeared in our Glidden Tour report on page 106 of our issue of July 22 an error was made in stating the make of tires and air bottles carried. The truck carried Goodyear products, and the service of air bottles was so much appreciated by the contestants that those who participated in the Hower run-off insisted on having air bottles shipped ahead to every night stopping place.

LEGISLATIVE and LEGAL

Liability of an Owner for a Chauffeur's Acts.

By Xenophon P. Huddy, LL. B.

The owner of an automobile is not necessarily liable for an injury committed by his chauffeur while driving the automobile with the owner's consent, if the chauffeur was driving at the time for his own pleasure or business. This is what the Appellate Division of the Supreme Court of New York has just decided, and decided correctly, in the case of Cunningham vs. Castle, reported in the New York *Law Journal* of Monday, July 20, 1908. The owner had loaned the chauffeur his automobile for a certain length of time, during which time an injury was inflicted on the public highways. The opinion of the court is based upon the theory that there was no relationship of master and servant when the injury was inflicted. The consent to use the machine did not make the owner liable. The case was the same as any other where a person loans one vehicle to another. Although the court in this case did not cite the authorities, there are, nevertheless, two decisions in this country which hold that the owner of an automobile cannot be held legally responsible for the acts of a borrower.

Just exactly under what circumstances an owner is responsible for the acts of his chauffeur, and when authority, or at least the presumed relation of master and servant, does or does not exist is a question not often easy to decide.

In the case mentioned Judge Houghton dissented. The facts in this case as disclosed by the evidence were as follows:

The plaintiff called the defendant as a witness, who testified: "I owned a Mercedes automobile and employed one Harry Boes as a chauffeur at that time. I had been out in the automobile the day before this [accident] occurred. After my return the automobile was left in the possession of Harry Boes, my chauffeur. At that time he asked me if I would loan him the machine to go uptown on some business for himself. I told him yes, but to hurry back; only to be gone a short while; come right back. That was all that took place between the chauffeur and myself as to loaning him the machine. It was about 11 o'clock at night that I returned to my apartment and loaned Harry Boes the machine."

Boes testified: "I was Mr. Castle's chauffeur, and had been in his employment at the time of this accident to the best of my knowledge about two and a half or three months. On the night before this injury happened, which was Sunday night, previous to the time when I went out when the accident happened, I had been out with Mr. Castle. I left him at the Pierrepont Apartment in Thirty-second street, right near Broadway. On leaving him I spoke to him about borrowing the machine or as to letting me have the machine for purposes of my own and my own pleasure. I said: 'Mr. Castle, may I use your car for an hour or two? I just want to take a run up to Harlem and be back in an hour or an hour and a half or two hours.' Then he said: 'All right, be careful; if anything happens be sure to notify me right away.' That was his consent. I took it out for purposes of my own entirely, for my own pleasure, and not on any business of Mr. Castle's. It was about ten minutes to 11 that I asked Mr. Castle for permission to take it out."

The chauffeur then went to Shanley's, where he was joined by two women and a friend. He took them uptown, and was coming down Eighth avenue from 150th street when he struck the plaintiff at Eighty-first street and Central Park West, about half past 1 in the morning.

In considering these facts the court lays down the following propositions of law which are controlling in similar cases:

"From the foregoing cases we may deduce the following rules as thoroughly established: First, that a master is responsible for the negligence of his servant when engaged about the master's business, and within the scope of his employment; second, that a master is not responsible for the negligence of his general servant if at the time of the negligence he has become *ad hoc* the servant of another, and engaged in the business of that other and under his direction and control; third, that the master is not responsible for the negligence of his general servant if the negligent act was committed by the servant not in the prosecution of the master's business but in the course of some private enterprise of his own; fourth, that even if in the prosecution of that private enterprise the servant uses the instrumentalities of the master for his own purposes, without the knowledge and consent of the master, the master is not responsible."

In response to the contention that the automobile is a dangerous instrumentality, and that having been entrusted to the chauffeur the master is liable because of its dangerous character, the court said:

"The automobile is not a dangerous device. It is an ordinary vehicle of pleasure and business. It is no more dangerous than a team of horses and a carriage, or a gun, or a sailboat, or a motor launch. If a gamekeeper had borrowed his master's gun and had gone from the estate on a hunting expedition of his own and had negligently shot a man, would the master be responsible because he was using that instrument if carelessly used, the gun? I do not think that the question of ignorance or consent of the master has any bearing whatever upon his liability. The fact that the servant has used the horses or the automobile without his consent has probative force upon the proposition as to whether or not the servant was engaged in the master's business and was acting within the scope of his employment."

Judge Houghton in the dissenting opinion argues that: "While a powerful automobile may not, strictly speaking, be deemed a dangerous instrument, it may become so if recklessly driven. They are so dangerous that the Legislature has prescribed that their ownership must be registered, and the driver licensed, and that speed in different localities must be regulated. If a railroad official should loan a locomotive to one of the company's engineers for the purpose of hurriedly visiting a distant locality it could hardly be said that the engineer alone would be liable for injuries inflicted upon third persons. I appreciate that the case is on the border line, but it seems to me that the chauffeur was engaged in the business of the master."

The great importance of the above decision rests upon the fact that consent to the use of the car is immaterial.

See also Sawyer vs. Mitchell, 35 Supr. Ct. (Pa.), 69, holding that the owner is not liable where the chauffeur is driving for his own pleasure.

Recent Decisions.

UNLAWFUL OPERATION WITHOUT SPEEDING.

The fact that excessive speed was not maintained does not preclude dangerous operation nor mitigate a refusal to stop the machine when signalled to do so.—Walkup vs. Beebe, 116 N. Y. Rep. 321.

DUTY TO STOP ON ABSENCE OF SIGNAL.

The automobile law of Iowa, which requires an automobilist to stop immediately when signalled by one driving a restive horse, does not relieve an automobilist from the duty of stopping without such signal on seeing that one is being imperiled by his horse taking fright.—Walkup vs. Beebe, 116 N. Y. Rep. 321.

FRIGHTENING HORSES.

In an action against an automobilist for negligently frightening a horse, resulting in the plaintiff's injury, the plaintiff can show as part of the transaction that, after the defendant had passed the place of the accident, she heard one near by call to him three times to help the plaintiff, as tending to show that the defendant had not attempted to stop his machine as he approached the plaintiff, and that he did not consider her to have been in danger or to have been seriously injured.—Walkup vs. Beebe, 116 N. Y. Rep. 321.

PENNSYLVANIA LAW APPLIES ONLY TO OPERATORS.

The Pennsylvania automobile act of April 19, 1905, P. L. 217, applies to the operator of an automobile and not to the owner.—Comm. vs. David, 33 Penn. Co. Ct. Rep. 12.

IDENTIFICATION OF OFFENDER.

There can be no conviction for violating the speed law where the only evidence to connect the defendant with the case is the fact that according to the automobile register a machine having the same number as the one used in violation of the law belongs to the defendant.—Scranton vs. Hawley, 9 Lack. (Pa.) 65.

PLEADING.

In an action for negligence of the defendant's chauffeur in driving an automobile a statement is sufficient which avers that the approach of the automobile frightened the plaintiff's horses, which fact the chauffeur must have seen, yet he continued to drive toward the horses at a high rate of speed, causing them to break from the plaintiff's control and run away.—Rupp vs. Snyder Automobile Company, 21 York (Pa.), 177.

Rushmore Injunctions Sustained.

The Rushmore Dynamo Works announce that the appeal taken by the Manhattan Screw and Stamping Works from the decision rendered against them in the United States Circuit Court, Southern District of New York, last spring in the suit brought against them for injunction by the Rushmore Dynamo Works has been decided in favor of the Rushmore concern. This decision sustains the original order of injunction and appears to settle definitely the right of the Rushmore Dynamo Works to hold its flare front design exclusive. Following the decision just referred to, an order of injunction will immediately issue against the Badger Brass Manufacturing Company, of New York, against whom decision was rendered in the same court last May, but in which the signing of the actual order of injunction was suspended pending the decision of the Manhattan Screw and Stamping Works appeal.

Legal Notes.

A suit for $15,000 damages has been brought by the receiver for the Muncie Auto Parts Company, Muncie, Ind., against the Bartholomew Company, of Peoria, Ill. The claim is said to be several years old.

Assistant State Attorney Barbour, of Chicago, is endeavoring to have the grand jury indict Policeman Moore, of Glencoe, who recently shot at an automobile and injured one of the occupants for assault with intent to kill.

The case brought by the White Company to test the validity of the New Jersey automobile law has been set down for a final hearing on September 4, 1908, at which time the objections against the law raised by Richard H. Johnston will be thoroughly considered.

There promises to be a number of petty suits against the Prest-O-Lite Company because of the recent explosion at its Indianapolis plant. Persons living two or three squares away allege that they were injured by the force of the explosion throwing them to the floor. Last week Homer Watson filed suit for $200 saying a transom was blown out of his home, striking him on the head. Three suits for $10,000 of a similar nature were filed a few days ago.

Deputy Chief Wescoat, of the Atlantic City, N. J., building department, recommends the passage of regulation prohibiting the selling of gasoline to all persons except those having a permit issued by the building department.

Commissioner of Motor Vehicles J. B. R. Smith, of New Jersey, has revoked the licenses of Clarence Gritman and George R. Vreeland, both of whom recently caused accidents while driving motor vehicles on New Jersey roads, and sped away without ascertaining the extent of the injury done by them.

Anti-Smoking Park Ordinance Enforced in New York.

On August 1 the following ordinance of the New York Park Board went into effect:

"Whereas, The emission of smoke and gas in large volume from the exhaust of motor vehicles has become a nuisance in the parks and parkways of this city, the park board does hereby establish the following rule and regulation for the comfort, pleasure and safety of the people in the parks and parkways of this city, which shall be known as Section XXXIII of the General Park Ordinances, Rules and Regulations, Chapter 16 of the Code of Ordinances of the city of New York, to take effect August 1, 1908:

"No person shall be permitted to run a motor vehicle in the parks or parkways of this city under the jurisdiction of the department of parks, which emits from the exhaust or muffler thereof offensive quantities of smoke or gas, or disagreeable odors."

On the first day the new ordinance was in effect no less than seventeen arrests for excessive emission of smoke were made in Central Park, although policemen stood watch at the main entrances to the park, and turned away all cars that seemed to give out much smoke. Eight of the arrested drivers who were brought before Magistrate Moss in the Yorkville Court were discharged with a reprimand. The others were arrested after the police courts had closed for the day.

Imports and Exports for June.

During June last there were imported seventy-one foreign automobiles, valued at $153,521, and parts valued at $61,027, as compared with sixty-three automobiles, valued at $201,980, and parts valued at $84,020, in June, 1907. Of the seventy-one cars imported last June forty-four came from France, twenty-three from Italy, two from Germany and one from the United Kingdom.

During the twelve months ending with June, 1908, there were imported 1,045 automobiles, valued at $2,500,134, and parts valued at $490,905. The following table gives a comparison of the imports for the last three fiscal years, respectively, and also the respective shares in these imports of the different countries:

IMPORTS.	1906.		1907.		1908.	
Imported from—	No.	Value.	No.	Value.	No.	Value.
United Kingdom	77	$314,193	103	$347,758	65	$199,377
France	820	2,806,898	841	2,940,387	793	1,775,589
Germany	86	360,252	61	252,062	32	124,747
Italy	91	270,794	144	420,154	132	331,365
Other countries	32	92,368	27	80,664	23	69,058
Total	1,106	3,844,505	1,176	4,041,025	1,045	2,500,134
Parts of	....	400,514	....	801,254	....	490,905

During June last there were exported from this country 271 automobiles, valued at $648,267, and parts valued at $62,455, as compared with 295 automobiles, valued at $669,570, and parts valued at $62,484, during June, 1907. The total value of automobile exports for last June was, therefore, $710,722, while for June, 1907, it was $732,054. During the fiscal year which ended with June, 1908, there were exported 2,477 cars, valued at $4,656,991, and parts valued at $620,856, making a total value of exports for the year of $5,277,847, as compared with 2,862 automobiles, valued at $4,890,886, and parts valued at $611,355, a total of $5,502,241, during the previous fiscal year. The following table shows the distribution of our automobile exports by countries during the past three fiscal years respectively:

EXPORTS.	1906.	1907.	1908.
United Kingdom	948,005	$1,530,304	$1,706,500
France	282,317	512,524	602,365
Germany	99,732	155,623	178,914
Italy	265,070	254,694	247,357
Other Europe	199,580	288,921	186,968
British North America	618,438	1,175,334	951,386
Mexico	422,626	812,610	401,617
West Indies and Bermuda	241,353	207,390	250,201
South America	96,174	204,211	220,644
British East Indies	37,644	34,608	29,510
British Australasia	160,944	207,715	155,782
Other Asia and Oceania	59,335	97,050	115,938
Africa	28,529	8,874	7,420
Other countries	14,370	12,354	23,287

Pierce Car Wins Hower Trophy.

The two Stoddard-Daytons in the Hower contest run off withdrew at Pittsburg on Wednesday morning, July 29, leaving the two Pierce contestants the only ones in the run off. One of the Stoddard-Daytons had a broken frame and the other one suffered from troubles which are not specified in the reports. The two Pierce cars, driven by Edward Rettling and John Williams, respectively, finished the run from Pittsburg to Bedford Springs in good shape, which is probably the most difficult stage of the entire Glidden route. On the next morning, according to agreement, only Rettling checked out, thus winning the Hower trophy for Charles Clifton, of the George N. Pierce Company, in whose name the car was entered.

New York Dealers Organize to Control Racing.

At a meeting of the New York dealers held on July 30 eight of them formed an association with the avowed objects of seeing to it that races are properly conducted, that their expenses are minimized, and that conditions in general are improved. The eight members of the association are Harry A. Lozier, of the Lozier Company; Harry S. Houpt, of the E. R. Thomas Motor Company; C. G. Wyckoff, of Wyckoff, Church & Partridge; Walter Allen, of the Allen-Kingston Company; E. R. Hollander, of the Fiat Automobile Company; Paul La Croix, of the Renault Agency; Percy Owen, of the Bianchi Agency, and W. D. Hamilton, of the Isotta Agency. The members of the organization agree not to enter their cars in any races that are not approved by the majority of their association. The association has no connection with either the A. A. A. or the A. C. A., nor with any of the trade bodies. The members feel that they pay for the races in which they take part, and that they are at liberty to conduct the events in their own way, without the dictation of outsiders.

Franklin Salesmen's Convention.

Salesmen of the H. H. Franklin Manufacturing Company from all over the country met in Syracuse last week to discuss the models and policies of the company for the coming business year. This was the third annual gathering of Franklin salesmen, and it wound up with an automobile excursion to Glen Haven in the company's Glidden Tour cars. In speaking of the conference Mr. Franklin said that all of the salesmen predicted a great improvement in business conditions for 1909. This was particularly true in the West, where crops were abundant and where the automobile buyers are showing a tendency to purchase a better grade of machine than heretofore. It was announced that this season the company would add taxicabs and commercial cars to its output.

The company has added three new salesmen to its force this year. Territory has been assigned to the various salesmen for 1909 as follows: W. J. Reynolds, Southwest, Texas and Oklahoma; J. F. McLain, Pacific Coast; J. E. Doane, Syracuse; A. D. Caldwell, Michigan, Illinois, Indiana and Wisconsin; W. S. Jewell, manager New York branch, and A. B. Henley, manager Boston branch Franklin Automobile Company; R. H. La Porte, New England; L. E. Hoffman, the South; Geo. Ostendorf, western New York, Pennsylvania and Ohio; F. H. Sanders, Minnesota and North and South Dakota; Geo. E. Messer, Iowa, Nebraska, Kansas and Missouri.

The salesmen made a trip of inspection to the works of the Crucible Steel Company's plant, which supplies the Franklin Company with some of its raw materials. A complete history of the company covering a period of fourteen years was given by Vice President G. H. Stilwell. The 1909 models were explained by Chief Engineer John Wilkinson, and mechanical and engineering features were also covered by Superintendent F. J. Haynes and mechanical experts of the company. Last year there were 145 dealers selling Franklin automobiles, and it is expected that before the first of next January the number will be increased to over 200.

Maxwell-Buick Merger Plans.

The plans of the big combination in the automobile industry, about which rumors have been afloat for some time, are taking on definite shape. The name of the combine is to be the International Motor Company, and the capitalization will be $25,000,000, according to the plans, of which $14,000,000 will be preferred, and $11,000,000 common, stock. It is understood that an issue of $900,000 preferred stock will be put out first, this amount having been underwritten by several members of the firm of J. P. Morgan & Co., including Mr. Satterlee and W. P. Hamilton, both sons-in-law of Mr. Morgan. Although only the Maxwell and Buick firms will enter the combine at first, it is intended to bring a number of other manufacturing concerns in later. In the preliminary prospectus it is estimated that 13,000 cars can be produced during the current year, and that the capacity can next year be increased to 15,000. It is stated that options have been obtained on a number of properties, including a number of plants furnishing raw materials for automobiles, and that if the plans go through the concern will be the biggest of its kind in the world.

It is estimated that if the above mentioned output is produced the company will be able to earn 7 per cent. on the preferred stock, and not less than 25 per cent. on the common stock. According to the plans the holders of the preferred stock of the Maxwell-Briscoe Motor Company, of which stock $[illegible] have been issued, are to receive for each share of their present holdings two shares of preferred stock and one of common stock of the combine. There is also $660,000 Maxwell-Briscoe common stock outstanding. It is understood that the preferred stock of the International Motor Company is to be offered at 97½, and that one share of common stock is to be given with each share of preferred stock.

The Brush Efficiency Run Under Way.

The Brush runabouts and package cart started upon their trips to the principal cities of the country about 1 o'clock last Saturday afternoon. The start was made from the Hotel Tuller, Detroit, following a luncheon served to the drivers, observers, members of the factory force, and a few guests. The runabouts were fitted with the new style bodies, painted "in the lead" only. A noticeable novelty in their equipment was the use of a waterproof boot at the rear. This extended from the top of the seat back to the rear of the body, and served the double purpose of protecting the luggage and furnishing a groundwork for signs indicating the starting point and destination of the car and its make.

Thomas Car Wins New York-Paris Race.

The Thomas car in the New York-Paris race reached Paris at 8 p. m. on July 30, four days after the German Protos car, but as it gained a lead of thirty days over the Protos in the United States, and both cars started at about the same time on the trip through Asia and Europe, it secured first place. The occupants of the car when it arrived in Paris were George Shuster, the driver; George Miller, the mechanic; Hans Hansen, the Siberian traveler, and George MacAdam, a newspaper correspondent. The start from New York was made on February 12, consequently the car was 170 days en route. The trip across the United States was made in forty-two days, while the trip from Vladivostok to Paris occupied seventy days.

Pope Reorganization Plans.

A committee of holders of first and second preferred stock of the Pope Manufacturing Company has been appointed to prepare plans for the reorganization of the company. The committee consists of Harry Bronner, Frederick H. Ecker, August Heckscher, and Henry V. Poor, 54 Wall street, New York city, as secretary. The formation of a new company with a capitalization of $2,500,000 preferred and $4,000,000 common stock has practically been decided upon to take over all of the assets of the old company. Under the plans prepared the stock of the new company will be placed in the hands of voting trustees until August 1, 1911. In order to provide working capital it is proposed to issue $800,000 of 6 per cent. notes, dated August 1, which will be taken over by a syndicate. It is planned to operate only the factories at Hartford, Conn., and at Westfield, Mass.; the other plants are to be sold.

Business Troubles.

A court order has been issued authorizing the receiver for the Brock Creek Auto and Wagon Works, Washington, D. C., to sell the property and holdings of the company in order to pay off the indebtedness.

G. H. H. Emery has been appointed receiver for the Royal Garage Company, 1010 Morton street, Baltimore, Md. The application for receivership was made by Jesse L. Cassard, Jr., one of the partners in the firm.

A petition in bankruptcy has been filed against the Aurora Motor Works, Aurora, Ill. The liabilities are said to amount to $30,000, while the assets are only about $10,000. The petitioning creditors are a tire company and a New York automobile paper. The factory was closed some time ago on behalf of employees who have wage claims of $900 against the company.

Club Notes.

The Tampa (Fla.) A. C. was permanently organized at a meeting held on July 28.

The Niagara Falls (N. Y.) A. C. has decided to make application for membership in the A. A. A.

The Jefferson City (Mo.) A. C. held a meeting on July 24, and adopted a resolution to fight the $5 automobile license ordinance.

The Chicago Motor Club has once more postponed its 1,000 miles reliability trial, this time to October 6-9. The route remains unchanged.

An automobile club has been formed at Austin, Minn., with the following officers: Dr. Daigneau, president; J. L. Mitchell, vice president, and A. M. Lewis, secretary.

The Columbus (Ohio) A. C. at a recent meeting decided to bring a test case to determine whether the city has a right to collect an automobile license fee in addition to the State license fee, unless the city officials recede from their present position.

An automobile club with an initial membership of about twenty was formed at Hamburg, Pa., last week. Officers have been elected as follows: W. E. Schmick, president; M. L. Buchman, vice president; F. Y. Bowman, secretary, and M. E. Seidel, treasurer.

The Springfield (Mass.) A. C. will hold a hill climb on Wilbraham hill on September 11. The course is one mile long, nearly straight, and with a total rise of 453.1 feet, equal to an average grade of 8.58 per cent., the maximum grade being no less than 22.1 per cent.

The Oakland (Cal.) Motorcycle Club was formed at a recent meeting, and the following temporary officers were elected: George Faulkner, president; George R. Ainsworth, treasurer, and A. K. Fitzsimmons, secretary. The charter will be kept open for sixty days, by which time it is expected the roll will include 100 names. The initiation fee is $1, and the monthly dues are 50 cents.

Commercial Notes.

The American Hotel, Hutchinson, Minn., has added an automobile to its livery.

C. O. Christianson, Greenbush, Minn., and J. C. Parr, of Argyle, have started automobile liveries.

Harry D. Miller, of Bridgeport, Conn., contemplates the introduction of a taxicab service in that city, using Renault cabs.

An automobile service between Oroville, Riverside and Brewster, Wash., was started on July 20 by C. J. Johnston, of Oroville.

It is reported that the American Express Company has purchased forty taxicabs to place in service at the Grand Central Station, New York city, and at the ferry stations.

The Milwaukee board of fire underwriters is planning to replace its horse drawn insurance fire patrol wagons with motor cars. It is believed that the cost could be reduced more than one-half.

W. H. Mahaffey & Son have introduced a motor parcel delivery service between Pittsburg and Tarentum, Pa., stops being made at all towns between these two points. The office of the firm is at 317 Liberty street, Pittsburg.

It is reported that if the experiments now being made by the Post Office in Washington in the collection of mail by automobiles prove successful postal automobiles will probably be introduced in all cities having first class post offices.

The Atlas Motor Car Company, of Springfield, Mass., have recently delivered twenty taxicabs to the New York Transportation Company. The latter company has had one of these cabs on trial for some months, and has placed an order for 100 of them.

An automobile service has been inaugurated by the Dallas (Tex.) Motor Car and Transit Company, J. A. Bergfeld president, between Sangers and the Monarch and Fakes addition. Two large sightseeing cars are used, one leaving each terminal at twenty minutes intervals.

About 100 citizens of Bismarck, a suburb of Tacoma, Wash., met on July 20 and formed the Bismarck Improvement Club, with the object of securing a street car extension, and until that can be obtained an automobile passenger service. One or more motor buses will be leased for the purpose. C. H. Miller is president of the club.

The Thompson Automobile Company, of Plainfield, N. J., which has been operating a motor stage line between Plainfield and Boynton Beach, has decided to extend that line through Metuchen and Plainfield. The trip leads from Plainfield to South Plainfield, to Perth Amboy, to Boynton. A twelve passenger car is used, and two trips are made daily.

The Greensburg, Napoleon and Osgood Rapid Transit Company has been organized in Indiana by Frank J. Grow, William J. Kelley, Milton C. Roemer, Jacob A. Meyers, Charles Brooks and G. R. Kemper for the purpose of operating an automobile stage line between those points. A twelve passenger Rapid bus has been purchased and placed in operation.

A company has recently been incorporated with the object of operating an automobile line between Spencerville and Ada, Ohio, and the opening of the service took place last Saturday. The officers of the company are A. E. Henry, Spencerville, president; J. P. King, Lima, vice president, and R. R. Kennedy, Spencerville, secretary and treasurer.

Another motor vehicle service is proposed for Council Bluffs, Ia., the line to start at the Goodrich Hotel at Eighth street and Broadway, to lead north on Eighth street, thence by way of the Mynster Springs road to Harrison street, and back to the hotel. It is asserted that such a service would not only be a great accommodation to the population of this district, but would furnish a good opportunity for sightseeing trips by visitors.

A company of which W. A. Ruhl, formerly cashier of the National Bank of Commerce of Kansas City, Mo., is the promoter, is being organized in that city for the purpose of installing a taximeter cab service there. It has been announced that the proposed company has secured nearly sufficient capital to begin the undertaking. It is the intention to put about thirty cars in service as quickly as possible, a large part of them for use at the railway stations.

Vanderbilt Cup Race Dates and Route.

The A. A. A. has secured permission from the board of supervisors of Nassau County, Long Island, to hold the elimination trials for the race on October 10, and the race for the cup on October 24. The A. A. A. is required to give a bond of $25,000 to repair any damage done to the roads, and it further agrees to guard the course with 1,200 men, in addition to the sheriff's deputies. The course as laid out is said to be very fast, it being fairly level with macadam roads. It will be over a stretch of 11 miles of the new Motor Parkway, which will be completed in time for the elimination trials, starting at Whaleneck avenue, Westbury, and running east to Bethpage. The course then turns north over the Round Swamp road to the Plainview road, thence to the Hicksville and Woodbury road to Woodbury. Here, at what is known as the "Flatiron" turn, it joins the Jericho turnpike and proceeds west to the Old Westbury road, where it turns south through Westbury over Whaleneck line to the Motor Parkway. The distance around the course is 25.4 miles, with eight sharp turns and one grade crossing. It is proposed to erect a large steel grand stand, accommodating about 10,000 people, at the centre of the completed stretch of the Motor Parkway, from which the race can be watched over the entire 11 miles of this stretch.

MINOR MENTION

C. F. Johnson, city engineer of Stephen, Minn., has built a motor runabout and given it a trial.

The address of the Buffalo representatives for the Swinehart Clincher Tire and Rubber Company has been changed to Buffalo Wagon Works, 113 Carroll street.

An auction sale of automobiles was held in Rochester, N. Y., on July 28, but the bidding was so slow that after four cars had been sold the auctioneer called the sale off.

The personal effects of the Earl Motor Car Company, of Kenosha, Wis., bankrupt, were sold for $70 to satisfy an execution secured by a Cincinnati screw manufacturing company.

The Driggs-Seabury Ordnance Corporation, of Sharon, Pa., has awarded a contract for the erection of a $50,000 building for the manufacture of automobile parts and pressed steel shapes.

The Atlas Motor Car Company, Springfield, Mass., are erecting a new three story brick and frame addition to their factory in Birnie avenue, which will practically double their present capacity.

The H. H. Babcock Buggy Company, of Watertown, N. Y., are erecting a new building, 80x25 feet, at the completion of which they will begin to manufacture automobile engines and running gears.

It is reported that the Knox Automobile Company, Springfield, Mass., will install considerable new machinery and employ several hundred additional men in a few days when its new models are completed.

Deibler & Russell, of Berlin, Wis., assemblers and manufacturers of small parts, are forming a stock company to build cars. The Rutenber engines will be used. Contracts for small parts have been closed in Detroit.

The Phillip Gross Hardware Company, of Milwaukee, one of the largest retail concerns in the Northwest, has added a line of motor supplies, establishing an "auto supply department" under the management of L. Connie, an experienced supply man.

The Winton Motor Carriage Company will next season market two models, their present Six-Teen Six, which provided with a five passenger body will sell at $3,000, and a six cylinder 60 horse power car, with seven passenger body, to sell at $4,500.

The National Metal Trades Association has taken a hand in the labor troubles at the plant of the Badger Brass Manufacturing Company at Kenosha, Wis. Robert Wuest, of Cincinnati, is on the ground, and expects to have all differences equitably settled soon.

The Waldron Manufacturing Runabout Company is being promoted in Waldron, a village near Kankakee, Ill., one of the parties interested being E. O. Parker. It is intended to erect a 50x100 foot building and to manufacture runabouts and light delivery wagons, to sell at $500 each.

We learn that the Rushmore Dynamo Works have just closed a contract to furnish the Maxwell-Briscoe Motor Company complete lighting equipment for 5,000 Maxwell cars for the season of 1909. The consideration amounts to not much less than $100,000.

The Englebert tire made in Belgium is now represented in this country by the Wm. Sanford Company, of Philadelphia. The principal features of this tire are heavy, tough beads, thick walls and an abrupt shoulder just clear of the beads designed to prevent rim cutting.

Good roads advocates from one Ohio and five Indiana counties will meet at Richmond, Ind., on August 8 for a conference and to form an organization to encourage road building and improvement. Those who will attend will include county and township officials, farmers and automobile owners.

The Milwaukee Common Council has taken up the dust evil in earnest, and has asked the Illinois Good Roads Company for data on the use of dust laying preparations. Only a few districts have been treated with preparations and others are demanding it. The automobile owners are supporting the move with vigor.

The Garage Owners' Association of California, organized recently in San Francisco, has made application through its secretary for membership in the Automobile Dealers' Association of California. R. J. Marx, San Francisco manager of the Renault Freres selling branch, has also applied for membership.

G. Winthrop Sands, a stepson of William K. Vanderbilt, Sr., was killed in an automobile accident at Poissy, France, on July 29, while on a trip from Dieppe to the castle at which his family was staying. At the time the accident occurred Sands was driving himself, at a speed of about 75 miles per hour, according to his chauffeur.

We are informed that the New York city magistrates at a recent meeting resolved to accept the bail bonds of the National Surety Company in case of the arrest of automobilists for violation of the motor vehicle law. These bonds have been accepted by the police heretofore, and now the magistrates will accept them in all cases where automobilists are held to answer at special sessions.

The Sherardizing process of dry galvanizing, invented by Sherard Cowper-Coles, the noted English electro-metallurgist, and described in one of our February issues, will now be introduced into this country, the United States rights for the process having been acquired by the United States Sherardizing Company, of Newcastle, Pa., and shop rights having been issued to the Globe Machine and Stamping Company, of Cleveland, Ohio.

One of the new Chalmers-Detroit "30" cars will be driven 200 miles daily for a certain period of time, in order to give prospective agents visiting the factory an opportunity of learning for themselves the capabilities of the car. The route selected for the trial is from Detroit to Pontiac, Mich., and back, a distance of 26 miles each way, and four round trips are to be made per day, starting from the Pontchartrain Hotel.

Motor Stumping Tour in Missouri.

The automobile has probably never been put to a more novel use in political campaigns than in northwestern Missouri the last week in July, when Governor Joseph Wingate Folk, now a candidate for United State Senator and recently mentioned for the Democratic vice presidential nomination, made a speaking trip of something more than 110 miles from Rockport to Maryville, Mo., attended by fifty-two cars of all kinds and descriptions. The Governor himself traveled in a big 40 horse power car, the property of a friend. Other candidates for nomination in the Missouri primaries followed in personally owned or hired cars, and in the end there were about twenty-five cars belonging on the nearby farms or in the little towns whose owners went along for the novelty of the thing.

The Missouri Governor made five stops on the way to deliver addresses. On one occasion he delivered two short speeches in a single night in towns 14 miles apart by means of making a night trip. All along the line the farmers had decorated their homes and their fences in anticipation of the coming of the automobile train, an attraction which drew more crowds than the annual circus in rural communities.

Foreign Business Opportunity.

The Bureau of Manufactures is in receipt of a letter from a British Indian business man, who states that he has had wide business experience in the Orient and the United States, and wishes to represent the foreign department of an automobile factory for the territory he will personally cover in the near future. The factory must make machines for hauling freight, as well as passenger and touring cars. He is willing to furnish references, and adds that he feels sure that satisfactory results will be accomplished if he can make suitable arrangements. In writing refer to No. 2,471.

Louis Rene Panhard, of the Panhard-Levassor firm, died on July 18, aged sixty-seven years. M. Panhard was the senior member of the firm which first gained an international reputation as makers of successful motor cars, but it was his business partner, M. Levassor, who did most of the practical work in the perfection of the automobile.

The Ardennes race, which has been held annually in Belgium for many years, had to be called off this year owing to lack of entries, and also on account of interference of dates.

Garage Notes.

W. H. Olds, Crookston, Minn., will enlarge his garage.

A garage is to be established in Fairbury, Ill., by N. J. Foster.

The Corn Belt Auto Co., of Waterloo, Ia., are building an addition to their garage.

A garage and repair shop has been opened at 367 East Third street, Winona, Minn., by a Mr. Duncan.

L. A. Perkins and C. C. Fletcher, Rutland, Vt., have formed a copartnership to handle the Chalmers-Detroit car in their city.

Bjoin & Carlson, Crookston, Minn., will shortly open a garage, 26x50 feet, and will also conduct a motor livery business with two cars.

William F. Mueller, of Milwaukee, will build a $7,000 garage at Farwell avenue and Brady street, 30x130 feet in dimensions, two stories high.

Al Cobett has retired from the garage firm of Graham & Cobett, Lama, Ia., and the business in future will be conducted by Mr. Graham alone.

The Buick Motor Co. are establishing a branch sales office for southern Michigan at Battle Creek in the Y. M. C. A. Building. A new building will probably be erected later for the business.

A new garage was opened last Wednesday at 2128 Cottage Grove avenue, Des Moines, Ia., by George A. Kuntz. Only a few machines will be stored, the owner of the garage figuring especially on repair work for owners of the University place district.

The garage of Dr. A. B. Straight, Hornell, N. Y., was badly damaged by fire and the doctor's runabout ruined on July 30. The car had been placed in the garage about an hour before the fire was noticed, and it is thougnt that the fire originated in the machine.

Fred J. Yarger and Fred W. Fuller will, on August 10, open a garage at 614 West State street, Fremont, Ohio. A new one story truss roof, glazed block building, 45x125 feet, cement floor, has been erected for the purpose by Dr. McKimvey. Mr. Fuller is retiring as superintendent of the Herbrand Company, of Fremont.

New Incorporations.

Brunns Carriage Manufacturing Co., Buffalo, N. Y.—Capital stock, $100,000. Directors: Henry Brunn, Eugene W. Harrington and Frank A. James, Buffalo, N. Y.

Empire Tire Supply Co., Newark, N. J.—Capital stock, $100,000. Incorporators: W. L. Montrose, Chester C. Henry and S. J. Campbell. The company is to manufacture automobiles and parts.

Brunn & Co., Buffalo, N. Y.—Capital stock, $7,500. Directors: Herman Brunn, Anthony Stortere and William J. Sandrock, all of Buffalo. The company intend to manufacture automobiles.

Carl H. Page & Co., New York (motor parts).—Capital stock, $50,000. Directors: Carl H. Page, 1627 Broadway; Robert H. Montgomery, 165 Broadway, and Henry Bennett Leary, 55 Broadway, New York.

The George H. Tyrrell Co., New York.—To operate a garage. Capital stock, $50,000. Directors: George H. Tyrrell and Joseph F. Althause, 2637 Webster avenue; William F. Burrough, 280 Broadway, New York.

Motor Van Co., Lewisville, Ky.—Capital stock, $3,000. The object of the company is to do a business of storing and transporting goods and merchandise. The incorporators are Dennis Long Miller, J. Morris Robinson and Dennis Hodgson Long.

Trade Literature Received.

Remy Electric Co., Anderson, Ind.—Circular of the Remy Type L magneto.

Chas. D. Shain, 90 Murray street, New York.—Circular of Shain's Ball Spray carburetor.

International Acheson Graphite Co., Niagara Falls, N. Y. "Acheson Graphite Products."

R. I. V. Co., Incorporated, 1771 Broadway, New York.—Catalogue of the R. I. V. annular ball bearings, which are imported from Italy.

Trade Personals.

Jos. Grossman, for the past two and a half years treasurer and manager of the National Sales Corporation, New York, has resigned from that position to go into the special advertising business in Cleveland.

Fred O. Paige, who was formerly engaged in the insurance business in Detroit, has become interested in the Reliance Motor Car Co., which will locate in Owosso, Mich., and will henceforth devote his entire time to the affairs of that company.

E. F. Bunker, of Boston, Mass., who has been associated for many years with a well known Eastern firm in the manufacture of automobile springs, has accepted a position with the Perfection Spring Co., Cleveland, Ohio., whom he will represent in the territory east of Buffalo.

J. D. Carrico, of Indianapolis, formerly designer of the engines manufactured by the Speed Changing Pulley Co. and more recently with the Overland Automobile Co., is trying to organize a company for the manufacture of engines and parts for high wheeled motor buggies. Plans so far are indefinite.

New Agencies.

Schenectady, N. Y.—Vrooman & Myers, Cadillac.

Miles City, Mont.—Miles City Automobile Co., Buick.

Salina, Kan.—Center Automobile Co., North Santa Fé avenue, Regal.

Patents Issued July 28, 1908.

894,255. Fuel and Water Controlled Apparatus for Flash Boilers.—Jesse W. Chenoweth and Oscar U. Chenoweth, Otterbein, Ind. Filed October 14, 1907.

894,271. Folding Shield for Automobiles and Other Vehicles.—Frank Jackson, Denver, Col. Filed Agust 28, 1907.

894,276. Vehicle Wheel.—Harry M. Martin, Columbus, Ohio. Filed June 10, 1907.

894,286. Air Intake Regulator for Carburetors.—Frederick C. Reineking, New York, N. Y. Filed April 10, 1908.

894,290. Vehicle Wheel Rim.—Edwin C. Shaw, Akron, Ohio. Filed February 20, 1907.

894,327. Change Speed Gear.—John Johnston, Putney, London, and Harry W. Buddicom, Nannerch, near Mold, England. Filed May 9, 1905.

894,377. Tire Armor or Protector.—Charles Filler, St. Johnsville, N. Y. Filed November 20, 1907.

894,389. Carburetor for Explosion Engines.—André A. Louis, Paris, France. Filed November 10, 1905.

894,423. Lubricator.—James M. Chambers, Boulder, Col. Filed August 12, 1907.

894,426. Clutch.—David E. Dolson and Elbert R. Pease, Charlotte, Mich. Filed November 25, 1907.

894,431. Shock Absorber for Vehicles.—Edward A. Garvey and Christopher A. Garvey, St. Louis, Mo. Filed September 23, 1907.

894,444. Controlling Device.—Wellington P. Kidder, Boston, Mass. Filed May 18, 1903.

894,472. Mechanical Lubricator.—Jacob Suess, Chicago, Ill. Filed March 9, 1907.

894,473. Power Changing Mechanism.—Robert Symmonds, Jr., Kenosha, Wis. Filed December 14, 1905.

894,493. Pneumatic Cushion for Vehicles.—Edward A. Garvey and Christopher A. Garvey, St. Louis, Mo. Filed January 9, 1908.

894,520. Spring Wheel.—Henry Neubert, Chicago, Ill. Filed April 27, 1907.

894,[illegible]. Carburetor for Internal Combustion Engines.—John Johnston, Fulham, London, England. Filed June 3, 1907.

894,719. Gearing for Motor Vehicles.—Frank Beemer, Philadelphia, Pa. Filed June 19, 1907.

894,724. Motorcycle.—Camille Contal, Levallois-Perret, France. Filed March 30, 1906.

894,730. Road Vehicle Wheel.—John Stee, Earlstown, Newton-le-Willows, England. Filed March 18, 1907.

894,751. Tire Protector Holder.—Frank O. Slanker, Pomona, Cal. Filed December 20, 1907.

894,775. Sparking Device for Explosive Engines.—Charles R. Greuter, Wilkes-Barre, Pa. Filed April 25, 1907.

894,800. Power Translating Apparatus.—Joseph Sachs, Hartford, Conn. Original application filed September 19, 1903; divided and this application filed July 2, 1904.

Coming Events.

August 6—Demountable Rim Contest of Chicago Motor Club.

August 14—Algonquin, Ill., Hill Climb of the Chicago Motor Club.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

September 11—Hill Climb of Springfield (Mass.) A. C.

September 14—Annual Economy Run, Chicago Motor Club.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

Milwaukee's Municipal Cars.

The city of Milwaukee will be well nigh horseless, as far as departmental service is concerned, within a few years. The latest applicant for a car is the city engineer and board of public works. Up to this time the board has been forced to rent machines to accomplish its work with dispatch and thoroughness. When Sherburn M. Becker was mayor his private cars were often pressed into service. City Treasurer Schoenecker, former member of the board, is the hottest agitator of the plan. He said he was afraid to advocate the matter when he was a member lest it be construed as in his own personal interest. The police and fire chiefs, park superintendent, county sheriff, police patrol, and many other departments have been granted cars by the city.

Willing to Pay the Damage.

(From the El Dorado (Kan.) *Republican*.)

Should the Edwards County farmer, who may have found the seat of a pair of trousers hanging to his barb wire fence, send it to this office, we will see that he receives pay for the row of corn knocked down by a Mitchell car. The mud hole in the road was deep, and the only way to get around it was to cut the barb wire fence and smash about 200 yards of corn, which would have been paid for on the spot had not the farmer appeared with a shotgun while swearing a blue streak. There was really nothing left for the boys in the car to do but to cut the fence a second time and skip, and in the skip one of them lost a quarter section of his trousers. But then they will pay for the corn when the proof is furnished.

The Horseless Age

First Automobile Journal in the English Language

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Charge Distribution in Multi-Cylinder Engines—A Suggestion for Its Improvement.

By Warren Noble.

There has been much written and said upon this problem of charge distribution. Many puzzled engineers have worried over the peculiarities which certain engine types have insisted on developing. Many are the freakish arrangements which have been tried out as a last resort to overcome the insidious trouble which, ever faintly present and by elimination traceable to the carburetor or the carburetor leads, was eventually recognized as a flaw in the distribution of the charge.

If we look at a section of a typical six cylinder inlet pipe, such as used for the usual six cylinder engine with separately cast cylinders, and trace the probable gas paths through its length to various cylinders, we can easily see that, although the summation of the centre lines AB, BC, CD, DH, HI, IJ, JK is the same as the summation AB, BC, CD, DH, HI, IL, LM, and as the summation AB, BC, CD, DE, EF, FN, NG, the gas paths are entirely different. I have indicated imaginary gas paths to the different cylinders without regard to residual gas, and an inspection will show that gas flow widely differing in resistance is to be expected. For instance, cylinder 6 can take its gas more easily by reason of its location than cylinders 2 and 5, with which a reversal of gas direction is necessitated. The distribution to the cylinders at 3 and 4 is equal, but entirely different from that to cylinders 2, 5, 6 and 1.

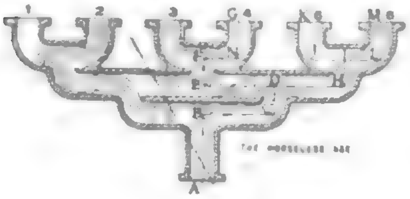


Fig. 1.

With such a distribution scheme it is to be expected that the weakest cylinders, i. e., those getting the weakest charges, will be 2 and 5, a conclusion completely in accordance with practice. Complicate such conditions with the slightest air leak between carburetor and cylinder port, and the behavior of many "sixes" is accounted for. I have analyzed in this way all the piping arrangements I have seen, and of them the most efficient, considered solely from this point of view, is that in which six pipes (or with paired cylinders three) run radially from a central chamber above the carburetor. Not only would I opine that the flow to the valve ports would be more even than with the neater and more conventional types, but I would definitely state that the trouble arising from residue gas would be less.

Unfortunately, with all known inlet pipe arrangements there are many variable conditions that are difficult to diagnose. An editorial in The Horseless Age of July 23 drew attention to one such condition, by referring to manifold pocketing. The behavior of an engine will be markedly influenced by the substitution of a cast manifold in place of a built-up one. One engine which I recently saw in a professional capacity was vastly improved in regularity of running by drilling a number of small holes in the wall of the manifold casting between the primary and secondary leads. My theory of the improvement effected was that the holes lessened the resistance of flow to the end leads, in comparison with the central ones.

I have come to the conclusion that for engines having more than four cylinders, i. e., with primary and secondary manifold branches only, the charge distribution must be accomplished by some other means than at present adopted. The residual gas in the manifolds in general use, the inertia of the gas columns, the wide diversity of firing sequences—all these have so marked an effect upon the efficiency and economy of the multi-cylinder engine that it is essential in the search for perfection to abolish these troubles, and adopt some system in which a more direct means of gas introduction is employed.

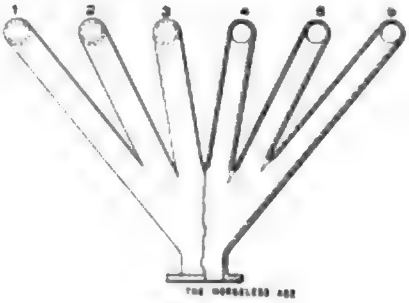


Fig. 2.

I am investigating at the present time the merits of a mechanical distribution system. In this the gas is distributed from the carburetor to the cylinders exactly as the current is distributed from a commutator to the coils in the ignition circuit.

To each cylinder a lead, to each lead a check valve—there we have the simplest form of mechanical charge distribution. Fig. 3 shows the port arrangement clearly. The check valve is light, seating on a leather ring for the sake of quietness, and is held in place by a light coiled spring. Care is taken not to restrict the area of the gas passages which, being ample in size, materially add to insure homogeneity of the mixture by acting as baffles.

The action of the device is simplicity itself. The valves will only open in the direction of suction, imposing a resistance to the flow, which is so slight as to be negligible.

The results from its use are not easy to predict offhand. Certainly it would stop the unevenness of cylinder feed that is such

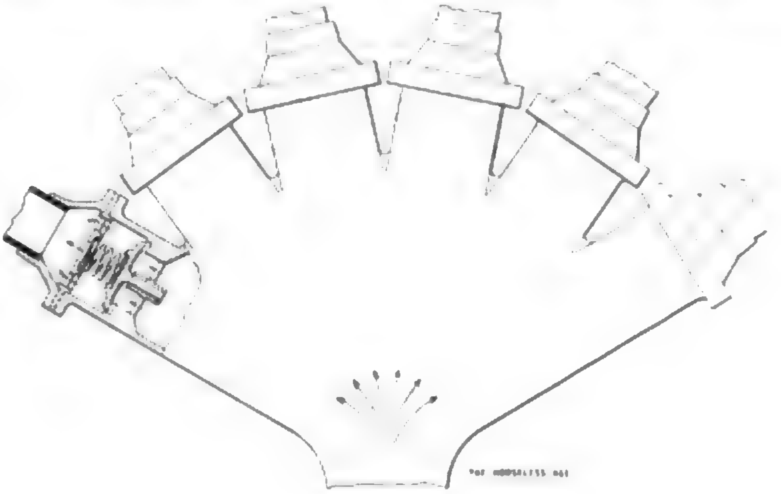


Fig. 3.

a source of trouble in six and eight cylinder engines. The residual gas is trapped securely in its own lead. Each cylinder coming in phase takes in its lead full of previously trapped gas, plus a quantity newly drawn through the carburetor. Each cylinder would get a uniform charge not deteriorated by stale gas. A greater volume of charge per cylinder would be drawn in, since the lead resistance would be much less. Gasoline separations, resulting in pockets of liquid, would be stopped. The phenomenon of separation is generally traceable to expansion through the orifices throughout the manifold, which in obstructing free flow cause pressure fluctuations in the body of the gas.

The late closing inlet valve would no longer be a necessity. Starting would be materially facilitated, since, the gas being trapped, it could not be diluted by filtration into the air through the carburetor orifices.

The problem of the carburetor becomes at once infinitely more simple, since it has to do only with a fundamental suction, not, as in ordinary practice, with an indrawing of air dependent upon and influenced by many disturbing factors, such as gas inertia, flow resistances, and so forth. It would be possible to use a compressed air self starting device without additional cylinder valves, by using only two or three cylinders for starting purposes and fitting glands to the valve stems (excellent practice in any case). Lastly, it should make very strongly for increased flexibility at low speeds.

Personally I think that this simplest of all arrangements—the check valve in the carburetor end of each cylinder lead—is by far the best, but even with leather seats for the checks I am inclined to believe that there would be considerable noise at high speeds. My own experience with valves of this type is that they are by far the hardest to make noiseless, so that in considering the advisability of adopting a mechanical system we must perforce examine the alternative means of carrying it out. Terming the scheme just discussed the automatic, we come naturally to a mechanically operated distributor, and the reader will instantly think of the obvious disc valve system.

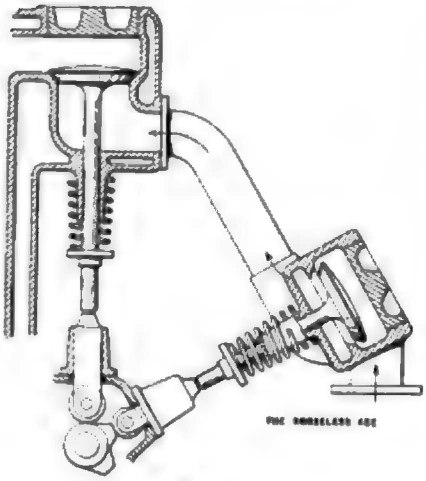


Fig. 6.

In Fig. 4 I have diagrammatically indicated such a system. It will be noticed that the inlet pipes run as would the insulated wires of the ignition system, i. e., in firing order. The disc has a radial port cut in it corresponding (according to the engine valve setting) to one of six ports, equally spaced, communicating with the gas leads. The discs would be rotated in synchronism with the cam and shafts of the motor, i. e., at half the engine speed. Such a device would not appear as a good job to a careful designer, who would probably adopt some such scheme as that shown in Fig. 5.

These are merely sketches, and are not offered as designs, but the general idea will be easily seen. A rotary valve has three sets of ports cut in its periphery, but in different planes. Opposite these ports and set neatly in a vertical plane are the cylinder leads diametrically opposite each other, each pair thus being served by one port. The firing order is determined by the circular location of the ports in the valve. By adopting some such construction as this the surface velocity of the active distributing mechanism could be materially reduced and trouble so avoided. Yet another scheme would be to adopt a series of mushroom valves as used in the cylinders, and operate them by a cam set fixed to one of the cam shafts. A series of piston valves would also do.

Now of all these schemes the first is the best, mechanically and probably also in action, where simplicity overshadows some small economy. All the systems have two strong objections to their use. Firstly, all add complication, and, secondly, without further complication it is difficult to predict safety in the event of a back fire through the inlet valve. In any case it may be worth investigation by engineers troubled by this problem.

The Location of Sight Feeds.

Not long ago the typical touring car dashboard was littered with a lot of gauges, pumps and other apparatus, conspicuous among which was a more or less mussy mechanical oiler with its row of sight feeds. Oiling systems have become more positive, and at the same time simpler, and it is quite the rule now to locate mechanical oilers under the hood. In a few instances the sight feeds are still placed on the dash, but usually this is not considered necessary. Where the oil tank and single gear pump system is employed one large sight feed is frequently located upon the dash, so that the operator will instantly know when the oil ceases to flow.

In a recent commercial design a new location of the sight feeds was observed. They were placed close to the bearings to be lubricated, and if the oil could be seen passing through the feeds there was absolutely no doubt that it reached the bearing surfaces as intended. Where oil is fed to each bearing separately this location of sight feeds would seem to be the logical one, because the rate of feed can be noted at the daily inspection, and with the self contained tank and pump system there is little danger of the oil supply giving out.

A motor truck operating company with 1,500,000 francs capital stock, divided into 15,000 shares of 100 francs each, has been formed in Antwerp, Belgium, the object being to operate motor trucks on the docks and wharves of that seaport. Among the founders are the Marienfelde branch of the Daimler Motor Company, which holds 1,000 shares, and several local banks. Of the total issue of 15,000 shares 3,000 are promoters' shares.

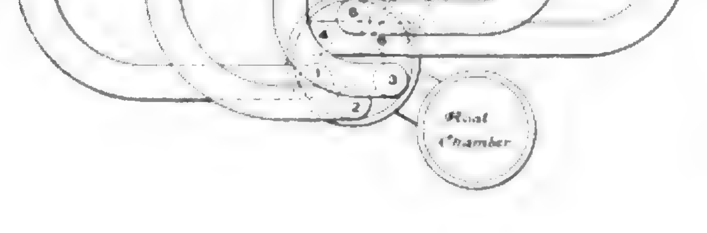


Fig. 4

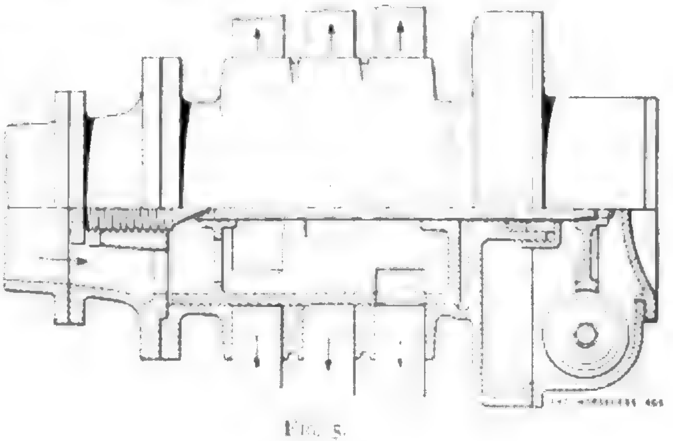


Fig. 5.

Crank Effort Diagrams.

By E. J. Bartlett.

In a reciprocating engine gas and inertia forces acting on the piston are transmitted through the oblique connecting rod to the crank shaft. The tangential components of these forces, in so far as they are transmitted, are the turning forces, and the diagram of the turning forces, showing the changes of the tangential forces, is the crank effort diagram.

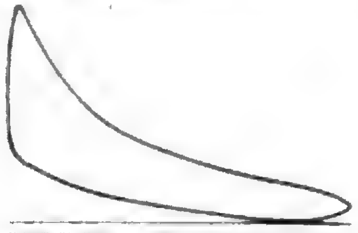


Fig. 1.—Gas Pressure Diagram.

Ninety pounds compression (absolute). Pressure ratio, 3:1; scale, 100 pounds = .5 inch.

The construction of such a diagram for any engine affords a very convenient method of studying some of the important characteristics of the engine, as, for instance, the relation between the maximum turning force and the mean turning force, which gives at once a comprehensive knowledge of the stresses on the parts affected, when the mean turning force or torque is known. The excess energy delivered by the engine over the mean energy at every point in the cycle may also be studied; this is a guide in establishing the flywheel size and weight necessary to limit the angular velocity variations. We may also determine the number of reversals of the turning force; that is, the number of times the curve crosses the mean, which shows the frequency of the rocking of the engine as a whole about its crank shaft in the opposite direction to that in which the power is applied.

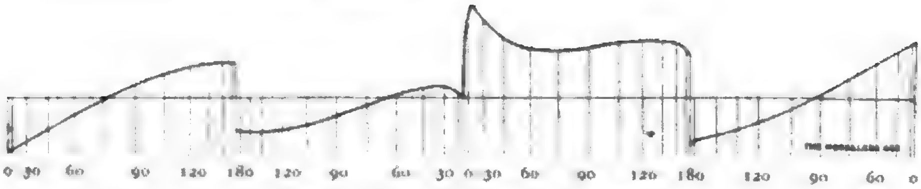


Fig. 3.—Piston Pressure Diagram.

The crank effort diagrams of different engines vary in form to quite an extent, depending in the four cycle engines on the gas pressures, combination of cylinders and crank angles, and the inertia of the reciprocating parts. A set of conditions for a single size of cylinder will be assumed, and the crank effort diagrams for some of the most typical and common engine arrangements worked out.

The tangential forces may be found either algebraically or graphically. Unless a number of diagrams are to be constructed, or tables of tangential factors are at hand for different crank angles and ratios of connecting rod length to crank arm, the graphical method is convenient and accurate enough for practical purposes.

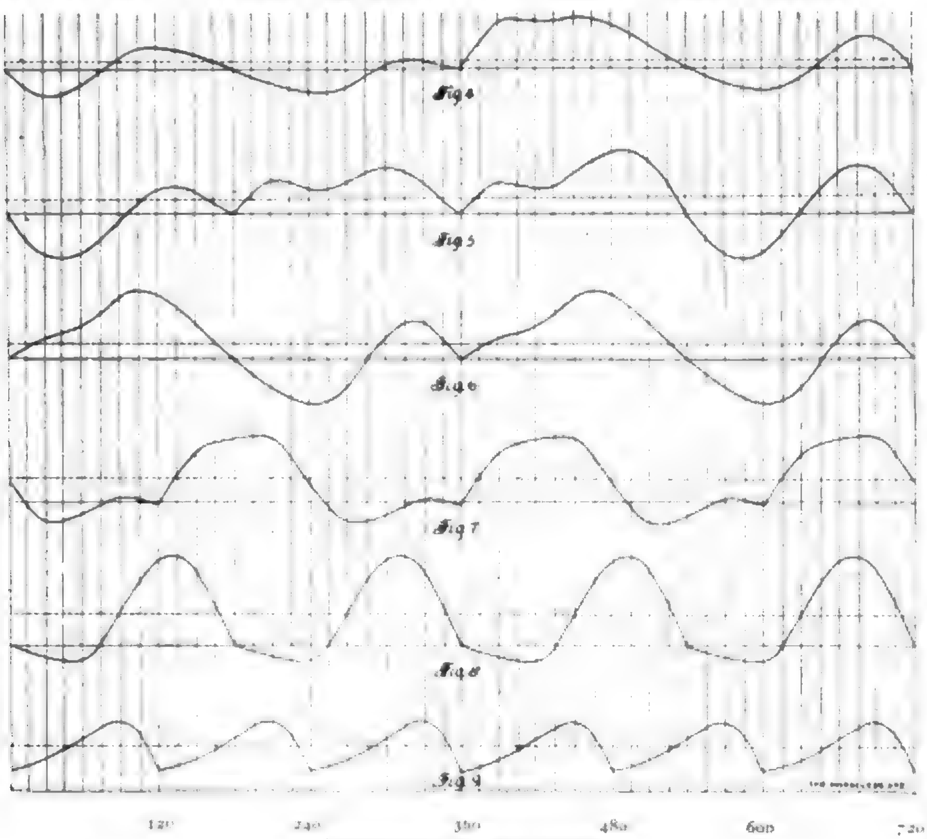


Fig. 4, single cylinder torque curve. Fig. 5, twin cylinder, 180° crank torque curve. Fig. 6, double cylinder opposed torque curve. Fig. 7, three cylinder 120° crank torque curve. Fig. 8, four cylinder torque curve. Fig. 9, six cylinder torque curve.

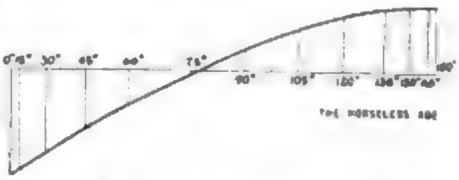


Fig. 2.—Inertia Diagram.

Scale, 100 pounds = .004 inch. Maximum inertia = 74.3 pounds.

The data assumed will be for gas pressures an indicator diagram as shown in Fig. 1, which is constructed for an engine of 5½ inch bore and 5½ inch stroke. The four strokes of suction, compression, expansion and exhaust are laid down on a base line four times the length of the stroke, the assisting gas pressures above and the resisting pressures below.

The next step is to construct the inertia diagram to the same scale. This may be done by the aid of the formulæ $\frac{F}{a} = .00034 \frac{W}{a} N^2 r (\cos \theta + R \cos 2\theta)$ for the inertia forces acting on the piston in pounds per square inch of area, and $S = r [(1 - \cos \theta) + \frac{1}{2} R \sin^2 \theta]$ for the piston travel corresponding to the angular movement θ of the crank.

In addition, $\frac{W}{a}$ = weight of reciprocating parts per square inch of piston area, which we will assume as .8 pound, a fair estimate for this size engine.

N = r. p. m., which on the basis of a piston speed of 1,000 feet per minute becomes 1090.

r = radius of crank in feet.

l = length of connecting rod.

$R = \frac{r}{l}$, or ratio of crank arm to rod length, which is assumed as $\frac{1}{4}$.

Substituting these values in the formulæ and solving for $\frac{F}{a}$ and S for every 15 degrees of crank movement and plotting the values of $\frac{F}{a}$ as ordinates and of S as abscissæ, gives the curve shown in Fig. 2. For the return stroke the curve is reversed. The part of the curve below the base or zero line represents the energy stored in the reciprocating parts in accelerating them, and that above the base line the energy delivered on retardation. For the assumed value of R the curve crosses at a point corresponding to 75 degrees annular movement

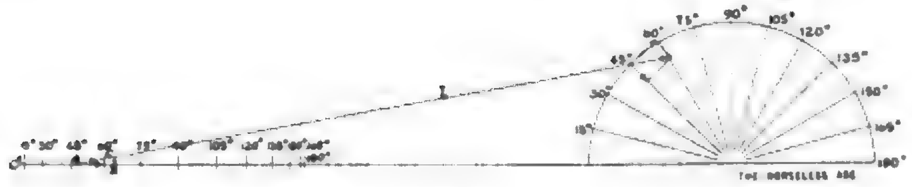


Fig. 10.

of the crank. The area of the two portions of the curve should be equal.

Combining the four inertia curves with the gas pressure curves, and noting the direction of the forces results in the net pressure curve shown in Fig. 3. This represents the forces acting on the piston for the four strokes.

To graphically transform these to tangential forces draw a circle representing the path of the crank and divide it into a number of equal parts, say of 15 degrees each, to correspond with the divisions used in plotting the inertia curves. For any position of the connecting rod lay off on a line representing the piston stroke, a distance A B equal to the pressure at this same point of piston travel, shown by the net pressure curve. This force is resolved into a side thrust B C against the cylinder and the force A C acting along the connecting rod. At the crank pin this latter is resolved into two forces, one acting radially against the crank shaft bearings and the other tangentially on the crank pin.

On a base line whose length is the circumference of the crank circle, equal spaces corresponding to 15 degrees spacing of the crank circle form the abscissæ of the curve, and the tangential forces found for the corresponding divisions of crank motion the ordinates. This resulting curve is the crank effort diagram of a single cylinder per cycle. As the curves shown are for comparison only, for convenience the base line is made equal in length to the net pressure diagram, and all four strokes are plotted on it.

Fig. 10 shows clearly the method of plotting a single value. Fig. 4 shows the diagram resulting from plotting all values as indicated. For different cylinder and crank arrangements the single cylinder diagrams are simply combined in the proper angular relation and the effective values plotted.

Fig. 5 is the diagram of a twin cylinder engine with cranks at 180 degrees. The phase relation is therefore 180 degrees, since similar strokes in the two cylinders occur at successive half turns of the crank.

Fig. 6 is the diagram of either a twin cylinder engine, with cranks on the same side of the shaft, or a double opposed horizontal engine whose cranks are, of course, at 180 degrees. The phase relation of both engines is the same, although the mechanical balance is quite different. The power strokes are seen to be evenly spaced, and the diagram is repeated every 360 degrees.

Fig. 7 shows the action of a three cylinder engine, with cranks spaced 120 degrees. The diagram is repeated every 240 degrees, or three identical power cycles occur in two revolutions of the crank.

Fig. 8 shows the diagram of a four cylinder, vertical engine, and is of particular interest, as so many of this type are used. There is seen to be a distinct reversal of the power in every 180 degrees, which is also the period of the power cycles. The importance of light weight reciprocating parts is also shown, for with a very small initial inertia force the curve may be kept entirely above the base line. The power would then be varying in intensity only, and be constant in direction. It is not practical, however, to make the reciprocating parts light enough for this.

Fig. 9 is the diagram of the six cylinder vertical engine, and shows that the torque is continuous. This is also an interesting diagram, as it shows a comparison, so far as torque development is concerned, between the four and six cylinder vertical engines. The dotted horizontal line shows the approximate mean pressure.

Graphite Lubrication.

By L. H. Snyder.

Graphite is closely related to the diamond chemically, but is much different in structure physically. Graphite occurs as and is known by the names of graphite, plumbago and black lead, graphite usually referring to the American product, plumbago to the Ceylon product, black lead to the inferior grades of graphite.

The origin of graphite is not definitely known; probably it was formed from the distillation of vegetable matter, though this is only a theory. The process of refining, unlike the refining of petroleum, has been taken care of by nature, a low grade of graphite being formed in some localities, while in others a high grade of graphite, rich in unctuous qualities, is found.

The purity of lubricating graphite is usually expressed by its percentage of graphitic carbon, though graphite analyzing high in carbon may be totally unfit for lubricating purposes because of its physical formation and lack of natural lubricating qualities. If one were to insist on graphite analyzing 100 per cent, he might have powdered charcoal palmed off on him.

Probably the best known American natural graphite is that produced near Ticonderoga. This is mined in flake form, and while the flake formation remains through every stage of refining the graphite may be ground to a state of extreme fineness.

Examination of a bearing surface under a powerful microscope will show it to be full of irregularities, something on the order of a nutmeg grater. Flake graphite when used as a lubricant fills up the depressions, becomes pinned upon the pointed elevations and forms over all a thin, tough, veneer-like coating of marvelous smoothness. This prevents actual contact of the metal surfaces and substitutes a graphite to graphite contact, which means a reduction in solid friction, and further protects the metal surfaces from cutting and like injury.

When finely pulverized flake graphite is used with the cylinder oil as a lubricant for gas engine cylinders smoother running is obtained and better compression (resulting in more power), and the danger of scored cylinders is eliminated. If the cylinders should become dry for any reason the graphite will prevent cutting.

What is the cause of most trouble in the use of graphite in a gasoline engine is the tendency to use too much. Where splash lubrication is employed the graphite should be put into the crank case mixed with the oil in the proportion of a teaspoonful to a pint of oil. This should be done whenever the crank case is cleaned out and new oil added. This will depend, of course, on the mileage and usage of the machine.

Where splash lubrication is not employed a method that is very satisfactorily used is the one suggested in the July 22 issue of The Horseless Age by Mr. Roberts, that is, removing the spark plug and squirting a little graphite into the cylinders while the piston is at the end of its stroke. This may be done by means of an insect gun or a quill and rubber tube. Where the quill and rubber tube are used the quill is filled with graphite and the contents are blown into the cylinders through the tube.

When the fine flake mentioned above is used on the tires there need be no fear that the graphite will prove in any way harmful to the rubber. It is far superior to talc and when applied to the tire rims will prevent rusting. Oil and graphite mixed to a stiff paste and used upon the threads of the bolts and tire rims will insure a joint always free from rust.

Special graphite greases are made for the different parts of the automobile. One that has proven most popular where adapted to the design of the car is graphited wood fibre grease for transmissions. Machines supplied with grease cups also make use of graphite cup greases which owe their superiority to the graphite incorporated in them.

The Paris correspondent of the *Autocar* opines that the British press will have cause to regret its gloating over the French defeat in the recent Grand Prix race, for French makers will certainly not release their hold of the British market, while, on the other hand, German makers will be spurred on by their victory and attempt an invasion of the British market, so the net result to the British makers will be an additional formidable competitor.

Improvements in the Two Cycle Motor.

By E. A. Huene.

The day has come when the two cycle motor for automobile use must seriously be considered by those who would profit by anticipating probable developments. The unusually large sales of the pioneer makers of cars using this type of motor, the favorable criticism of technical experts who have hitherto been open scoffers, the irrepressible interest of the non-technical, general public, and the world wide reaction in favor of simplicity and lower initial cost and upkeep, all point to the path of least resistance, to ignore which is neither the part of wisdom nor of profit.

For motor car use the two cycle motor has had so few friends, and they have been kept so busy developing a complete car along lines analogous to its more pretentious competitor, the four cycle car, that outside of refinements, better engineering practices, better materials and better workmanship in assembling, the motor has not been improved at all by any maker commercially in the field, the real improvement as a type coming from the long and painstaking efforts of private investigators.

Nor has there been much data available, such as that furnished by the series of port tests by Professor Wheeler at the University of Michigan, from which investigators might profit. It may be noted that, though chiefly carried out with respect to their bearing on the motor for automobile purposes, these tests at Ann Arbor were not made upon a motor which had served or could serve in a car, being apparently one of the various two cylinder motors built for boat propulsion.

And yet these tests well serve their purpose, whether it be for the study of those few builders who have courageously developed a car using the two cycle motor of conventional type, or for those who seek further improvement along lines of radical change in port design. The first class will find little, if any, difference in method of port location and sizes of ports from their own car motors, while the latter will find ample reasons for the innovations they propose. It is along the latter lines that real improvement is most likely, hence the recital which follows.

In 1903 the writer very rashly decided to build a four cylinder, shaft driven touring car, to be driven by a two cycle, air cooled motor. It was another case of "fools and angels," and in looking back it is surprising that so much car was evolved from so little knowledge. The two cycle critics were then loud in their claims that it was utterly impossible to air cool the two cycle motor, and their reasoning seemed plausible until its inconsistency appeared. In one breath they declared that as there were two power strokes in the two cycle to one power stroke in the four cycle, there was double the heat to be dissipated in order to preserve a working temperature. This might have been a terrible warning if it had not been that in the next breath the critics denied that in equal sizes the two cycle produced twice or nearly twice the power of the four cycle. At least the writer figured that after all was said and done it took, other things being equal, so many thermal units to produce so much power, and that it would probably make no difference whether the power was produced in one large or two small impulses. On this theory very thin copper flanges were inserted in the cylinder walls vertically, these flanges being of No. 20 gauge and spaced one-fourth inch. These flanges on these cylinders (which were 4 inches square) were 3 inches long. Pasteboard spacers one-eighth thick were then inserted between the plates and all were wiped to the curve of the cylinder, bringing the end of each plate about 1 inch away from the cylinder wall. The general assembly was then as shown in Fig. 1.

This arrangement apparently violated all rules and all precedent. The thickness of the plates at the cylinder wall was far too little to convey heat a fraction of the width of the plates, and each plate for a certain part of its length radiated heat to the adjacent plate at a section farther toward its outer edge. But it cooled, and cooled so well that never was there a preignition, in spite of the fact that the car had no fan of any description. Yet to this day the writer has not decided whether it was a misconception of the operation of the two cycle motor or the peculiar cooling plates that permitted these results.

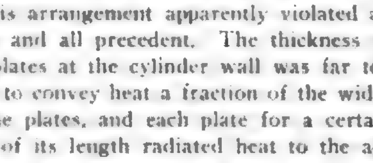


Fig. 1.

It is the writer's opinion that almost or quite every case of two cycle overheating may be traced to improper mixture or abuse of the spark timer, to which latter the two cycle motor is at least as susceptible as the four cycle, and there are enough conventionally designed two cycle, air cooled motors on the market now to dispell the last lingering suspicion upon this score.

What, then, are the merits and what the faults of this motor as a type? In the three port type we have a motor performing the various functions of aspirating, compressing and exhausting its gas without the intervention of some eighteen mechanical parts for each cylinder in the four cycle type, to say nothing of having double the power impulses per revolution. Every down stroke being a power stroke makes for the multicylinder flexibility sought in the other type of motor; every up stroke being a compression stroke eliminates knocking of loose rods.

These undoubted features of merit are in themselves enough to attract every fair minded observer regardless of whether more power is developed size for size, though it is true that the well designed, conventional, three port, two cycle motor does develop within a certain range 50 per cent. more power than the four cycle motor. The main advantages of the two cycle motor are more power and greater simplicity, with equal design, material and workmanship.

There has been much disappointment among friends of this motor because its behavior in automobile use has not in general been as good as in its widespread—in fact, almost universal—boat use. As compared to the boat, the demands of the motor car are greater regularity of operation at higher speeds and greater regularity of operation at lower speeds; in other words, greater flexibility. By more liberally designed ports little remains to be desired at higher speeds, but at low speeds and light load it appears to be impossible to secure regular firing under normal conditions. So notorious is this fault that automobile makers using the two cycle motor rely on multiplication of cylinders and hand control of gas and spark to minimize the trouble. This plan naturally involves waste of fuel and causes that aggravating muffler spitting and resultant foul odor. The danger of loss of crank case compression through worn bearings has been criticised, but this criticism now has little weight, as the idea of the necessity of high crank case compression has been abandoned, and so much progress has been made in bearing metals and bearing lubrication as to reduce the wear of the bearings to a minimum. To those in close touch with owners and drivers of four cycle cars it is well known that the moment a two cycle motor is produced that fairly approximates a good four cycle as regards flexibility there will be a widespread conversion to its standard.

Is it possible, then, to keep the general design of the two cycle motor as applied to the motor car today, yet so change its methods of gas admission as to fairly overcome its faults? Experiment seems to prove—and several long established makers of boat motors by their practice concur—that the introduction of the gas charge into the head of the cylinder at once solves the problems of greater economy, more reliability at low speeds and light load, a snappy exhaust and no muffler burning. There are relatively few builders of this type because of its being in a sense a retrogression, necessitating as it does some form of extra valve and valve mechanism—automatic poppet, mechanical poppet or rotary—and no maker has yet had the temerity to complicate the two cycle ever so little for motor car use.

The reasons for the improvement produced by charge admission at the head are readily explained. Even under most favorable conditions it is surprising that the fresh charge from the crank case under only a few pounds pressure can so successfully fight its way through the contrarily moving exhaust gases, and reach the plug in a condition to ignite at all, to say nothing of its inevitable losses to the exhausts along the division line. Immediately the throttle is fairly closed the crank case pressure at the moment of transfer port opening falls from several pounds to about the same number of ounces; in fact, at times it drops close to atmosphere, and the gas, which under the higher pressure at wider throttle passed over and upward in a well defined stream, now oozes over and largely passes out with the exhaust in spite of the use of the best form of deflector known. A small residue remains which is so much increased after from one to three idle strokes as to again fire at the plug.

When the charge enters at the head a natural course is followed. The burnt gases are moving downward, and by their inertia produce a zone of relative rarity amounting at times to some 2 pounds vacuum in the head of the cylinder. Into this zone comes the fresh gas in a compact body, and passes down, forcing the remnant of burnt gas before it. Throttling and the resulting small gas charge has little effect in causing a misfire, while nothing short of a charge so complete as to completely fill the cylinder down to the exhaust port can cause waste, mixture and spark being right. In this case the motor would develop twice the power of a four cycle motor, which is sufficient of a gain to make up for the extra gas used.

In practice such complete filling of the cylinder does not occur with an automatic valve in the head, because of the valve spring lag; nor is the loss by leakage more than appreciable with a mechanical valve in the head, for the reason that in this type of port arrangement, where higher crank case pressure is an advantage, the long transfer passage reduces that pressure materially.

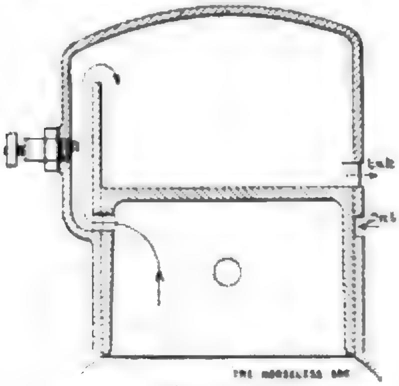


Fig. 2.

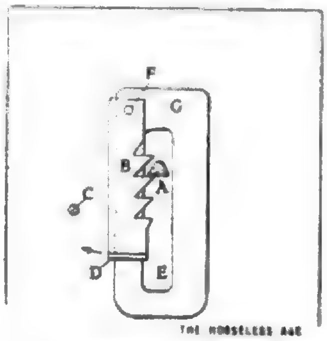
The writer now proposes to describe an absolutely new system of port arrangement whereby gas is taken directly to the head of the cylinder by means of a transfer port quite similar to the usual type, save in location and passage. Letters patent are being sought upon this invention.

Reference to Fig. 2 and the following annotation fully explain. Imagine the usual transfer passage, which ends in a port high above the head of the piston in its lowest position, and communicates with the crank case at the lower end, reversed end for end, so that its throat opens into the compression chamber of the cylinder. Its closed lower end then abuts against the piston wall down to below the top rings of the piston when in its lowest position, at which place registering ports are cut through the cylinder wall and the piston wall. In a word, this passage is a four cycle valve pocket minus the valve, laid down along the cylinder wall and tapped through the cylinder and piston as shown. This makes the transfer passage a part of the combustion chamber, gives all the advantages of gas admission through the cylinder head without complication, and the additional advantage that the plug may be located in the transfer port close to the ports, where the smallest charge must regularly ignite. There is with this method but one limit upon the time of opening of the transfer ports; it must not precede the time when the terminal pressure of the exhaust equals the crank case pressure, for there is no possibility of firing the new charge from the flame of any ordinary mixture. The fact that it is not necessary to give the exhaust such a lead over the transfer allows of a larger charge being passed.

The motor now being prepared for the testing stand is 4½x4 inches, two cylinder air cooled cast as a unit, the cylinders being offset one-half inch. The inlet ports to the crank case, three in number, are ⅜x 1⅝ inches; the clear area is 1 8-10 square inches; there are also three exhaust ports, ⅝x1⅝ inches, giving a clear area of 2 4-10 square inches. The transfer passage from the crank case to the cylinder has three ports, ½x1⅛ inches, giving a clear area of 1.76 square inches. The crank runs on two New Departure double annular ball bearings at its outer ends. The shaft carries a pair of piston rings in a single groove for a gas seal at either end inside of the ball bearings, and also at the centre. This motor should be fast running, sweet and strong, with unusual ability to throttle down.

A Foot Brake Latch.

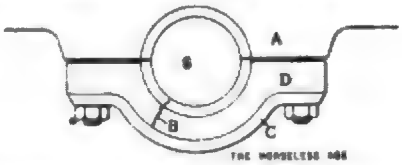
While a great number of planetary geared cars are provided with latches on the brake pedal there are a number which have no such device, and which must be kept from moving away on a grade by turning one of the wheels against the curb. The fitting of the various attachments listed upon the market requires not only time but considerable money for the fitting, etc. The following described latch can be made with a hammer and chisel, or can be filed out in a short time, the materials used being one inch flat stock and one three-eighths pin, or a screw and nut. The cut shows the latch applied to a well known runabout. Here A is the arm of the brake pedal (shown in section), B the plate with notches cut into it for retaining the brake pedal, and D the upturned end of B, so that the foot may move the plate in or out of contact with the pedal arm. The plate is pivoted at F to the brass plate G, within whose slot E the pedal works. C is a stop pin to prevent the plate B from moving beyond a position where it may be readily operated by the foot. When the brake is set the plate is moved into the position shown in the cut, the brake arm entering one of the notches and retaining the pedal in the desired position. When it is desired to release the brake the plate is moved against the stop, thus releasing the pedal. The pin C may be omitted if desired.



Brake Latch.

Repairing a Broken Bearing Cap.

As a result of a heavy back fire the cap of one of the crank shaft bearings of a gasoline motor cracked across, and as there was no possibility of procuring another for some days, the following temporary repair was made: A piece of steel was bent over the cap, and holes were drilled in it to correspond to the holes in the cap. The strap thus formed was placed as in the cut, and the same nuts were used to hold the whole in place. This enabled the driver to run about carefully until a new cap was procured. In the cut A is the upper half of the crank case, B the bushing and D the cap. The steel strap is shown at C, and the shaft at S.



The Roman Court of Cassation has confirmed the decision of the Court of Appeals, according to which the Banco di Liguria in Genoa is obliged to refund 200,000 lire to stockholders of the Savoja-Palmer Automobile Company, which stocks are guaranteed by the bank and have lost all value.

The Hungarian Minister of Commerce announces that he has fixed the price of tax exempt gasoline for use in minor industries and in agriculture for the quarter ending October 31 at 16 crowns per 110 pounds (18 cents per gallon).

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Tendency in Automobile Legislation.

It has been said that the tendency in automobile legislation will be toward simplicity, and it is predicted by prominent automobilists that the statute books of the various States will not be burdened with so many involved motor laws as at present. Upon what grounds these predictions are made is not clear, and they seem, in fact, to be contrary to all past experience, which seems to indicate that automobile legislation is becoming more intricate, and that the operation of automobiles is being regulated more in detail year after year. Let us take a few examples.

New Jersey has enacted probably the greatest amount of law concerning motoring of any State in the Union. Massachusetts only this year went into great detail concerning automobile driving. Rhode Island has enacted a very comprehensive and complicated law, in place of its former very simple law, which did not provide any speed limits at all. Ohio has added materially to its former small amount of automobile legislation. Illinois last year passed a new act which was considerably more comprehensive than the one superseded. Connecticut's new law, although very liberal as to speed limits, is more intricate and covers a much larger scope than the previous automobile law of that State.

Amendments to existing automobile laws are enacted at every session of the State legislatures, and the signs are that this movement will continue. The continual occurrence of accidents on public roads will call forth new regulations. Thus the daily press is at present advocating strict control over chauffeurs, because several serious accidents have occurred to cars that were taken out of garages and driven without the authority of the owners. As long as such accidents continue to happen—and the expectation is that they will increase in number with the increase in the number of cars on the road—the public will clamor for more restrictive legislation.

Then there are various other matters connected with automobiling which will come under legislative control, such, for instance, as the storage of gasoline, the conduct of garages, etc. Probably within another year we will have a provision forbidding the emission of offensive vapors from automobiles, a matter that has already been regulated by the New York Park Board. The dust nuisance will probably come in for some attention on the part of our legislators, although at the present time the situation can hardly be met by legislative enactments.

It is therefore a vain hope that there will be less automobile legislation in the near future; we may hope, however, that automobile laws will be enacted with more wisdom.

More Extended Guarantees Advocated.

The reduced demand for motor cars which has prevailed of late, and the increased sharpness of competition between agents thus brought about, has led, in a good many isolated instances, to the offering by the agent to his customer of some sort of a guarantee in addition to that usually given by the manufacturer.

With a slackened demand for cars and an increased disposition on the part of prospective customers to take into account the element of future repair expense, agents have occasionally found that a sale could be closed by offering a personal guarantee relative to future maintenance costs when all other inducements failed.

Such guarantees have sometimes insured the purchaser against a repair expense exceeding a very small sum per month for a period of time such as one year, and in other instances the agreement has been made that parts found defective within a given period, usually one year, are to be replaced free of charge.

There is no doubt that such a guarantee made by a reliable agent is a strong incentive toward buying a car, as there are a great many prospective buyers who, while ready to invest a goodly sum of money in the first cost of a car, have well developed and sometimes greatly exaggerated ideas as to the bills for repair parts which they are likely to be called upon to meet when the car is put into service. It seems decidedly illogical, however, for the agent to offer his customer a guarantee, the natural source of a guarantee on apparatus being the maker, and not the vendor thereof. The manufacturers' "standard warranty" is a form of words which is almost entirely discounted by the average customer, who regards it rather as a disclaimer of liability after a very limited period than as a valuable guarantee.

Conditions have changed very materially since the regular forms of warranty in use by most American manufacturers were formulated and adopted. Alloy steels and special anti-fatigue materials have taken the place of common metals, and development in the direction of the correct proportioning of parts has gone on apace. Breakages of parts caused by defects therein are now relatively uncommon. There was probably some justification for the very restricted and somewhat illusory nature of the standard warranty at the time it was originally put into force, but it seems beyond question that those reasons which led to the formulation of so illiberal a guarantee are much less effective at the present time than formerly. Occasionally there is to be noted in the announcement of an unattached manufacturer the statement that his product is guaranteed for a year from the date of purchase thereof, and the cars of one of the best known foreign makes are guaranteed against defects for the life of the vehicle.

Manufacturers should not forget that a tangible guarantee is interpreted by the buying public as an expression of good faith, and of confidence in the excellence of the product sent out on the part of the producer, and that the absence of a "guarantee which guarantees" is often held to indicate the reverse.

Without at this time reopening the question of the actual value to the customer of the present forms of standard warranty, it may be proper to express the hope that under the improved conditions now existing the guarantee may soon be liberalized to the extent which the times seem to warrant.

Incorporating a Magneto in the Flywheel.

The adaptation of the engine flywheel or a properly formed soft iron extension of the same to perform the function of the rotating inductor of a magneto in connection with stationary coils in close proximity therewith is an expedient which has been considerably used as a source of ignition current for stationary engines, and in a few instances for automobile motors.

In a recent preliminary announcement of a company which manufactures cars on a large scale an arrangement of this kind is shown in connection with the enclosed flywheel of the inlet type power plant, the rotating conductor being carried by the flywheel, and the stator carrying the magneto and the coils in which the induced currents are generated being a stationary spider, the whole combination being carried within the flywheel casing.

It has always been considered a desideratum to render the auxiliaries of the motor as nearly as possible integral parts of the same, and this construction achieves this end in a high degree, so far as the source of ignition current is concerned, the magneto being as much an integral part of the power plant as the clutch. The demand for "cleanness" and simplicity of external appearance of the motor is satisfied in a high degree by such arrangements that involve the concealing of a part hitherto separately mounted. Obviously no gearing or any other kind of special connection is required when such a magneto arrangement is used, and there is no such thing as disarranging the timing of the electrical impulses when the parts are once adjusted. A magneto generator so located is inaccessible in a high degree, but as there are no moving contacts or moving wires involved, and as the low tension current only is developed in the magneto itself, this should not necessarily prove a serious practical disadvantage. It is not difficult to believe that by following the best practice in insulation the live conductors within the engine case, and thus presumably exposed to oil splash, may be rendered free from any serious danger of breakdown for extremely long periods.

If the right relation is secured between the form of the inducing rotor, and the wire inductively exposed to its influence, each electrical impulse may be made of such length as to permit of an adequate timing range. As it is hardly practical to locate the make and break mechanism at the generator itself, this must be carried on a shaft of the motor in some accessible position.

The tendency toward "self containedness" and toward the attainment of an external appearance of extreme simplicity has become so strong among designers, and has been so eagerly approved by the general public, that it will not be strange if the enclosed low tension flywheel magneto may meet with a degree of favor which it did not achieve at its earlier appearances. There are no obvious electrical or mechanical difficulties in the way of its adoption, and there may be certain advantages in having the magneto "built into" the motor in a manner which renders it inseparable therefrom.

Automatic Transportation.

The public is usually ready to discourage the practical and to believe in the impossible. A striking instance of this is offered by the present situation in the transportation field. It is very difficult to finance a company for the manufacture of motor trucks, although such an enterprise, if correctly managed, should afford an almost certain prospect of good dividends. To be sure, there are numerous difficulties to be overcome in bringing out a new truck, but their nature is well known and the working out of the details is only a matter of care for experienced men. Once the design of the truck is perfected the market is ready, and there are no difficulties in the manufacture other than those offered by the highest grade of pleasure car work.

In contrast to the difficulty in obtaining money for such a reasonable, non-speculative enterprise as the foregoing is the apparent ease with which promoters are getting capital for what they term "automatic transportation" in some of our Middle Western cities.

Briefly, the scheme is to install an outdoor system similar to the familiar "cash carrier" system used in stores, the cars to be electrically operated and controlled from a central station. For city routes these cars would run in concrete conduits, while in the open country the track would be laid on poles, "8 to 20 feet from the ground." The articles carried would include "anything from a letter to a ton of coal," according to the promoters.

The idea is an attractive one and undoubtedly has certain possibilities. But a brief consideration of the numerous details which must be worked out, the few places where such a service would pay, the tremendous difficulties which must be overcome in getting a working schedule in cities where the carrying business is large enough to pay for the installation, and last, but not least, the long fight with "vested interests" before rights of way could be secured should convince anyone considering investment that such an enterprise is not likely to reach a practical working basis during the present decade.

Is a Motorcycle a Motor Vehicle?

The automobile law of the State of Pennsylvania provides that drivers of motor vehicles must register and become licensed. The authorities in charge of the execution of the statute assume that the term "motor vehicle" covers the motorcycle, and those driving motorcycles are compelled to register and take out a license. It is a question, however, whether a motorcycle is a motor vehicle. Ordinarily speaking, a vehicle might be said to include anything that is capable of carrying either persons or property. The term is comprehensive enough to include a railroad train or a street car, but we all know that the automobile laws by the use of the term do not mean these vehicles. Almost all of the automobile acts expressly define the words "automobile" and "motor vehicle," and in none of the laws does the term "motor vehicles" cover motorcycles. In New Jersey there are specific provisions in regard to motorcycle drivers. From a consideration of all the automobile legislation in the United States, it would seem that the Pennsylvania authorities are straining a point in demanding a license from motorcycle drivers under the automobile law. It can hardly be said that it was the intention of the Legislature to control those operating motorcycles when the motor vehicle law of that State was enacted.

Fuels for Automobiles.

(From a paper by Dr. Fritz Warschauer presented to the Association of German Chemists at Berlin.)

For explosive engines in general gaseous, liquid and solid hydrocarbons are available as fuels. However, if the fuel must be stored in large quantities and carried along over great distances—conditions which obtain in connection with the automobile—liquid hydrocarbons are found most suitable. They are preferable to the gaseous fuels on account of their greater heat density, i. e., amount of heat per unit of volume. As compared with solid hydrocarbons they possess the advantage that it requires only a single change of state in order to render them adapted for combustion in the motor. The solid hydrocarbons must first be transformed into a liquid, from which alone they can be changed to the gaseous state.

Among liquid hydrocarbons the following three kinds deserve consideration as motor fuels:

1. Olefiant hydrocarbons.
2. Aromatic hydrocarbons.
3. Alcohols.

Which one of these three series is to be used depends in the first place upon their price. Technical considerations are only of secondary importance, but cannot be entirely disregarded, as will be seen further on.

The most important technical considerations determining the value of the hydrocarbons with respect to their adaptability as automobile fuels are the following:

1. The hydrocarbon must possess a low temperature of inflammation, and it must be possible to ignite it without preheating.
2. It must be of the greatest possible uniformity chemically.
3. It must burn as completely as possible without appreciable deposits, and quite odorless.

Let us now consider the various hydrocarbons, to see on the one hand how the question of price may be solved to the greatest advantage, and, on the other, how the technical requirements may be best satisfied.

The accompanying table gives the chemical composition, the lower heat value, the consumption per horse power hour and the price per hundred kilograms for all of the most important hydrocarbons. The prices stated cannot be claimed to be absolutely correct, as they depend upon market conditions. In order to also introduce a gaseous fuel for purposes of comparison, acetylene has been included in the table.

Fuel.	C. Per Cent.	H. Per Cent.	O. Per Cent.	Lower Heat Value. (Calories.)	Consumption Per H. P. H. (Grams.)	Price Per 100 Kg. (Marks.)
Gasoline	85	15	....	10,500	260-350	34
Kerosene	....	....	....	10,100	360-400	17
Benzol	92.3	7.7	....	9,600	220-340	42
Naphthalene	93.8	6.2	....	9,600	260-340	16
Alcohol	52.2	13	34.8	6,000	360-400	28
Benzol-Alcohol	....	....	....	7,580	250-320	25
Acetylene	92.3	7.7	....	12,200	146	160

GASOLINE.

Among the olefiant hydrocarbons gasoline (German benzin) deserves first mention. With its aid the automobile has conquered its way through the world. It is the automobile fuel par excellence, and most perfectly meets all the requirements made of a hydrocarbon used as automobile fuel. It is different, however, with regard to the matter of price. The price of gasoline rose so much during the past year that earnest endeavors were made to break up its monopoly. The rapid rise of gasoline prices is, of course, a consequence of the increasing consumption of this fuel. Germany's gasoline consumption for the current year is estimated at about 120,000 tons. The annual increase in the consumption is estimated at about 20 per cent. Of the 120,000 tons mentioned, about 70,000 tons are used in laundries, rubber factories and fat extraction installations, and also as a substitute for turpentine, so that the consumption of gasoline in automobiles amounts to about 50,000 tons. Whether the increase in price can be traced back to a scarcity of petroleum appears very doubtful, for the reason that in the case of a liquid product of nature, derived from springs, there is no means of ascertaining the quantities yet remaining, as is possible in the case of saltpetre, for instance.

It seems rather that the production of light or high test gasoline, which is the best adapted as automobile fuel, cannot long keep step with the constantly growing demand. This is due to the fact that the United States, formerly the chief source of supply furnishing Germany with a crude oil containing a comparatively large proportion of light gasoline (about 10 per cent.), has almost entirely disappeared from the German gasoline market. The Dutch East Indies, Russia, Galicia and, most important of all, Roumania, have been in recent years the chief sources of supply of the crude product. The oil produced in these countries, and especially that coming from the Dutch East Indies, contains a much smaller proportion of light gasoline than the American oil. In addition to this the petroleum industry is confronted by the constantly increasing demand for light gasoline, with the unpleasant condition of a large excess of partly viscous, partly solid, products, for which up to the present no sufficient market has been found. Whether the automobile movement will indirectly create a market for these products by bringing about their use for the suppression of road dust is still an open question.

HEAVIER DISTILLATES.

It is, therefore, only natural that the petroleum interests and the gasoline refiners are endeavoring to curtail the refining of crude petroleum to light gasoline, and are seeking to introduce the heavier grades of gasoline and even kerosene as fuels for explosion motors. We need here only make mention of the several grades of heavy gasoline which have recently been placed on the market by the manufacturers under special names—Autonapht, Motonapht, Borneoxin, Motorin, etc. These grades of gasoline, of a specific gravity of .750 to .770, may, aside from the above mentioned reasons, be sold at a lower price by the refineries for the reason that the tariff on them is considerably less. While the tariff on light gasoline of a boiling point up to 120° amounts to 7.75 marks, the grades referred to in the tariff schedule as heavy gasoline pay only 2 marks for 100 kilograms, in so far as the use of the gasoline as motor fuel is placed under the control of the tariff officials.

Recently attempts have been made, apparently by means of another than the thus far customary process of distillation, to refine crude petroleum so as to produce a light hydrocarbon, and at the same time a substitute for turpentine. This product is to be marketed under the name of Rapidin. About the process to be employed nothing is yet known, and the regular manufacture of the product, which is to be carried on in Birkenwerder, near Berlin, has not yet begun.

COMPOSITION OF GASOLINE.

As regards the composition of automobile gasoline, this is quite different according to the origin. Thus, for instance, the specific weights of the fractional distillates of Russian crude oil are materially higher than the corresponding fractional distillates of American petroleum, although the boiling point may be the same for both. This proves that a test of the gasoline simply with respect to its specific gravity admits of no definite conclusion whether it is specially suitable for automobile use or not. A statement of the upper and lower boiling limit would be a much better and more important criterion of the properties of the gasoline for automobile use. Until recently automobile gasoline was sold almost exclusively on the basis of its specific gravity. Since some time, however, the gasoline refiners do not give any kind of guarantee with respect to the specific gravity. Even though this may seem quite justifiable, it would still be desirable that the boiling points be stated, which until now is not the case, however.

ADVANTAGES OF LIGHT DISTILLATES.

The reasons why light gasoline is given a preference over the heavier grades are of a technical nature. An important condition tending to the complete combustion of the charge in an explosion motor is the formation of an always uniform gasoline-air mixture. The components of heavy gasoline do not all possess the same degree of volatility. In consequence, if air is led through the whole supply of gasoline, all the more volatile components are carried off first, and after these have been consumed the less volatile portions are carried along by the air. It is, therefore, obvious that an always uniform composition of the explosive mixture is the more difficult to obtain the less uniform the composition of the gasoline. The boiling point of hydrocarbons is of great importance in connection with their gasification, because the vapors of gasoline of high boiling point are naturally heavier, and a uniform mixture with the air is more difficult to obtain. This results in more or less incomplete combustion in the motor.

CRUDE OIL.

The substitution of petroleum itself for the product of distillation of petroleum for use in automobile motors is naturally a pet idea with petroleum interests. There are, however, technical difficulties opposed to its realization, which so far have not been fully overcome. A direct gasification of the petroleum without heating is impossible, on account of the high boiling point. Special heating devices, with the aid of which the petroleum can be brought to a sufficiently high temperature, are necessary to vaporize it.

Petroleum distills only between 170° to 250° C. It must, therefore, be raised to a temperature of 250° before being ignited. This may either be done within the vaporizer or carburetor itself, either by means of the exhaust gases, whose temperature lies betwen 400° and 500° C., or by means of a special burner; again, this temperature may be produced within the cylinder by means of high compression.

COAL TAR OILS.

Of the olefiant hydrocarbons other than petroleum and its derivatives, the distillates of coal tar deserve attention. The latter, which possess a substantially higher boiling point than the distillates of petroleum, have so far been almost exclusively used only for stationary motors, as, for instance, the Diesel and Trinkler motors. If, however, it should be found possible, by means of the Krey process, to transform the heavy coal tar oils of high boiling temperature into lighter products of lower boiling temperature, by distillation under pressure, then almost unlimited quantities of cheap fuel of native production would be available.

All of the olefiant hydrocarbons mentioned possess about the same calorific power, viz., about 10,000 calories.

BENZOL.

We now come to a consideration of the aromatic hydrocarbons. As regards benzol, its price is at present considerably more advantageous than that of gasoline, as 100 kilograms cost only 22 marks. This is the most important reason why benzol has recently come into the foreground of public interest. A complete substitution for gasoline is, however, not even dreamed of by the German benzol trust (Deutsche Benzolvereinigung). As we have already seen, the total consumption of gasoline for automobile purposes in Germany amounts to about 50,000 tons per year. As the economy of benzol is lower than that of gasoline—according to the Daimler Motor Company the proportion of the respective consumption is about 52 of gasoline to 57 of benzol—about 60,000 tons of benzol would be required per year to meet the demand for automobiles alone. But the total production of benzol in Germany at present amounts to only 60,000 to 75,000 tons. However, during the past year a large number of new coke works have been installed at which the by-products are also recovered. No definite figures could be obtained regarding the resulting increase in the production of benzol. It seems, however, that the intention is to introduce benzol only for use in commercial cars in large cities, as no arrangements have been made for distributing it throughout the country. The gasoline stations distributed over the whole of Germany will probably this year reach the 11,000 mark, about 6,000 of these stations being controlled by the German-American Petroleum Company and the United Gasoline Works, while about 5,000 are being established by the German Gasoline and Oil Works in Regensburg. In contrast to these figures there is a total of only fourteen benzol stations, according to a prospectus of the Daimler Motor Company.

CHEMICAL AND PHYSICAL PROPERTIES.

Now, as regards the technical adaptability of benzol for motor purposes, as compared with the mostly non-uniform olefiant heavy hydrocarbons, it possesses the advantage of an always uniform composition. A further advantage of benzol, as well as of all aromatic hydrocarbons, in comparison with the olefiant series, consists in the fact that one may use a higher compression, which results in a higher efficiency of the motor. With the olefiant hydrocarbons, if the compression exceeds five atmospheres, preignition takes place, while coal tar hydrocarbons in a gaseous state and mixed with air will withstand at least twice this compression without danger of self ignition. This behavior of the olefiant hydrocarbons on the one hand, and the aromatic hydrocarbons on the other, seems to depend upon their chemical structure. While the olefiant hydrocarbons are readily broken up into small fractions the aromatic series, on the contrary, possess the not readily breakable benzol chain. Not only their different structure but also their chemical composition serves to explain this different behavior. While the olefiant hydrocarbons contain 14-15 per cent. hydrogen, the hydrocarbons of the aromatic series contain only 7 per cent. hydrogen, i. e., only one-half as much as the olefiant series. The greater the proportion of hydrogen in a hydrocarbon, the greater its volatility and inflammability. This again leads to the conclusion that the limit of compression is inversely proportional to the hydrogen content of the hydrocarbon.

DEPOSITS.

In spite of these advantages it has thus far been found difficult to perfectly and completely burn benzol in an automobile motor. Frequently, in the case of incomplete combustion, carbon in the form of soot would settle on the working parts of the motor and become mixed with the lubricating oil. As a consequence stoppages and frequent cleaning of the valves were unavoidable. These disadvantages, however, were only present as long as a gasoline carburetor was used for feeding benzol. Since it was recognized that benzol, on account of its different properties, requires different means for its proper combustion, and that especially the admission and control of air must be effected in a different manner in the case of benzol as in that of gasoline, quite a number of designers have succeeded in producing suitable benzol carburetors.

Among the disadvantages of benzol it is to be mentioned that on account of its high temperature of solidification it is likely to give trouble in cold weather. After benzol has once assumed the crystalline state it only changes back to the liquid state at 7 to 8 degrees centigrade (46° Fahr.). The danger of freezing of benzol could perhaps be met by placing the fuel tank close to the motor, or by heating it by means of the exhaust gases.

A further disadvantage of benzol consists in its sulphurous impurities, of which thiophene and sulphuretted hydrogen deserve special mention. On the combustion of these sulphur products in the motor, sulphurous and sulphuric acid are apt to form and to attack the parts of the motor. There is, of course, here also a possibility of overcoming the disadvantage by purifying the benzol of the sulphur products. But a treatment of this kind would undoubtedly increase the price of benzol.

NAPHTHALENE.

As another representative of the aromatic series adaptable for motor purposes we must mention naphthalene. Its extraordinarily low price—it costs about one-half as much as benzol and about one-quarter as much as gasoline—would seem to insure for it at once the premier place among motor fuels. The conditions of its production are also exceptionally favorable. While coal tar in general contains only about .5 per cent. benzol, its content of naphthalene is 7-9 per cent.

From a technical standpoint there is this difficulty, that naphthalene, as a solid hydrocarbon, must first be transformed into the liquid state before it can be gasified. This necessarily involves troublesome or tedious starting. Another difficulty resides in the fact that naphthalene, as soon as the motor is stopped, readily solidifies again, and is apt to block the fuel passages. It would seem, however, that this difficulty is not unavoidable. Already in 1904 two French manufacturers, Chenier and Lion, built an automobile motor to run on naphthalene. In contrast to an ordinary carburetor, which consists of one main portion, they made use of a gasifier consisting of two separate parts, communicating through pipes. They used the naphthalene in the form of balls, which dropped from one vessel through an opening into a second one, which latter was heated by the exhaust gases.

The use of naphthalene in stationary motors apparently no longer offers any difficulty. I would like to mention the naphthalene motor of the Gasmotorenfabrik Deutz, which was exhibited last summer at the Inventors' Show. It was an ordinary Otto motor, which, by the addition of some accessory apparatus, was adapted for running with naphthalene. This motor was started and run with another liquid fuel until the water bath reached the boiling point, whereby the naphthalene was liquefied.

It might be thought that on account of its high carbon content naphthalene would tend even more than benzol to incomplete combustion and sooting of the motor. This, however, is not the case. The valves and the frictional surfaces of the piston remain clean and tight. The exhaust is practically free of soda. These apparently contradictory phenomena are probably explained by the fact that naphthalene possesses a considerable vapor tension even at its melting temperature. The usual spraying devices produce a dense mixture of liquid particles which are distributed like a fog in the air drawn in. Each of these particles, on account of the high vapor tension, surrounds itself with a vapor veil, which readily transmits the flame. The imperative condition of a rapid flame propagation through the whole charge is, therefore, here satisfied.

Even though the use of naphthalene for automobile purposes may still be beset with a number of difficulties, it possesses, aside from its low price, quite a series of advantages as a fuel, which make it worthy of considerable attention. Thus, for instance, it can be handled and transported as a solid; its storage is a very easy matter, and absolutely devoid of any danger of explosion.

ALCOHOLS.

Let us now turn from the hydrocarbons proper to their oxygen containing substitutes, the alcohols. With regard to the advantages which the farmers would derive from an increased use of alcohol, so much has already been said that it would be superfluous to dwell on it again here.

The production of alcohol in Germany during the last season amounted to about 450,000,000 litres. Germany's consumption of petroleum, which it is forced to obtain from foreign countries, amounts at present to about 1,100,000,000 litres, but even now 100,000,000 litres are replaced by German alcohol. The production of alcohol, however, does not simply follow the demand, but new fields of application are constantly sought for it and successfully opened.

Other countries as well are eagerly engaged in the application of alcohol for technical purposes. While in France special attention has been paid to the gasification of alcohol since the introduction of the explosion motor, England has approached the question with increased interest only quite recently. The formation of a national alcohol committee has been suggested, to urge Parliament to remove the tax from alcohol for industrial purposes. The committee is also to encourage the construction of light alcohol motors. But even in the United States, where gasoline as a native product costs less than half as much as here in Germany, the use of alcohol as a motor fuel has been seriously considered since the recent passage of a law making alcohol used for industrial purposes tax free.

The price of alcohol in Germany is at present so high that it cannot successfully compete with the hydrocarbons. It is also impossible to predict whether there will be any change in the price, as this depends upon whether the alcohol monopoly will be established or not.

LOW HEAT VALUE.

In its behavior during combustion in the explosion motor alcohol differs very materially from the olefiant and aromatic hydrocarbons. In this connection its oxygen content is of determining influence. The portion of the carbon in the alcohol which is bound to oxygen is in one sense already burned. The consequence is that as a result of the oxygen content the calorific value of alcohol is substantially less than that of the oxygenless hydrocarbons. It amounts to only about 6,000 calories.

In the operation of stationary motors alcohol has so far successfully been used in more than 3,000 installations in Germany. In connection with its adoption as an automobile fuel, its difficult gasification is a disadvantage. With this fuel the motor cannot be readily started. Besides, in case of incomplete combustion, aldehyde and acetic acid are apt to form, which latter may cause rusting of the metal parts. These troubles can, however, be avoided if the charge is preheated and perfect combustion is obtained. The amount of air used for combustion is, however, limited, as with too large an excess of air the alcohol air mixture is difficult to ignite, consequently the admission and control of the air is an important matter in the case of alcohol, the same as in that of benzol. A special carburetor, designed in view of the peculiarities of alcohol, is necessary.

ODORLESS AND EFFICIENT.

Among the advantages of running on alcohol must be mentioned the comparatively negligible odor on combustion, and the reduced danger of fire. Aside from this, in the case of a suitably designed motor, the thermal efficiency is almost twice as high as can be obtained with gasoline. This high efficiency is a direct result of the high compression permissible, which is limited only by the structure of the motor and the inflammability of the charge.

ALCOHOL-BENZOL MIXTURE.

The use of alcohol is rendered substantially more favorable and successful by mixing it with a hyrocarbon, as, for instance, benzol. The addition of benzol materially increases both the inflammability and the calorific power of alcohol. The motor output, therefore, increases while the fuel consumption is reduced. The formation of acetic acid is also prevented by the addition of benzol. Benzol in this case acts as a reducing agent by depriving the acetic acid, which is an intermediary product formed in the combustion of alcohol, of its oxygen. An intermediary product formed during this process is ethane, which during the oxidation is burned directly to carbonic acid and water. These phenomena take place according to the following equations:

$$CH_3COOH + C_6H_6 + 12O = C_2H_6 + 6\,CO_2 + 2H_2O \quad \text{.........} (1)$$

$$C_2H_6 + 7O = 2CO_2 + 3H_2O \quad (2)$$

The benzol-alcohol mixture has proven quite satisfactory in practical operation so far, even in very cold weather. Thorough investigations made by Fehrmann to the order of the Association for the Promotion of Industrial Activity also demonstrated the utility of the benzol-alcohol mixture, among other things. It develops from the report of the International Alocohol Congress held in Paris during December of last year that the Paris motor omnibuses using the benzol-alcohol mixture had until then covered an aggregate distance of 3,570,000 km. and consumed 2,200,000 litres of this fuel, which in Paris is known as Motoline. The use of this fuel resulted in a saving of 310,000 francs, as compared with gasoline.

It has also been suggested to produce mixtures of alcohol and kerosene, and to use them as motor fuel. According to a process of the A. G. Xylolose in Zawadzki, a mixture of alcohol and kerosene is treated with ether, acetone, or similar compounds, in order to make the alcohol a solvent of the hydrocarbon, and in this manner make it possible to prepare a uniform mixture. According to another process, of Guttmann, Herzfeld & Beer, kerosene is rendered soluble in alcohol by adding benzol to the mixture, and the solubility is increased still further by adding also naphthalene, if necessary.

ENRICHING ALCOHOL.

We will not conclude our discussion of alcohol without making mention of some of the numerous admixtures suggested with the object of rendering alcohol more explosive. Although the use of these admixtures has mostly been claimed for gasoline, it would seem that practically they are more adaptable to alcohol.

Some years ago the use of picric acid as an admixture for hydrocarbon fuels was suggested. This suggestion will, however, not withstand a close investigation. Although chemically pure picric acid does not attack metals; when it is mixed with water it acts exactly like an acid. In practice, however, picric acid can be dissolved only in alcohol containing water, and, under these conditions, it forms with the metals very dangerous picrates, which render the combustion of this explosive substance impossible. According to a process of Frederic de Mare in Brussels, these difficulties are claimed to be avoided by the use of nitro benzol as an admixture for alcohol.

Of special interest are the several processes invented by Dr. Roth, of Frankfort, known for his work in the manufacture of explosives. Among other things, he makes the suggestion to increase the explosive power of alcohols or hydrocarbons, or mixtures of the two, by the addition of oxygen carriers, by adding to the fuel ammonium nitrate alone, or in combination with potassium nitrate, or nitrate combinations of the benzol derivatives. According to another process of Dr Roth, the fuels are made more inflammable and explosive by adding acetylene.

A common disadvantage of all these admixtures resides in the difficulty of obtaining the necessary chemicals at different points of the route in case of a long tour. Besides, the price of the fuel is materially increased by these admixtures. From a technical standpoint the addition of salts, like ammonium nitrate, is open to the objection that under certain conditions segregation takes place, and the salt is crystallized and deposited. In addition to this, the content of nitrous vapors of the exhaust gases is increased, and metal parts with which they come in contact are attacked. Of course, the formation of such vapors is not entirely avoidable even in motors running on ordinary hydrocarbons, as at the high temperatures of explosion a partial combustion of atmospheric nitrogen to nitrous and nitric acid always takes place.

ALCOHOL-ACETYLENE MIXTURES.

Probably the only admixture which is free from these disadvantages is gaseous acetylene. The admixture of alcohol with acetylene has been proposed by several others besides Dr Roth. Thus the Americans White and Barker bring a spray of diluted alcohol in contact with calcium carbide, thus forming an explosive vapor known as alcoethin. This fuel is, therefore, a mixture of air, alcohol vapor and acetylene gas. This process, which, besides in America also caused considerable discussion in France, is, however, probably not very practical, for the reason that the acetylene is generated from the carbide directly on the vehicle. Aside from the great weight resulting from the carrying along of the carbide, this process involves the further objection that the acetylene is generated irregularly, especially on account of the vibration on the road.

It will thus be seen that vigorous efforts are being made everywhere to produce a suitable and at the same time low priced automobile fuel. The high importance attached to the fuel question in automobile circles is shown by the fact that the Automobile Club of France, in conjunction with some other interests, is offering a prize of 45,000 francs for a cheap, universally available fuel, and for a device for its proper gasification, which must both be adaptable to all motor systems.

Let us now take a glance at the thus far considered liquid and solid hydrocarbons, and inquire whether in their use as automobile fuels one of the most important requirements made of such fuels, that of odorless combustion, is fulfilled. This question must be answered in the negative. The experience that has been had with other fuels than gasoline has led to the conclusion that each fuel requires a vaporizer designed specially in accordance with its peculiarities, to admit of suitably regulating the admission of the air required for combustion. This seems at once quite obvious if we look into the use of different fuels for other purposes, as, for instance, for illumination.

As the burner of a kerosene lamp is formed differently from the burner of an alcohol lamp; as the construction of a gas burner is radically different from that of an acetylene burner, so, also, the combustion motor must be specially adopted to the peculiar properties of the fuel used. Until now the design of vaporizers for different fuels has been determined entirely by empirical methods. Right here the assistance of the chemist is required by the automobile engineer. By systematic gas analytic quantitative and qualitative tests we would certainly obtain quite valuable data regarding the degree of combustion of the fuel. To use once more the comparison with fuels burned for purposes of illumination, I will quote one of the most important propositions from Stepanoff's "Theory of Kerosene Lamps." It is as follows:

"The efficiency of the lamp is best determined by an analysis of the gases given off."

The same with a suitable change in the wording would also apply to the efficiency of motors.

EXHAUST DEODORIZERS.

Mention should also be made here of the tests in which the incompleteness of the combustion in an explosion motor seems to have been accepted as an unalterable fact, and which were conducted with the object of overcoming the resulting disadvantages, that is, rendering the exhaust odorless. Of the many processes to this end I will mention only three, which are entirely different from each other in principle.

The first of these processes was obviously evolved by a manufacturer who neglected to consult a chemist. According to this process the fuel is directly mixed with some sort of perfume, as, for instance, lavender oil. It is not plain what influence the admixture of such a substance can have on odorless combustion.

The second method which I will mention consists in absorbing some of the exhaust gases by a liquid carried in a tank before they are discharged into the atmosphere. This process hardly takes account of the great quantities of gas evolved at each explosion, nor of the fact that the odorless gases of combustion are also partially obsorbed in this manner, nor of the further fact that the water formed during combustion is condensed and is apt to fill the tank.

A third method makes use of the property of spongy platinum of condensing gases and igniting them, the exhaust gases being led through a pipe filled with this material.

GASEOUS FUELS.

We have now considered all the liquid and solid hydrocarbons, and have seen that their proper gasification involves certain difficulties. The idea, therefore, occurs that gases might be used directly in the automobile motor, which would thus become a true gas engine, thus avoiding the transformation of solid and liquid fuels into gaseous fuels. As already pointed out, in the case of a portable motor the heat density of the fuel is a very important factor. But this heat density is very low in gases. It may, of course, be increased by compression, but equality with liquid hydrocarbons is not nearly attainable in this manner. Thus, for instance, illuminating gas would have to be compressed to 1,700 atmospheres in order to have the same heat content as an equal volume of kerosene. Then it must be considered that illuminating gas under high compression will become partly liquefied, which would result in a non-uniform fuel mixture.

The conditions are more favorable with respect to acetylene, which thermo-dynamically stands at the head of all possible fuels, its heat value being 12,200 calories. Besides this it may be handled very conveniently in the form of dissolved acetylene. According to the process of Claude & Hess, the great absorbing power of acetone for acetylene is mode use of in order to condense acetylene into steel bottles filled with acetone. Under a pressure of 12 atmospheres, one volume of acetone will absorb 300 volumes of acetylene gas.

Motors have already been operated with acetylene, but the high price of this gas has so far prevented its introduction in actual practice.

The Austrian Minister of the Interior has circularized the governments of the different departments requesting them to see to it that whenever contracts for automobiles for government use are let the specifications call for cars of Austrian construction, and to give concessions for motor lines only if the petitioners agree to use native built cars. This action was taken in consequence of a petition addressed by the Austrian Manufacturers' Association to the Minister of the Interior in which the assertion was made that the native industry could only hold its own if given every encouragement

Maintenance and Repairs

Experience with a Friction Driven Magneto.

By "Owner."

Next to the question of tires the question of ignition of a four cylinder engine is the most important one that confronts the automobilist.

Engines, as a rule, operate if the gasoline flows and the ignition is good, and as the stoppage of the gasoline flow means usually only a clearing of pipes or carburetor, the ignition stop is the only one of importance, and therefore the most vexatious of all stops.

Experience proves that dry batteries and storage batteries when fresh are excellent sources of electric current and make an engine free and powerful, but such freshness soon wears off and the engine becomes sluggish and lazy, and missing and back fires and popping in the carburetor are the result until at last there is a complete stoppage or at best a miserable, ignominious crawl to the nearest garage.

The writer has had all these things happen to him and looked forward with hope to some future time when some genius would produce a source of electric current which would obviate the many difficulties of the dry and storage batteries. Of course there is the geared magneto, but this was expensive and involved the making of many changes, and was practically out of the question with the writer's car.

It was therefore with some hope but many misgivings that a certain type of magneto was purchased and attached to the car. This machine is made so that the magneto proper is free to move in grooves upon its base, so that after attaching the base to the frame of the car as near the flywheel as possible the wheel of the magneto may be put in contact with the flywheel by the pressure of a flat steel spring which forces the magneto along these grooves and keeps the magnetic wheel in constant contact with the flywheel of the engine. As this flywheel is 18 inches in diameter and the magneto wheel 3 inches, the magneto wheel revolves six times to one revolution of the flywheel. With a normal number of revolutions of the flywheel, on this engine about 600, the magneto would turn at the rapid rate of about 3,600 revolutions per minute.

It was found at first that at slow speeds, at starting the car or at slow speed on any gear the engine would fire regularly and with good power, but at high speed on any gear the spark would miss quite often, but this was annoying only, and while the full power of the engine could not be obtained with this missing of the spark the results were mainly satisfactory because of the dependability of getting a spark in four cylinders a great part of the time and in three cylinders at all times.

The magneto therefore was used as an auxiliary source of current, the main dependence being placed upon a storage battery, with the result that many times upon failure of the storage battery the car came home in good shape over many hard miles with the magneto doing the work.

One day, however, the storage battery gave out quite suddenly; in fact, a new charge had not lasted 50 miles, and the magneto was switched on to bring the car home; but it seemed impossible to get more than three cylinders to work for any length of time, so, having plenty of leisure, a stop was made and the vibrators were examined.

It was found that each vibrator and contact screw was badly pitted, and they were filed down carefully and made as smooth and even as possible. Some automobilists are very careful in filing platinum and often leave pits in the platinum, thus erring on the side of economy, which is bad practice, because, although platinum is valuable, it is not of much use unless it makes a perfect contact, and pitted platinum is the cause of many misfires, often erroneously laid to wrong adjustment of the vibrator.

This time, however, the platinum was ruthlessly removed until the surfaces of screw and vibrator were clear and bright as new.

The vibrators were screwed in, and the contact screws were adjusted so that they merely touched by the slightest pressure. The results were surprising and satisfactory, and the engine ran as perfectly as if the storage battery had been freshly charged and switched on.

It is not to be understood, or at least it is not my experience, that this magneto will fire an engine as well as a storage battery, because no matter how fast the magneto works there must necessarily be a moment when the impulse of the magneto will not be in proper time with the firing point of some one cylinder; but the result is not so much a clean miss, but rather a slight halt in the perfect rhythm of the explosions, which probably would not be observed in some cars, but in this car is noted by the experienced ear because of the comparatively loud hum of the gears.

The result, therefore, is satisfactory, because of the assurance that if the magneto wheel turns a spark will result, and the sole care is the proper adjustment and dressing of the platinum points, which involves only a slight amount of easy work.

HOME MADE MASTER VIBRATOR.

The writer has recently procured a coil, which was advertised some time ago, in which the primary coil, condenser and secondary coil are all made in unit form and can be separated by a few moments' work. The secondary coil was removed from the box and the primary and condenser were left in their places, making a simple primary coil or interrupter. This was connected between the magneto and the coil on the car to perform the functions of a master vibrator.

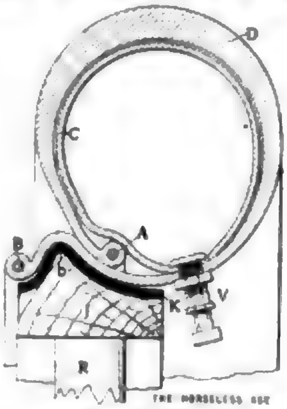
The vibrators on the old coil were "shorted" by bare wire, but the adjustment was carefully retained so that in case the master vibrator failed recourse could be had at once to the original method. The engine runs very smoothly, but the slight missing or halting in the engine has not been corrected.

Sufficient experience has not been had with this arrangement to justify commendation, but it seems that the result should be satisfactory in that the constant need of adjustment of the vibrators would be obviated and a much smoother running of the engine obtained.

The cost of the experience with this home made master vibrator is the best part of it, as the list price of the coil without the secondary winding was $3.50.

A Novel Method of Tire Mounting.

The novel method of tire mounting shown in the accompanying engraving is being exploited by the Wolber firm of Paris, France. The tire is held to a peculiarly shaped rim by two wire hoops, as in the old style Dunlop tires. The form of the rim and retaining portions of the tire is entirely different, however. The rim of the wheel is provided with a retaining ridge. The two hoops A B are of different diameters, and are contained within the beading of the shoe. D C is the inner tube and V the valve. J is the wooden felloe, with the rim K fitted with the ridge *b*. The left part or side of the shoe is made deeper than the right, so that it can bend over the ridge in the manner shown, while the right part bears against the left for a short distance. It has been found during the tests to which this mounting was subjected that the tire was extremely difficult to tear off upon turns taken sharply at high speeds. The tire is readily removed by partially deflating and pushing the bead containing A away from the axial line of the wheel, when the whole tire may be pulled clear in the opposite direction. This tire depends upon the pressure of inflation for its grip on the rim, and it is to be feared that trouble from creeping would ensue in case the inflation pressure was allowed to run low, though this would not entail any valve trouble.



Wolber Tire.

NEW VEHICLES AND PARTS

Two New Knox Models.

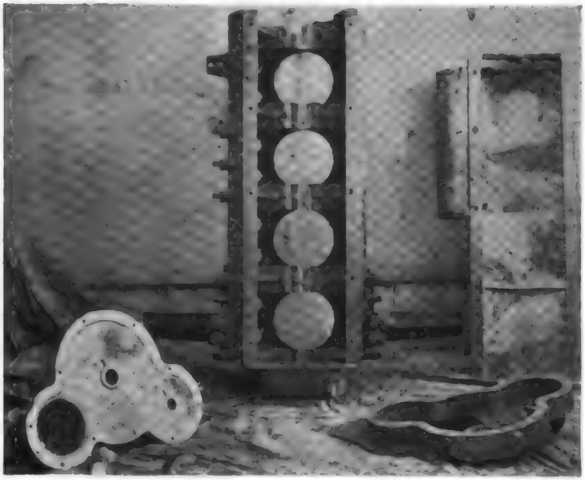
The Knox Automobile Company, Springfield, Mass., has brought out two new models, equipped with water cooled motors, known respectively as Model O and Model M., the former being a five passenger touring car of 40 horse power and the latter a seven passenger car of 50 horse power. Both chasses may be had equipped with "sportabout" or with closed bodies.

Model O is very similar to the Model L car, which was fully described on page 617 of the October 23, 1907, issue of this journal, to which the reader is referred. It will be remembered that the Model L engine possessed the peculiarity of having the water cooled heads and their jackets separable from the cylinder barrels and their jackets, the water connections between the head jackets and the jackets of the cylinders proper being made by means of outside water connectors fitted with ground joints. All valves were located in the heads and tappet operated, and the two parts of the cylinder structure were bolted together over a copper gasket.

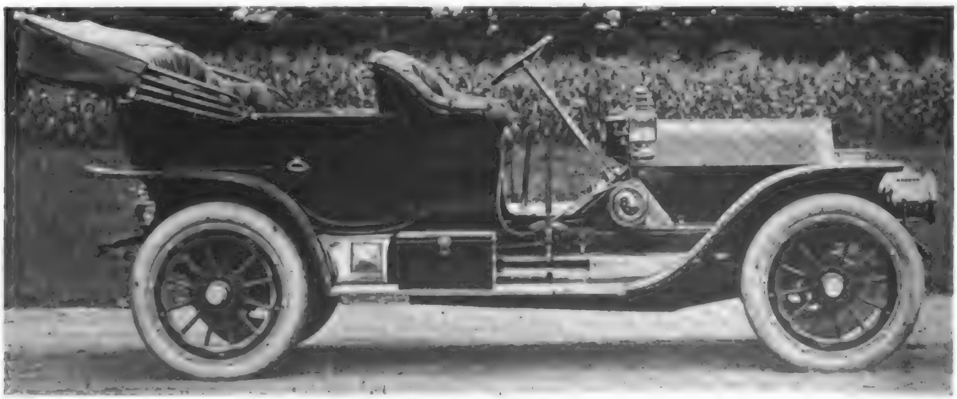
This construction has been followed in the Model O engine, but some few changes have been made. The Model O cylinders are larger than those of the L, their bore being 4⅞ inches and the stroke 4¾ inches.

The water outlet manifold from the four heads was formerly located above them, the outlets being in the tops of the heads. In order to take off any one head it was thus necessary to remove all outflow connections to this manifold. In the present construction the outflow connections and the manifold are on the right hand side of the heads, and any cylinder head may be removed by removing its four holding bolts and its own outflow flange connection, the cylinder then being capable of being lifted clear of the water manifold. The same clamping device is now utilized for the double purpose of making fast the ground flange connection from the manifold to a cylinder head and for securing the outside water connection leading from the cylinder barrel jacket to the head jacket. The illustration presented herewith clearly shows this construction. A change has also been made in the water passages within the head jacket, so that circulation is bound to be absolutely positive and no possibility remains of the formation of any dead water spaces. Both inlet and exhaust ports are now located on the left side of the heads instead of the exhaust leaving on the left side and the charge entering on the right side. The exhaust manifold is located above the intake pipe, and both are secured to their ports by the same clamps, four in number. The single cam shaft and all valve rods are, as formerly, on the right side, but are not interfered with as formerly by the presence of the mixture piping. The magneto, the timer for the battery system and the gear circulating pump are all on this side, the carburetor only being on the left of the engine. The Model O engine is provided with a duplicate set of jump spark plugs, one plug of each set being fitted to each side of each cylinder, near the top of the barrel section. Any standard magneto is fitted, as ordered, and the battery system consists of a timer on a vertical, spiral gear driven shaft and a quadruple dashboard coil with storage cells.

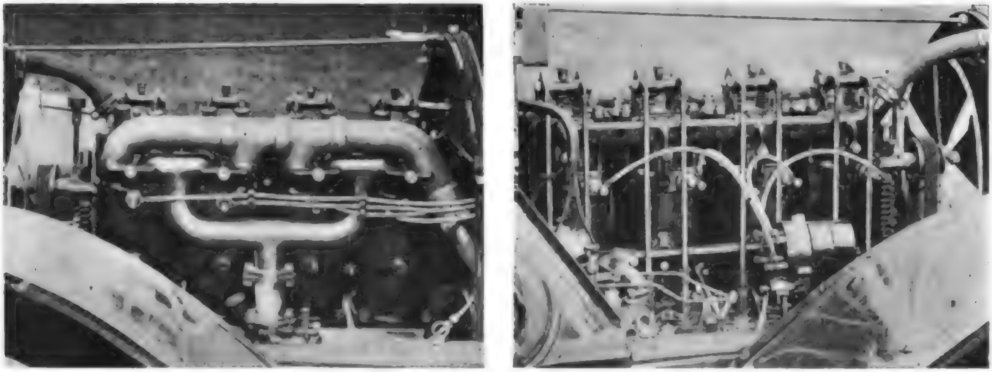
The running gear and transmission of this car will be found described in the October



Aluminum Crank Case of Knox Model M.



Knox Car Model O.



Left Side. Engine. Right Side.

10, 1906, number of The Horseless Age. Three point suspension, a unit power plant construction, straight line shaft drive and three speed and reverse sliding gear transmission characterize this car.

In the new model the wheel base has been increased to 115 inches and the frame is inswept at the front. The fenders have been made continuously flush with the running boards, sheet aluminum being used, and the tie rod of the steering linkage has been moved back of the axle. The radiator is now over the axle and all weight is between the springs. The clutch now used is of the De Dion flywheel type, consisting of a single plate carrying a large number of cork inserts, which is forced into engagement by a multiplicity of spiral springs. An entirely new body has been designed, giving a lower effect. The doors are 2 inches wider than formerly and somewhat curved outwardly to carry out the general body lines. A very wide and roomy tonneau is thus secured.

As far as cylinder construction is concerned the Model M 50 horse power engine is a replica, on a larger scale, of the Model O. Its cylinders have a 5½ inch bore and its stroke is also 5½ inches. The Model M car, outside of the engine, is practically identical with Model G, which was described in full in The Horseless Age of December 27, 1905. It will be recollected that this is a double chain driven car, with a four speed and reverse, ball bearing selective change speed gear of the Mercedes type, employing two bevel driving pinions in constant mesh with the double bevel gear on the differentail case, carried by the divided countershaft. In this construction only two more gears are in action on any of the lower speeds than on the direct drive. The wheel base has been lengthened to 127 inches, and 36 inch wheels are used front and rear, with 5 inch tires in the rear and 5 inch or 4½ inch in front, at the option of the purchaser. No change has been made in the spring suspension, which consists of half elliptics all around. A double universal joint between clutch and gear box has been added to give assurance against shaft binding. A new straight line body of larger dimensions, with more comfortable swing seats, has been designed and the weight of the engine is now all back of the front axle.

The following are some details concerning the M engine. The crank shaft is of nickel chrome steel of the five bearing type, formed from the solid slab, and is 1⅞ inches in diameter throughout, with pins lengths of 2½ inches and main bearing lengths of 3 inches, except at the flywheel end, where the bearing is 4 inches long. Bushings of Parsons white bronze are used throughout. The single cam shaft, with its eight cams, is tooled out of a solid bar by an automatic tool which reproduces the exact cam outlines. It is then heat treated and ground to exact size. Its bearings are five in number, bronze bushings being used.

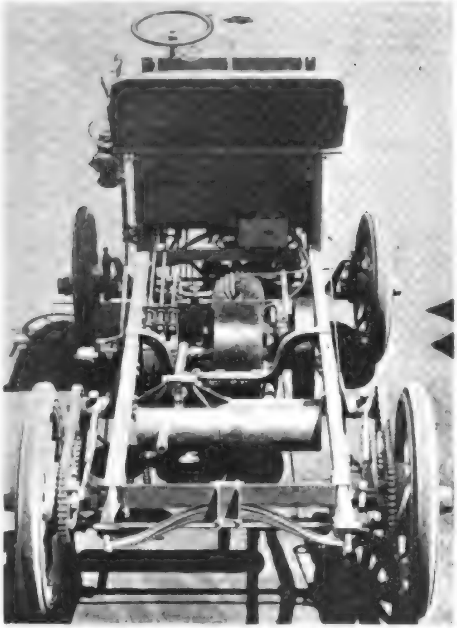
The pistons have three 3/16 inch diagonally split rings above the pin and one below and the piston pins are of hardened steel fast in the piston bosses, turning in hardened steel bushings in the connecting rod ends. The rods are steel tubes of very light and strong construction, and their tips are bushed with white bronze. They are of the four bolt type. An oil baffle plate is used in the lower end of each cylinder, the lubricating system being a modification of the De Dion and already described in these columns. The cam shaft carries at its rear end, within the case, the spiral gear which operates the timer shaft above and the oil pump below. Wide face gears of large pitch are used to drive the cam shaft and an auxiliary shaft which carries the water pump at its rear end and the magneto toward the front. No intermediate gears are used, and the gear housing is bolted to the main crank case. The cylinders are finished in baked enamel.

An aluminum crank case of the "single piece type" is employed, a bottom view of which is presented herewith, the sides and rear end being one casting and extremely rigid. The front end is closed by a removable piece, shown in the figure below and at the right of the main casting, which forms the housing for the timing gears. This is fitted with an aluminum cover shown at the left of the main casting. The oil pan, which bolts to the bottom of the main crank case section, is shown to the right thereof and contains an oil reservoir of 1½ gallons capacity fitted with a readily removable strainer for catching the larger impurities in the oil. On each side of the rear end of the main casting are brackets to which the supporting arms are secured. Any length or form of arm may be employed to fit the case to frames of varying width. At the front end of the case a single point of suspension is provided, thus giving the engine a three point support. By removing the gear housing at the front end, and freeing all bearings, the crank shaft may be drawn out of the case. In connection with the lubrication system it should be remarked that the oil is pumped from the crank case reservoir, where it has already been strained, to a combined strainer and adjustable bypass accessibly located on the left side of the motor. The lubricant is thus doubly strained, and in practice this last mentioned strainer, which is of fine mesh and readily gotten at, is the only one which requires attention. An oil gauge on the dash in connection with the adjustable by-pass gives full control of the pressure of lubrication. The lubrication system in general remains unchanged.

Knox Light Delivery Wagon.

The Knox Automobile Company, Springfield, Mass., have recently brought out a single cylinder delivery wagon chassis known as Model No. 20, which is capable of handling useful loads up to 1,500 pounds, and is adapted for the reception of any ordinary form of body.

The frame is of 2x3x¼ inch angle steel, hot riveted, and consists of straight side members and four straight cross members. One of these over the front axle carries the head end of the motor by means of a special hanger. A fifth cross member of angle steel located toward the rear is dropped to carry the crank case of the en-



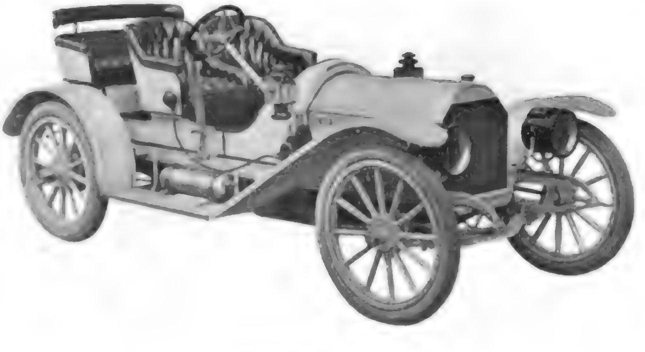
Chassis of Knox Ten Horse Power Delivery Wagon.

gine. The front springs are semi-elliptics, shackled at their rear ends, and fastened in front to cast bronze spring hangers bolted to the front corners of the frame. These springs are 38 inches long, consisting of 1¾ inch leaves of one-quarter inch stock, six in number. An auxiliary cross spring is also made use of. This is of the half elliptic leaf type, and it is clipped at its centre to the frame cross member over the front axle. Its ends strike the rear axle when the body is sufficiently depressed and undue stresses on the main springs are thus prevented. The rear spring is of the platform type, the side members being 41 inches long, and the cross member 33 inches in length, 1¾ inch leaves being employed. The forward ends of the side spring members slide in the countershaft brackets to allow for chain adjustment. Twelve spoke 36x3 inch wheels are used in the rear, and the front wheels are 32x3 inches, with solid tires. Two Timken roller bearings are used in each, which are supplied with grease from a compression cup in the hub. The front axle is a 2½x2 inch Timken I beam, and the rear axle is of 1¾ inch solid of square section. The rear wheel brake drums are integral with the driven sprockets, and bolted very securely. These drums are 11 inches in diameter, and have 3 inch faces. Internal expanding, self adjusting, cam actuated shoes of cast iron faced with copper are used, and are operated by a side lever. The equalizing rod runs across to the rear of the axle. Steering is by means of a nearly vertical column and wheel, with Ross steering device, and a linkage provided with spring ball joints with grease cup lubrication. Spark and throttle levers are mounted on the stationary shell of the steering column, and the control of the car is on the left side. The countershaft is carried in two very substantially ribbed cast brackets, bolted to the side frame members. These brackets are capable of horizontal adjustment in order to take up slack in the chain from the engine to the countershaft. A plate, with vertical serrations is riveted to the outside of the frame member, and a corresponding serrated plate is fixed to the back of the countershaft bracket. This allows of the brackets being placed in the correct horizontal adjustment to suit the chain length, and of being held there by means of four bolts. The distance rods which adjust the rear chains are made fast to the rear axle (their rear ends being made in two parts which bolt together), and their front ends are free to turn on the tubular countershaft casing, a grease cup being provided for lubrication at these points. The front ends of the rear springs slide in the countershaft brackets when the distance rod lengths are adjusted.

The countershaft casing is a large steel tube in which the divided shaft is carried on four Hyatt roller bearings, with grease cups, two in the brackets and two in the differential case. This case is anchored against rotation to a cross member by a slotted arm which allows for the adjustment of the shaft. The differential is of them spur type, and the number of teeth on its sprocket is variable up to thirty-eight in order to give a wide range of gearing. The tooth number of the driving sprockets on the countershaft ends is also variable, but the teeth on the rear wheel sprockets are forty-two in all cases. A five-eighths inch, one inch pitch detachable chain is used for the final drive, and five-eighths inch, 1¼ inch pitch detachable chain for the drive from the engine to the countershaft. Variation in the number of teeth in the engine shaft sprocket also allows of other gear relations. The two speed and reverse planetary gear carried on the left end of the crank shaft is the same as used upon the larger Knox commercial verhicles. In addition to the low speed

BALTIMORE
LUNCH

Knox Ten Horse Power Delivery Wagon.



1909 Moon Roadster.

and reverse drums a brake drum is provided upon which is constructed a band operated by a pedal. Maple blocks are used in the high speed clutch of this gear, and they have been found to give very long and satisfactory service. Low and high speeds are engaged by means of a short hand lever at the top of a vertical column to the left of the operator, and the reverse is secured by means of a pedal. Matters are so arranged that the planetary gear may be slid out under the side frame member, without the necessity of disturbing the engine.

Grease is supplied the planetary by means of a large compression cup on the left end of the transmission shaft, where the starting ratchet is also located. On the other end of the engine shaft is a cup which furnishes grease to the crank pins through channels in the shaft.

The motor is the regular single cylinder, horizontal 5x8 inch, pin cooled Knox type, practically no changes having been made in it except that the valves are now more accessibly inserted. Its lubrication is by means of a Lavigne three lead force feed oiler, with bleeder test. This is mounted on the cross member which supports the engine head, and is spur gear driven, the driver being keyed to the horizontal fore and aft shaft, which runs along the right side of the engine, operating the exhaust valve, and also carries the fan pulley. The leads supply the two main bearings and the cylinder wall. On the extreme front end of this horizontal valve and fan shaft is carried a Connecticut timer instead of the usual make and break box. The single unit Connecticut vibrating coil is carried on the outside of the body on the starting crank side, and the dry battery in a box under the driver's seat. A cooling fan of the usual construction, delivering its blast upon the cylinder head and driven by a 2 inch leather belt, is used.

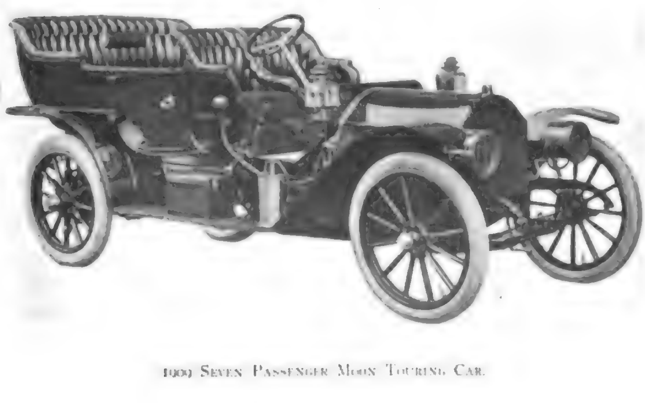
The gasoline tank, holding about 17 gallons, is located under the operator's seat, and connects with a Schebler carburetor. Provision is made for easy access to lubricator, timer and carburetor through large side panels under the operator's seat. A large muffler of Knox design is mounted over the rear axle, and provided with a horizontal outlet.

When equipped with a standard express body the weight of this wagon is stated to be 2,505 pounds. A sheet metal sod pan is fitted to protect all working parts. The wheel base is 85 inches, and the gauge is 56 inches.

The chassis is intended to combine extreme simplicity with low operating expense and high endurance, and is primarily intended for speeds not in excess of 15 miles per hour, with full load, although a wide variation in this regard may be secured by changes in sprocket relations, due regard being had to the load to be carried.

The 1909 Moon Models.

We illustrate herewith two models of the 1909 product of the Moon Motor Car Company, of St. Louis, Mo. These cars present no radical difference in construction over the product of 1908, which was fully described in The Horseless Age of March 13, 1907, and June 10, 1908. Two models are manufactured, one a seven passenger touring car with 121 inch wheel base, and a five passenger touring car and a roadster with 110 inch wheel base, both models equipped with a 30-35 horse power motor. The Bosch high tension magneto only will be used, instead of the double ignition system, the gear ratio on third speed increased and the brake surface enlarged. The wheels of the roadster have been increased to 36 inches, otherwise the cars are the same as last year.



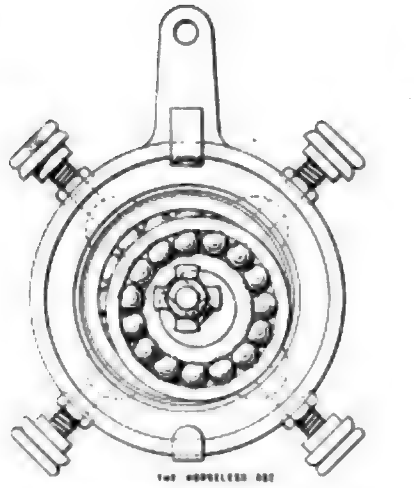
1909 Seven Passenger Moon Touring Car.

The Lehmann Ignition Specialties.

The Lehmann Manufacturing Company, of 62 Duane street, New York, are bringing out the Lehmann timer and distributor, for four and six cylinder motors, illustrations of which are here given. The Lehmann Company has been manufacturing timers for some time in moderate numbers, but now the instruments are to be made on a larger scale.

The first figure shows the construction of the timer. This is of the roller type, but employs a filled ball bearing instead of a ring or caster. This bearing is of the F. & S. type, of tempered steel, and is provided with a bushing having a radial slot therein. This bushing revolves with the inner race. The drive shaft of the timer is squared at its front end so as to fit in the radial slot. The casing of the timer is of fibre, with inserted contact segments of tool steel, these contacts being held in place by nuts upon the outside of the casing. The back body is of brass, and forms a seat for the ball bearing within which the drive shaft rotates. The fibre casing is bolted to a flange upon this back body which is fitted with an arm for connection with the control linkage.

A strong spiral spring contained within the radial slot on the bushing keeps the outer race in contact with the inner surface of the fibre casing. When the shaft revolves the ball bearing rolls within the casing with an eccentric planetary movement, the relation between the interior of the casing and the ball bearing being such that one point upon the circumference of the bearing makes contact only once in every eleven and

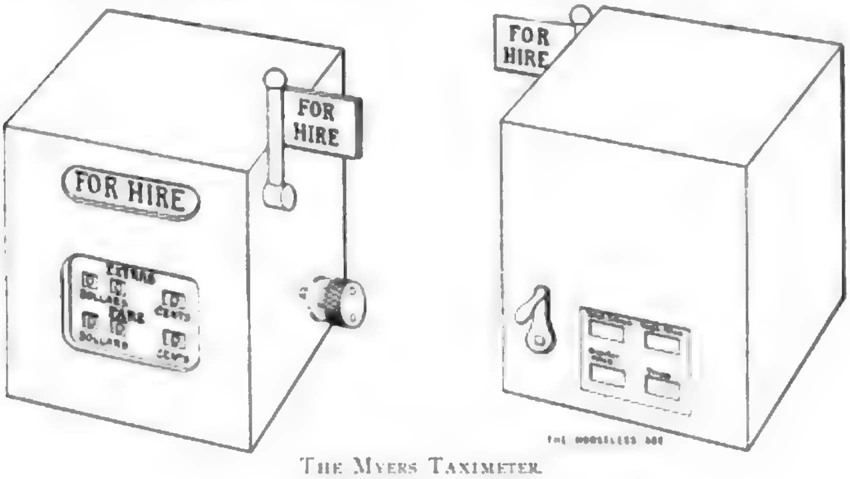


LEHMANN BALL BEARING TIMER.

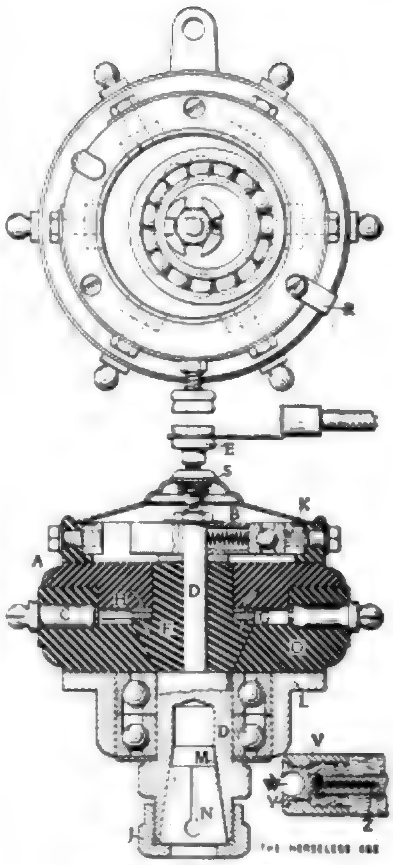
one-half revolutions, and then at different points upon the safe segment. Thus there can be practically no wear upon the circumference of the ball bearing. A deep channel is cut in the back of the timer where the fibre is fastened to the back body. This channel prevents short circuiting by catching any foreign substances accidentally introduced within the timer, and which would be like to "bridge over" from the back body to a segment and cause a short circuit but for this channel. The terminals are of the spring type, a circular flanged collar being spring pressed against a coned collar fixed to the end of a rod projecting from the timing segment. A flat terminal connector is shown in place upon the timer. The ball bearing is prevented from coming free by means of a nut and Maltese spring washer.

The distributor is made up in two sections, the front one being practicaly a timer, except that all the timing segments are connected externally to a single spring contact by means of a brass strip. The body of the distributor is of hard rubber made in two sections, the lower section O (see figure) being grooved for the upper section A and coned for F. This lower section is bolted to a back body or support L, to which is fitted the operating handle and which holds the double ball bearings for the shaft D. This shaft has two diameters, the larger fitting within the ball bearings and the smaller being flat sided for driving the vulcanite cone F and the ball bearing timer B. Upon the cone F are mounted two discs, one G, being of steel and having an arm projecting therefrom to a terminal on the casing, and the other being of brass, also fitted with an arm H. G is pinned to A and acts as a collector, while H revolves with F and acts as a distributor of the current collected by G. The end of H wipes the ends of terminals C C, inserted in section O. For the purpose of taking off the ground wire, a ball is fitted in the timer cover. This ball is held against the end of shaft D by means of a spring S, which is in electric contact with the spring terminal E. Similar terminals are provided upon all primary connections of the distributor, these being adapted for the Rajah connectors, one of which is shown in place on E. The ends of the terminals C are globular and are slotted for the application of the Lehmann terminal, which is of the "snap-on" type. This terminal consists of a hard rubber casing V, into which is screwed a brass plug Y fitted with a globular aperture W corresponding to the like portion on C, and a screw Z. The terminal is screwed on to the end of the cable, threads upon the interior of V enclosing the armor of the cable, while Z is forced into the strands. Connection is made by snapping-on to the end of C. The junction of the globular part of the connection of C with the body permits the use of a Rajah connector should no Lehmann terminal be at hand.

Unlike the majority of instruments of this nature, which fasten to the half time shaft by set screw, this distributor is fastened by means of a split cone N and a jam collar J which forces the cone into the coned hollow portion M of shaft D and grips the half time shaft closely. By this means the distributor may be placed in any desired position upon the half time shaft without boring holes or otherwise weakening the same. Both timer and distributor are made as light as is consistent with strength and wearing qualities, and are fitted with plates to prevent the entry of dust, etc. The extensive use of ball bearings obviates trouble due to neglect of lubrication.



THE MYERS TAXIMETER.



LEHMANN DISTRIBUTER.

The Myers Taximeter.

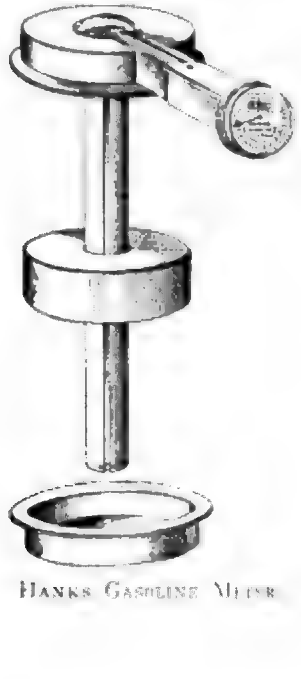
A. J. Myers, of 1610 Broadway, New York city, manufactures the taximeter of which illustrations are here given. It is of very light construction, weighing only 6¼ pounds without the flexible shafting, aluminum and brass for the gears being used throughout. It is cubical in shape, its dimensions being 7x6⅞x5 inches. Unlike the majority of meters in use, all operations, save the registering of "extras," are performed upon one shaft, with its connections to the "fare" and "totals" dials. As will be seen by the illustrations, on the front of the instrument are two mortises, or dials, the upper one showing the "signal," i. e., whether the meter is registering or whether the vehicle is for hire. At the centre is the registration dial, consisting of a series of apertures showing charges for "extras" and "fare." Upon the back are seen another mortise with four dials, and a small brass lever which operates the "extras" charges by a simple movement through a small arc. Of the dials the upper left one registers the total "extras," the upper right the miles run, while the lower left and right dials show the number of quarter miles or waits of six minutes and of trips (or initial charges) respectively. A flag is seen at the right hand side of the instrument, bearing the words "For hire," thus indicating the fact to the passenger. The operation is as follows:

At the moment of hiring the vehicle the knurled knob is pulled out and turned from left to right. This lowers the flag, shows an initial charge of 30 cents upon the fare dial, and allows the clock mechanism contained within the meter to act upon the registration mechanism, a charge of 10 cents being shown on the dial for every six minutes' wait. A unit is also registered upon the trip dial at the back of the meter. As the car starts off the drive mechanism from the road wheel also starts and commences to register, charges of 10 cents for each quarter mile being shown on the fare dial after the initial charge (for one-half mile) has been "covered." Should a certain speed be attained or exceeded the drive mechanism overruns the clock mechanism and prevents the latter from registering. Should this speed not be attained the clock registers as when waiting. Each quarter mile registered on the fare dial also shows as a unit upon the corresponding totals dial. When payment has been made the knob is again pulled out and turned from right to left, clearing the fare and extras dials and raising the flag to its upright position, when the meter is again ready for another hire.

The flexible shafting used upon this taximeter is of the unit link type, and is fitted in such a manner that it cannot be forcibly withdrawn or detached, except at the garage, thus eliminating the well known trick of disabling the meter by drivers by this means and pocketing the fare. The clock in the taximeter runs continuously, instead of intermittently, and for further protection all assembling screws are sealed. The instrument is the subject of both French and German as well as of American patents.

The Hanks Gasoline Meter.

Hanks Gasoline Meter Company, of 311 West Fifty-ninth street, New York city, are manufacturing a combined meter and gauge for use on fuel tanks of from 1 to 20 gallons capacity, and for either pressure or gravity feed. The device consists of a long slotted cylinder or tube within which is a spiral rod. A large float surrounds this tube. A shaft enters through the slot, and is provided with a nut through which the spiral rod works. The upper end of the rod is fitted with a pair of governor weights provided with spurs, and a bevel gear is fixed to the rod. This gear meshes with another bevel upon a shaft secured at the other end to a train of gears which actuate a pointer upon the dial of an exterior casing, which shows the amount of fuel in the tank at all times. One of the gears of this train has a pawl on it.



Hanks Gasoline Meter.

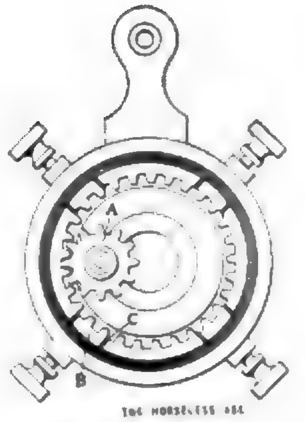
This pawl operates a ratchet toothed gear attached to the shaft of a mechanism similar to that of an odometer, only when fuel is being withdrawn from the tank, and rides over the teeth of this ratchet wheel at other times. The meter is fitted to the tank with the slotted tube and float within, and the bevel drive housed in a casing whose horizontal prolongation encloses the shaft driving the train of gears, and terminates in the casing fitted with the pointer and dial and the registering mechanism. The action is as follows:

When fuel is introduced into the tank the float rises, and acting upon the gears through the medium of the bevels, shafts, etc., moves the pointer showing the number of gallons in the tank. As fuel is withdrawn, the float sinks with the level in the tank, and the pawl engages into a tooth space upon the ratchet wheel, thus casing the amount withdrawn to be registered upon the dial of the registering mechanism.

False registrations, owing to centrifugal force in turning corners, jolting and surging of the liquid, are prevented by the flying up of the governor weights, their spurs catching in teeth in a stationary face gear retained in a suitable manner. When the action ceases the weights drop and allow the meter to continue working. The instrument is claimed to prevent illicit use of the car by chauffeurs, and to give an exact registration of all fuel used. The operating numbers cannot be tampered with without removing the whole mechanism from the tank, except by actually disabling it.

The Heath Challenge "V" Belt.

S. F. Heath & Co., 288 Columbus avenue, Boston, Mass., have recently placed on the market the Heath challenge belt for motorcycle transmission and fan driving on automobiles. The leather used for these belts is said to be made from specially selected hides, and so tanned as to give a high tensile strength. The leather is all hide, no filler being introduced to increase the weight. The belts are claimed to be waterproof and also to resist the action of heat, steam, oil, gases and alkalis to a remarkable extent. It is claimed that no idler is required, as the belt does not slip. The stretch in use is very small, and any slack can easily be taken up. The regular belts are of the V type, but the company are also prepared to furnish flat belts of the same leather.



Backe Commutator.

The Backe Commutator.

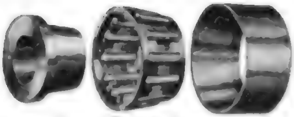
The Backé Motor Company, of 33 Herkimer place, Brooklyn, N. Y., are getting out the herewith illustrated commutator, which is designed along novel lines. The instrument has a positively rotated timing wheel, consisting of a brass pinion. Within an aluminum shell is fitted an internal brass gear, which is provided with four or six three tooth segments, insulated from the remainder of the gear by means of fibre, depending on whether the instrument is extended for a four or six cylinder motor. To each of these insulated segments is attached a brass binding post, which extends through the aluminum casing, and to which the leads to the sparking plugs are attached in the usual manner. The timing pinion meshes with the internal gear, and in addition revolves about a pivot or crank pin upon the tube which communicates the drive from the half time shaft. When this tube is rotated a planetary motion is communicated to the pinion, the current only passing when the pinion is meshed with one of the three tooth segments. A is the timing pinion, B an insulated segment and C the insulating fibre.

The Gray Tire Patch.

Albert Gray, of the Standard Leather Washer Company, of 24 Boudinot street, Newark, N. J., is marketing a tire patch of novel construction. The patch is made up of two layers, the lower one being of thin rubber, which is the surface upon which the solution is applied, and the upper layer of felt, the two layers being firmly cemented together. The felt layer upon the patch is designed to act as an insulator from the heat generated by the tire during its passage over the road. The patches are procurable in the usual sizes for tire repair.

The Gray "Squeeze-It."

Standard Leather Washer Company, of 24 Boudinot street, Newark, N. J., are bringing out a simple little device known as the "Squeeze-It," for retaining patches upon inner tubes until the solution has "set." The device is the invention of Albert Gray, general manager of the company, and consists of two octagonally shaped wooden blocks, the lower one having pivoted in slots



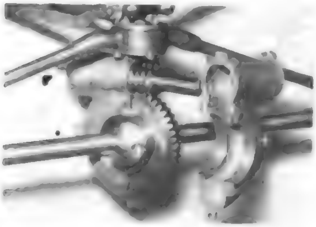
Grant Roller Bearing.

therein two bolts fitted with washers and wing nuts, the bolts being arranged at opposite ends. The upper block is fitted with a slot and aperture to correspond with the swing bolts before mentioned. One of these bolts passes through the aperture and couples the blocks together, while the other may be placed in the slot for the same purpose, or dropped free to allow the insertion of the tube to be patched. The operation is simple: the patch having been prepared and put in place on the tube, the "Squeeze-It" is opened, the tube put upon the lower block and the upper block brought down, the bolt being swung up into the slot in the upper block. By tightening the wing nuts any desired pressure may be put upon the tube and its patch. The device measures 5 by 7 inches, weighs only 18 ounces, and will take any inner tube up to 6 inches profile.

Fetzer Universal Joint Assembled.

The Improved Grant Roller Bearing.

The Standard Roller Bearing Company, of Philadelphia, has recently brought out an improved design of the Grant roller bearing. In the new type the cone has an especially wide shoulder, against which the ends of the rollers have a bearing, practically to the centre of the roll. The shoulder has the same degree of bevel as the ends of the rolls, and the entire thrust is taken in this manner, giving great durability and strength to the bearing in this respect, it is claimed.



Fetzer Four Wheel Drive

The Fetzer Automobile Parts.

A. H. Fetzer, of Galion, Ohio, is the inventor of a new four wheel drive and a novel universal joint for automobile purposes. Both of these inventions are shown herewith. The four wheel drive will be seen to consist of a worm driving gear, one of which, we take it, is fitted to either axle. The universal joint consists of two half shells forming the housing, and also bearings for the pins on which the forks swivel. The joint is entirely enclosed. These parts are used in one of the trucks of the Commercial Motor Truck Company, of Plymouth, Ohio. We are informed that the Fetzer Automobile Manufacturing Company, which has been organized to manufacture these parts, is seeking a location somewhere in Ohio.

The N. U. E. Dry Battery.

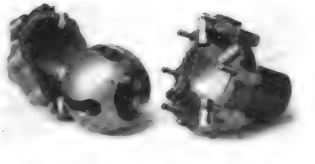
Union Battery Company, of Belleville, N. J., are putting out the N. U. E. dry cell, which is made of the standard dimensions and gives on an average 1.65 volts and 40 to 50 amperes, it is claimed. A guarantee of not more than 10 per cent. loss in efficiency on the shelf for a period of six months goes with the battery. Great recuperative power and absence of polarization are claimed by the makers.

The Dayton Airless Tire.

The Dayton Rubber Manufacturing Company, Dayton, Ohio, are placing on the market a new cushion tire for automobiles, as herewith illustrated. Exteriorly the tire is of clincher shape, and may be secured to any clincher rim. The tire is given its supporting strength by columns or cross partitions, of which a wedge shaped portion is cut away. The tread is much strengthened by an interior rib, which tends to distribute the load among the columns. The tire is built over a steel form and is cured in the operation, the interior columns and the outer covering becoming actually one piece, it is claimed. These tires are made with flat, corrugated non-skidding treads, and are similar in appearance to pneumatics. They weigh, of course, more than pneumatics, but are claimed not to consume any more power. The tire is held in place on the clincher rim by an endless rope of fabric and rubber lying in the cut-out of the columns.

New F. N. Motorcycle Model.

The Fabrique Nationale d'Armes de Guerre, in a response to a demand from their American agents, the Ovington Motor Company, have brought out a special model, particularly suited to American conditions. The American agents have decided to discontinue the ordinary 1908 model, and import only this special F. N. Big Four, known as the 1908½ model.

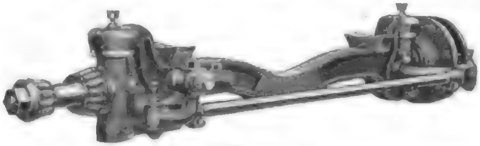


Fetzer Universal Joint in Parts.

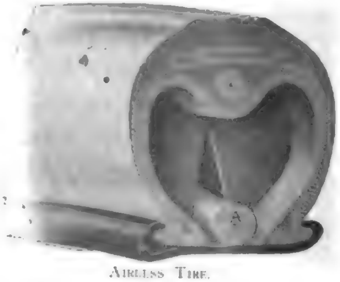
The differences between the 1907 and 1908½ models are as follows: The new machine will have a 5 horse power motor instead of a 4½ horse power. Formerly a 22 inch frame was used, but hereafter a 20 inch frame will be standard. On this frame a rider can easily sit in the saddle and rest both feet firmly on the ground. Much heavier rims than were used last year will be employed, and an American tire can be used on these rims, as well as the regular foreign tire furnished. Tires fully twice as thick as last year will be employed, with an unusually heavy, square tread.

New Timken Truck Axle.

We show herewith a cut of the new Timken front axle for motor trucks, etc. This new axle is of the "I" beam type, 2½ inches wide by 4 inches deep, with Timken roller bearings in the steering knuckle heads, universal steering joint connections and large knuckles of the Elliott type, hardened and ground steel bushings, grease cups, fittings, etc. This axle will carry a load, including the truck, of 18,000 pounds. Great range of the centres for seating springs is permitted. The pads being forged integral with the axle the seats can be located as desired.



Timken Truck Axle.



Airless Tire.

Novel Accessories Recently Developed.

By Albert L. Clough.

(Concluded.)

CHARGING RECTIFIERS.

Those motorists who employ or would like to employ storage batteries for ignition purposes, and who are remote from a garage where charging is done, and have no access to a direct current circuit, may well be reminded that rectifiers of the electrolytic type, specially adapted for ignition battery charging from alternating current circuits, are now on the market. These rectifiers are simple, not at all delicate, and their use requires no special electrical knowledge. They are cheap in comparison with the mercury rectifier, but not nearly as economical of current. The latter consideration is, however, not of great weight, as the total cost of the current consumed in this service is rather trivial.

LOW PRICED MAGNETOS.

It should not be forgotten that the advantages of the high tension magneto are no longer to be enjoyed solely by owners of high cost cars. Magnetos are now to be obtained at a price about one-half that charged for the machines generally supplied on vehicles de luxe. Experience seems to indicate that these low priced magnetos give excellent service as a rule. Of course it is by no means always possible without considerable labor and expense to fit a magneto to an engine which was not designed with suitable provisions for supporting and driving the same, but there are plenty of cars with motors which may be thus equipped without an unwarranted amount of fitting up. If there is no practicable way of applying a gear driven synchronous magneto, it may yet be possible to use a non-synchronous belt or friction driven magneto generator, as the driving connection under these circumstances is easier and cheaper of arrangement. Despite the theoretical objections which may be urged against them, these non-synchronous alternating magnetos appear to give very good satisfaction if driven at sufficiently high speeds, and are usable with the regular vibrator coil equipment. They are as well adapted for use on two cylinder cars as on fours. As these magnetos are sold at a popular price, they are being put out in considerable numbers. Direct current non-synchronous magnetos, designed for use with vibrator coils, have also made their appearance in the market.

ELECTRIC LAMP LIGHTERS.

Now that practically all cars are fitted with gas lamps it is rather strange that more of these lamps are not equipped to be lighted by the electric spark, especially as lighting them with matches is difficult when a high wind is blowing involving the stopping of the car, exposure to the weather if the day is wet, and a certain fire risk in case a gasoline leak should have developed. Self lighting acetylene burners, applicable to any acetylene lamp, are now obtainable. These are of three kinds, a magnetic vibrating contact spark burner, similar to the automatics used in domestic gas lighting, operated by a push button from a single wound spark coil supplied with current from a special dry battery or the regular ignition cells, a manually operated contact spark burner operated from the same kind of coil by means of a little lever within the lamp, the operation of which, however, necessitates the driver's leaving the car and opening the lamps, and lastly, a jump spark burner consisting of two fixed insulated spark points fastened one on each side of the burner, the spark passing from one point to the other, through the issuing gas. Two of these burners may be connected in series by means of carefully insulated wires, and will light simultaneously upon the pressing of a button. These burners take the high tension current from the secondary of a regular vibrating ignition coil, the primary of which includes the regular ignition battery and conveniently located button. If one has the burners it is very easy to arrange the necessary wiring and connections.

AIR BOTTLES.

For those motorists who desire to avoid the labor of hand pumping when tires are to be inflated on the road, and who do not care to install a power pump, the tire tank or air bottle should be well adapted. This is a strong steel tank or "bottle," fitted with a valve and flexible rubber tubing carrying a tire valve connection and filled with air or nitrogen under high pressure. The tank is of such size as to be conveniently carried upon the running board or elsewhere, and usually contains sufficient air to inflate at least a dozen large tires to full pressure. These tanks are also useful to owners of steam cars which carry their fuel under pressure. They are rechargeable when exhausted at a moderate expense. The avoidance of the use of the hand pump especially in scorching hot weather is highly desirable.

NON-CARBONIZING BRAKE LININGS.

Most owners are occasionally compelled to renew their brake linings, which have become burned out through very severe service. When doing this it costs but very little more and is well worth while to use one of the non-carbonizing lining materials which have of late come into pretty general use on high grade cars. These new lining materials are largely composed of non-combustible, wear resisting, and non-absorptive materials, such as asbestos and wire gauze, and beside being able to withstand a high degree of heat do not soak up oil as do leather and some other materials. These materials are adapted to the linings of planetary gear low speed and reverse bands as well, and should give very long service.

In connection with the matter of brakes it is a rather startling fact that there are many cars in daily use which have no means of locking the brake so that it will continue to hold the car when the operator's foot leaves the pedal. It is hardly good judgment to run a car, no matter how small, without a ratchet retaining device on the brake pedal. Anyone who has stalled one of these cars on a steep hill, and been forced to leave the seat, realizes this fully. Leaving such ill equipped cars at the curb on a steep street is also attended with inconvenience if not danger. Ratchet brake pedals are obtainable from the supply dealers which can be fitted usually without excessive cost and labor in place of a plain pedal. These are especially applicable to a popular form of low priced runabout which was put upon the market without this very necessary safeguard.

MOTOR STARTERS.

Automatic motor starters intended for installation upon automobiles have several times been placed upon the market, but have never been generally adopted. They have generally comprised either a mechanical device for turning over the motor from the seat by hand or foot power, or have consisted of a compressed air or carbon dioxide engine so arranged that when pressure is turned on it the vehicle engine is turned over until its explosions commence, when the starting motor is automatically disconnected. The first mentioned type of seat cranking device is used to some extent in various forms, but the latter arrangement is very seldom applied as an auxiliary. Good four cylinder motors will so frequently start on the spark that the demand for special self starting devices has not been so active as would otherwise have been the case. So long as there is an ignitible mixture in a cylinder within the spark range a four cylinder motor will almost invariably "spark up." When the mixture has condensed by the cooling of the engine or has leaked out, the motor will no longer start without cranking. The idea underlying a type of self starter recently offered to the public seems to possess merit. It is simply a device for filling the motor cylinders from the seat, with a readily explodable gasoline mixture, after which the motor is started by the spark lever.

This device consists of several small pumps so grouped as to be operated by a single handle within easy reach of the operator. These pumps discharge through check valves and copper tubes to the clearance spaces of the motor cylinders. In connection with the pump cylinders are small chambers kept full of gasoline, and during the suction stroke of the pumps gasoline is sprayed from this supply into the entering air, giving a rich explosive mixture in the pump barrels, which is forced into the motor cylinders. It is claimed that this device will charge the cylinders of a motor which has been idle for a long time so that it will readily start on the spark, and that it will make starting easy even during cold weather.

COMMUNICATIONS

Trouble from Back Firing.

Editor HORSELESS AGE:

I am having trouble with a double opposed 5x5 inch motor, which will back fire through the carburetor both at ordinary or full speed and while the car is standing still. Sometimes when the car is running along on a smooth road the engine back fires like a gun, perhaps once or twice, and then it will fire regularly again and pick right up. Sometimes I can go for a mile without having the trouble occur, if the road is not too hilly, while at other times it occurs every few rods. I find that each cylinder has good compression, and I have rewired the engine and changed the coils, using a double coil now. I have had the valves ground in and two or three experts have timed the engine, but it has given me no relief. The engine never back fires through the muffler. I find that it makes no difference with respect to the back firing through the carburetor whether the muffler cut-out is open or not. The water boils after running about 15 miles, but the engine has never been overheated, as I have been careful to avoid this.

I have changed the mixture in almost every conceivable way, but the only result has been to increase the heating. It back fires the same when cold as when hot. I believe it is in the front cylinder. I have increased the strength of both the inlet and the exhaust springs, but to no avail. The car consumes about 1 gallon of gasoline for every 8 miles of running, which seems rather a large fuel consumption, but this has been the consumption from the beginning.

I have had this same trouble since I got the car, but hoped that I would be able to overcome it. In my opinion the fault must be with the valves. How far should these valves open? Are the springs that come with the engine apt to weaken in use? The cam lifts have never been changed since the engine came from the factiry.

C. F. QUINN, M. D.

[We can only give you some general rules that may enable you to locate the trouble. If an engine back fires through the carburetor it is a sign that the inlet valve opens while there is a flame in the cylinder. Either the inlet valve opens at an improper time or the charge in the cylinder is so slow burning that there is still a flame in the cylinder when the piston starts on the inlet stroke. A slow burning mixture is usually an over-rich mixture, although a very lean mixture also burns slower than a perfect mixture. The fuel consumption of the car is certainly very high, and this would tend to indicate that the mixture is generally very rich. A cylinder of 5 inches bore would have valves of perhaps 1¾ inches clear diameter, and these should lift from three-eighths to seven-sixteenths of an inch. We understand from your letter that the inlet valves are mechanically operated. Back firing through the carburetor is much more likely to occur with automatic or suction operated inlet valves, as a slight change in the pressure of the spring and in the friction of the guide will make quite a difference in the operation of these valves. All springs are liable to change in strength in the course of time; but with the springs of mechanically actuated valves this is usually not an important matter, as the springs have mostly quite an excess of strength. Anyway, if you already had the trouble when you first received the car it cannot be due to weakening of the springs. We would suggest that you reduce the strength of the mixture as much as possible without seriously affecting the power of the engine, and also that you investigate whether there is any chance for the inlet valve to open at the improper moment.—ED.]

The New British Patent Law.

Editor HORSELESS AGE:

The "working clause" of the amended British patent laws, upon which you comment editorially in your last issue, will no doubt materially reduce the number of patent applications filed in Great Britain by American inventors, who have already been discouraged by the heavy taxes exacted.

Importation of vehicles into Great Britain from the United States may be restricted by valid British patents covering improvements embodied in the cars. The working clause, therefore, only affects imports indirectly because of its effect on the validity of patents. The British patentee is required to "work" the invention within the realm after expiration of four years if a demand for the article is then being satisfied by importation from abroad. If an article is manufactured in a free trade country it is not likely that the same thing, made under a protective tariff, can be profitably imported. Therefore, those who uphold their English patents by working, in accordance with the law, discourage importation either by themselves or others.

You also refer to "master" patents and state that no inventions of a scope which will justify such patents are likely to be made in connection with automobiles. A "master" or basic patent may cover a large or a small art. The Selden patent, according to the claims of its owners, is basic and covers a large art, yet it cannot possibly affect steam or electric vehicles. It is hardly possible that a patent will be issued hereafter which will seriously affect the unrestricted manufacture of some form of all of the three general types of automobiles. Pioneer inventions within the automobile art are, however, certainly to be expected and valid basic patents may be secured for these by skillful handling. A new form of running gear, for instance, which will render present forms obsolete may be devised at any time, and an adequate patent for this invention will be of vital importance to all motor vehicle manufacturers, and might properly be called a "master" patent.

It is unfortunately true that there are few patents in force in the automobile art which are of great scope or importance; but this is not because important and new inventions have not been made, but because, *first*, manufacturers have neglected to devote proper time and money to protecting them, and *second*, because patent applications are not prosecuted with proper appreciation of the merits and scope of the invention. This is particularly true of patents obtained in this country for inventions of foreigners.

The writer knows of no class of inventions which requires of a patent solicitor more special training and care in prosecution of applications for patents than those relating to automobiles, because of the number of elements composing the vehicle and the complexity of the relationships of these elements to each other.

DEMPSTER M. SMITH.

Balancing a Four Cylinder Motor.

Editor HORSELESS AGE:

I have a four cylinder opposed motor that is out of balance. Each piston and rod are within one-quarter ounce of the same weight. The crank shaft is not machined on the arms, but the flywheel is turned all over. Would you consider it sufficient to balance the crank shaft and the flywheel together? Any suggestion you may make will be appreciated.

CONSTANT READER.

[The best plan would be to first balance the crank shaft, then secure the flywheel to it and balance the two together. We should think that although the arms of the crank shaft are not machined, the shaft would be so nearly balanced that any want of balance could not be detected by ordinary means. However, if you should find that it is slightly heavier on one side than on the other you could probably remove sufficient metal from the arms by grinding or filing. Any want of balance in the flywheel is much more likely to give trouble in the way of vibration, owing to the greater radius at which it acts. We presume, of course, that your engine is so arranged that the two inner throws of the crank are on the same side of the shaft, and the two outer throws on the other.—ED.]

Locking Devices for Lever Steering Gears.

Editor HORSELESS AGE:

I am fitting up a runabout with side steering, putting the lever on the left side, so as to control it with the right hand. It is impossible, or at least difficult, to fit a wheel steering gear to this car, and lever steering seems to be particularly appropriate in this case.

The liability of the transmission of shocks to the driver's hands makes one hesitate in fitting such a gear. The Knox Automobile Company were about the last to fit lever steering to a runabout of any power, and they made use of a checking contrivance, a device filled with glycerine, with which you are doubtless familiar. Even if I could get the name of this device from an inspection of the Knox car, I should deem it unsuitable for my purpose, on account of its being too large and too heavy.

My purpose in writing is to ask whether you would kindly mention any other such contrivances on the market, with your recommendation, if you wish to give it. The present letter was suggested by seeing the description of the Blood Brothers self locking steering gear on page 103 of your issue of July 22. I have their circular, but seeing this one merely by chance it occurred to me that there might be other devices of the same kind on the market.

FRANCIS C. FALLON.

[We do not know of any other devices for locking or checking a lever steering gear besides the Blood Brothers self locking steering gear and the Lemp steering check, which latter was used on the Knox cars in former years. The Lemp check was made, and probably is still made, by the General Electric Company, of Schenectady, N. Y. Owing to the almost total abolition of lever steering in recent years very few such devices have been placed on the market.—ED.]

Offer of British Representation.

Editor HORSELESS AGE:

You may possibly have among your advertisers firms manufacturing motor or carriage goods who wish to be represented in Great Britain; if so, perhaps you could put me in communication with them. I am open to represent any manufacturer of American goods, on a commission basis. I have a good connection in the trade, and have offices and warehouse in London, and have recently opened another in Birmingham, besides which I have three travelers on the road. If you have anyone on your books requiring an agent, I should esteem it a favor if you would put me into communication with him. I might add that I have a stand at the forthcoming Olympia Show, which opens November 13.

W. H. T.

[We shall be glad to place any American firm referring to this in communication with our correspondent.—ED.]

What Is a Horse Power?

Editor HORSELESS AGE:

Will you kindly explain what is a horse power in an automobile, and why there is so much difference in power, according to Webster?

R. LAPOINTE.

[The English horse power is that power required to raise 33,000 pounds one foot per minute. American manufacturers make it a rule to rate their engines at or near the maximum horse power they are capable of delivering when perfectly tuned up, and as a gas engine may lose a great deal of its power through some slight fault or disarrangement of any of its vital parts it is obvious that the horse power of an engine may readily drop much below its rated power after it has been in use for some time.—ED.]

Another Demand for Short Tire Valves.

Editor HORSELESS AGE:

In operating a big car for the past four years, over bad roads, the writer has had fully his share of tire trouble. In changing tires the worst part has always been to get the valve stem of the inner tube through rim and felloe. Why don't tire makers cut off at least one inch and eliminate much profanity and many skinned knuckles?

O. X. BINNS.

Query.

Editor HORSELESS AGE:

In your honest opinion, what will become the most practicable and serviceable automobile gasoline engine as to number of cylinders used? Will it be the two or four cylinder?

W. P. MCGREGOR.

[We are inclined to believe that the two cylinder will be most popular for light cars, especially runabouts, and the four cylinder for large cars.—ED.]

Purging with Kerosene.

Editor HORSELESS AGE:

A person, who is supposed to be an expert on gas engines, makes the statement that injecting kerosene into a single cylinder jump spark motor does not cleanse the cylinder at all from carbon, etc., but the injection of same into a two, three or four cylinder motor does do a great deal of good in removing carbon, etc. Is not the expert (?) entirely wrong in this extraordinary statement?

H. E. D.

[The effect of the kerosene is not at all influenced by the number of cylinders.—ED.]

To Tour in Germany.

Editor HORSELESS AGE:

I am contemplating a short trip abroad the latter part of this month. I expect to spend about ten days in Germany, and wish to devote the time to making a trip by automobile through Germany to Switzerland. Can you or any of your readers advise me if ten days will be sufficient time to accomplish this in, and can you give me the name of any reliable garage in Bremen or Hamburg, where I can hire a car and chauffeur who speaks English, and knows the country sufficiently well to cover the trip. About what would be the cost of hiring a car for the trip for our party of three? I will appreciate any information on the above inquiry.

G. ELLSWORTH MEECH.

[You can easily make the trip through Germany from Hamburg or Bremen to the Swiss frontier in ten days, as the distance, if you take a fairly direct course, is only about 500 miles. We have no doubt that you would be able to hire a car and an English speaking chauffeur in either Hamburg or Bremen, but have no idea as to the probable cost. Probably some reader who has made a similar tour on the Continent can give us some enlightenment on the subject. Hamburg being a much larger city than Bremen, you would probably be most likely to find accommodations there. We have no complete list of garages in these cities, but would mention the Hamburg branch of the Adler Automobile Works, located at Alsterdam 16-17, and W. & A. Weill, Alterwall 48, Hamburg.—ED.]

Contents of Tire Filling Tanks.

Editor HORSELESS AGE:

Is there any danger in the use of a tire filling tank? I purchased recently a tire filling tank from one of the more prominent companies in that business. It had pasted on it a label which contained a warning not to expose it to the direct rays of the sun and other cautions which I do not now remember. Can you tell me what such a tank contains, and whether or not its contents are likely to injure the inner tube?

READER.

[We presume that you refer to the so called "air bottles" for inflating tires as brought out by several prominent tire makers. These are steel bottles containing atmospheric air under about 2,000 pounds per square inch pressure. With such a tremendous pressure the tanks must, of course, be handled carefully, or their walls might give way. Exposing the tank to the rays of the sun would result in heating the air and appreciably increasing the pressure. The air compressed being atmospheric air it is not injurious to the tires. We believe there is also one tire filling tank on the market in which dissolved carbonic acid gas is stored. This is also an inert gas without effect on the tires, but it has been shown by experiment that rubber is much less impervious to carbonic acid gas than to air, and tires inflated with the gas will need reinflation much quicker.—ED.]

Corporation Automobiles Can Only Be Driven by Licensed Drivers in Ohio.

According to an opinion given by the Assistant Attorney General of Ohio to Secretary of State Thompson, under the new Ohio law officers of corporations owning automobiles are not permitted to drive these vehicles unless they have taken out a chauffeur's license. The State law permits the owner of an automobile to operate it without taking out a chauffeur's license, and members of the owner's family are also allowed that right. But the fact that a person owns stock in a corporation does not make him an owner of the corporation's automobiles, according to the opinion. As many corporations own auto trucks and other similar motor vehicles, the opinion is important.

LEGISLATIVE and LEGAL

Test Case Under Anti-Smoke Park Ordinance.

The cases of the seven taxicab chauffeurs who were arrested in Central Park on August 5 for violation of the new anti-smoke ordnance came up before Magistrate Moss in the Yorkville Police Court on August 5, and the proceedings were attended by Assistant Corpordtion Counsel George Nickerson and Louis D. Mooney, counsel for the New York Taxicab Company. A test cast was decided upon, and William Scully, a chauffeur employed by the New York company, was chosen to be the defendant. After Policeman Austin testified that he saw smoke issuing from Scully's machine in the park, just off the Fifty-ninth street and Sixth avenue entrance, Magistrate Moss fined the prisoner $2. Copies of the minutes of the hearing were ordered for both Mr. Mooney and Mr. Nickerson. Mr. Mooney said he would pay Scully's fine under protest and would appeal the case at once to test the constitutionality of the ordinance. The other chauffeurs were discharged. Magistrate Moss announced that he would fine every violator of the ordinance brought before him until the test is decided.

Legal Notes.

According to a report from Norristown, Pa., the honor system of preventing automobile speeding has proven a failure in Whitemarsh Township, and the old system of having the highways guarded by constables has been returned to.

An ordinance has been introduced into the St. Paul, Minn., council forbidding the tooting of automobile horns between the hours of 8 p. m. and 7 a. m. within a distance of 300 feet of any occupied dwelling, except in case of necessity, under penalty of a fine of $25.

John Lorenz, a farmer of Windsor, Col., has been awarded $300 actual and $100 punitive damages against Dr. W. O. Upson, of Fort Collins, Col., who last year ran with his car into a horse led by the farmer's son, injuring the animal so much that it had to be shot.

Farmers of Mercer County, New Jersey, have decided to put a stop to automobile speeding by operating traps for speeders. Eight motorists were fined by Squire Marr at Trenton on August 6, and seven more had their numbers taken and were asked to appear in court on August 11.

An East Orange, N. J., dealer was recently arrested for running cars through the city without a license. His excuse was that he was only running new machines just arrived by railroad from the depot to his place of business. He promised to take the cars in future by the most direct route and at a slow pace, and the recorder suspended the sentence.

Wm. A. Healy, of Hoboken, N. J., has brought suit against Richard Shippen, president of the Hudson Tire and Rubber Company, 1121 Clinton street, Hoboken, for $150 salary claimed to be due him. A short time ago another employee of the firm, Frank Keresey, also brought suit for the same reason.

The supervisors of Nassau County, Long Island, where the Vanderbilt Cup race is to be held next fall, have called a meeting of representatives of automobile associations at the Nassau County Court House, at 10:30 a. m. on Wednesday, August 12, with the object of deciding upon some definite form of action, in order to repress automobile speeding in that county.

The coroner's jury who investigated the death of Dr. Carlton P. Flint, of New York, who was struck and fatally injured by John W. Masury's automobile, in charge of his chauffeur, Louis Le François, on July 24, held both Mr. Masury and the chauffeur responsible for Dr. Flint's death. According to the witnesses at the inquest the car was going at between 40 and 70 miles per hour at the time of the accident.

Members of the board of health of Fitchburg, Mass., have been using the automobile of F. R. Houghton, an agent of the board, in their official work for some time, the board paying Mr. Houghton a certain rate for the use of the machine. Some of the city's taxpayers objected on the ground that it is unlawful for the city to hire or buy anything from a city official. The matter was taken before the city attorney, who held that the board of health is a law unto itself and can spend its money as it chooses. The members of the board will therefore continue to use Mr. Houghton's runabout.

According to a list submitted to the Philadelphia Bureau of Boiler Inspectors, 3,000 operators of automobiles in that city have failed to take out city licenses this year. Dirctor Clay, of the bureau, is addressing a circular to all of these operators calling their attention to the fact that the State automobile law does not repeal or annul the municipal automobile ordinance, according to a Supreme Court decision. Last year the Bureau of Boiler Inspectors went after delinquent automobile owners only late in October, and as many of them had stored their cars for the season it was found impossible to enforce the license ordinance. This year the bureau will profit by this experience, and demand that the license fee be paid while the season is at its height.

Business Troubles.

A petition in bankruptcy has been filed against the Charleston Motor Company, Charleston, S. C. The petitioners are T. B. Jenkins, the Cameron-Barclay Company and the Charleston Metallic Company.

A voluntary petition in bankruptcy was filed on July 31 by F. S. Thompson, Dallas, Tex., who was formerly president of the Western Motor Car Company in Dallas. His assets are estimated at $25,084 and his liabilities at $42,702.13.

Harvey L. Hooke has been appointed receiver for the Muncie Auto Parts Company, Muncie, Ind., bankrupt. He has carried on the business for some time under court orders, but as it does not seem to be to the advantage of the creditors the property of the company is to be sold on September 2, at the office of the company in Muncie, Ind. The book accounts and bills receivable will not be included in the sale.

Roderick J. Kennedy has been appointed temporary receiver of the Stepney Spare Wheel Agency, of 341 Fifth avenue, New York, on application of S. S. Myers, attorney for L. Walter Lissberger, Joel Jacobs and Malcolm J. A. Lissberger, directors, for a voluntary dissolution of the corporation. The corporation is alleged to be insolvent. It has a capital stock of $4,000, and has been manufacturing spare wheels for automobiles. An order to show cause why the corporation should not be dissolved was set down for September 28.

Logan Construction Company Bankrupt.

The Logan Construction Company, of Chillicothe, Ohio, filed a petition in bankruptcy on August 10. The assets are estimated at $69,000 and the liabilities at $120,000. The company was organized four or five years ago, and of late manufactured commercial cars exclusively. The failure had been expected for some time.

Obituary.

Frederick W. Spaulding, owner and manager of the Broadway Garage in San Francisco, lost his life recently in the desert near Yuma. His chauffeur, T. P. McCauley, was found unconscious, but was saved from death. They left San Francisco on July 21 in a 60 horse power runabout and reached Yuma in good time. Against the advice of the residents, they started out at 1 p. m. for Gila Bend, where Spaulding was developing a gold mine. Sand clogged the machinery, and the men got out of the car to crank it. Both collapsed in the awful heat and lay unconscious near each other. A rancher's boy came upon them and brought a buggy and horse. He revived McCauley, but Spaulding had to be lifted into the buggy. On the way to Blaisdell, the nearest station, Spaulding expired. He was forty-five years of age.

Robert Shaw, a member of the firm conducting the Paterson Garage in Paterson, N. J., died on August 4, at the Hackensack Hospital, in consequence of injuries received when his car was struck by a Susquehanna and Western train at Bogota, N. J., on August 2. Donald Holmes, who was with Shaw at the time of the accident, was killed outright.

The International League of Tourists' Associations will hold its 1909 annual meeting in London, upon the invitation of the Motor Union of Great Britain and Ireland.

OUR FOREIGN EXCHANGES

Activity of the Austrian Physicians' Automobile Club.

As has been reported in former issues of THE HORSELESS AGE a physicians' automobile club was organized in Vienna about a year ago. A circular has recently been addressed by the president of the club, Doctor Karl Hochsinger, to the Austrian physicians, from which the following extracts are taken:

"The endeavors of the committee of the Physicians' A. C. have facilitated the acquisition of automobiles by physicians, and reduced the cost of maintenance to such a degree that the cost of operation to the physician is now at least no higher than the cost of a livery horse vehicle. In this comparison, however, only professional use of the car and no pleasure use is considered.

"Only gasoline vehicles were taken into consideration, as electric vehicles, owing to their high prices and their unsuitability for hilly country, are entirely out of the question. The gasoline cars considered were divided into three classes, as follows: Class 1, 7-10 horse power; Class 2, 10-14 horse power; class 3, 14-18 horse power. More powerful vehicles are unsuitable for professional use: first, on account of their high operating cost, and second, on account of their difficult handling in street traffic. As regards the use of the different types enumerated, vehicles of Class 1 are quite sufficient for a city practice, and also in a country practice where not more than two persons need be carried. Vehicles of the second class have a higher speed, and will carry a greater load in hilly districts. Vehicles of the third class are most suitable for physicians who are proprietors of sanitariums. These vehicles serve well for service between the sanitarium and the depot for the transportation of patients, etc."

French Liability Law.

The following law establishing the responsibility of drivers of vehicles in case of accidents has been adopted by the French Parliament and published in the *Bulletin Officiel:*

"Every driver of a vehicle of any kind who, knowing that the vehicle has caused or occasioned an accident, does not stop and thus tries to escape the penal or civil responsibility which he may have incurred, will be punished by from six days to two months of imprisonment, and a fine of 16 to 500 francs, aside from the penalties for other crimes or misdemeanors committed. In case the facts warrant an application of Articles 319 and 320 of the Penal Code, the penalties incurred according to the terms of these articles will be doubled. The provisions of Article 463, of the Penal Code, are applicable to the misdemeanor to which the present law refers."

New French Automobile Tax Rule.

The department of the French Government which determines the tax payable on automobiles in that country until now took for a basis of assessment the lower figure of all hyphenated horse power ratings. A vehicle rated as an 18-24 horse power was taxed on the basis of 18 horse power. The Minister of Finance has recently issued a circular according to which the opposite proceeding will be followed hereafter, the bigger of the two figures being taken as the basis for the tax, which will result in an increase of about a half million francs in the revenue derived from automobile owners. It is to be expected that the fashion of hyphenated ratings will become unpopular in France hereafter.

Enclosed Boxes for Acetylene Generators.

A most excellent tip for motorists with regard to enclosing of the acetylene generator to prevent the water freezing in frosty or cold weather is given by the *Autocar*. A small wooden box or casing is fitted to one of the running boards; this box should be large enough to enable the generator to be packed with cloths or waste, not only to prevent rattling but to obviate all chances of freezing. Besides a car presents a much neater and finished appearance when the generator is housed in a box finished to match the car. It is to be understood that the above does not apply to those cases where the makers forbid boxing the generator.

According to some figures published by the British consul at Havre, no less than 1,440 cars crossed the English Channel to France last year and 1,689 cars to England, making a total of 3,129. In 1906 the total number was 2,655, showing an increase of 476 for last year. The cars went by four different routes, the total number by each route in 1907 being as follows: Folkestone-Boulogne, 1,759; Southampton-Havre, 852; Newhaven-Dieppe, 470; Dover-Calais, 48.

All the drivers of motor cabs in Copenhagen, Denmark, went on strike last month with the object of protesting against the new Danish automobile law, which prescribes a speed limit of 4.7 miles per hour, and provides a fine of 50 crowns for violations. It is stated that police are stationed in the streets equipped with stop watches to take the time of all motor cabs. Three automobiles, viz., that of the Princess Mary and those of the English and German Ministers, are allowed to proceed at any speed desired by their drivers, and not much trouble is made for any private owners, but the strictest measures are adopted against drivers of public automobiles. The strike was inaugurated with the approval of the cab owners.

The Clement Automobile Works.

Special Agent Capt. Godfrey L. Carden, in a report from Paris under date of June 6, gives the following information about the automobile works of A. Clement, located on the Quai Michelet, Levallois:

This firm manufactures the machine known as "Bayard," and has about 1,100 men on the payrolls, which force is confined to the Paris shops. An additional 800 men are working in the branch shops in Messieres. Captain Carden was afforded every opportunity to inspect the machine tool installation in the Levallois works, in which many American machine-tools were found in service. The French automobile shops when installing American lathes have usually confined themselves to one make. When frank criticism of American lathes was asked for the reply was that such tools are too light for the new high speed steels. The opinion was expressed that the gears on the American lathes, as a rule, are too light and too small in diameter, and that the countershafts are faulty. In many instances the pulleys, it was declared, are too small and have insufficient driving power. Consequently the belts must be kept very tight.

The Clement works during the busiest times have employed about 1,400 men in the Paris shops. It will be observed that with 1,100 men now at work the shops are anything but quiet. The total number of machine tools installed on the Clement floors is approximately 900. The firm maintains a special department for tool repairs and for making special tools, such as are demanded by the peculiar character of the work of the shops.

The differential and axle boxes are made of French malleable iron. A. Clement criticises the American malleable iron as being rather black and of a character tending to crumble. The malleable iron is adhered to in the construction of these boxes, since aluminum would not be strong enough for the work. The cylinders for the Clement engines are all of French make, and quite a number of these cylinders of the same make are sent to the United States for working up into American automobiles. Clement bends all his exhaust tubes cold, without any inside strutting. He uses a French machine for this work, the design of Monet & Moine, of Paris. This tool saves about 200 per cent. over hand work [which is certainly astounding.—ED.]. All Clement engines under test are run fifteen hours under the belt and two hours under full load on the dynamometric brake. The dynamometric brakes of Hillairet-Huguet, of Paris, are used.

MOTORS FOR MILITARY SERVICE.

This establishment has taken up the work of making gasoline motors for direct connecting dynamo. Only small installations are manufactured, the powers ranging from 5 horse power to 30 horse power. Still another branch of work is the making of engines for dirigible balloons. One engine under construction has four cylinders and is designed for 120 horse power. Clement has a first class testing track built within the confines of his works. The roadway consists of concrete to a depth of 1½ feet covered with a light layer of small granite stone, laid with tar and asphalt mixed, and the whole covered with asphalt. The track has been in service ten years and is still in splendid condition.

Two automobiles were observed under construction in the Clement shops for military service. Each vehicle will carry two machine guns, mounted one on either side, about midway of the length of the chassis. When not mounted the guns will be slung in pouches over the sides of the car. An armed automobile is now in service with the French troops operating in North Africa.

The impression which a visitor receives on visiting the Clement works is most favorable. The shop administration is of a high order, and it is apparent that the men in charge of the various departments thoroughly understand their business. There is a good speed maintained on all tools, and the workmanship throughout the plant is of high standard.

Lathe men are paid on an average 80 centimes per hour. The maximum received by lathe men is about 1.20 francs per hour. Payment is by piecework, the men at the milling machines receive on an average between 80 and 85 centimes per hour, and the maximum does not exceed 1.20 francs. The men at the grinders receive on an average 90 centimes per hour, and a maximum of 1.20 francs. The same statement applies to blacksmiths and coppersmiths The men working at the drills, slotters and planers average about 80 centimes per hour. The maximum for all three tools is 1.20 francs per hour.

Millions for California Roads.

By a majority of three to one the citizens of Los Angeles County, Cal., on July 30 authorized a bond issue of $3,500,000 for the purpose of adding 307 miles to the county's system of permanent highways. The energetic work of the automobile dealers and owners contributed largely to the victory of the bonds; their donations made up the largest part of the campaign fund, their machines carried the voters to the polls and the speakers to the campaign meetings in the smaller towns. Undoubtedly the majority would have been larger but for the fact that the city of Los Angeles a year ago assumed obligations to the amount of $25,000,000 for the construction of an aqueduct to carry a water supply 250 miles from the Sierra Nevada to the city.

The specifications of the proposed roads call for a highway 16 feet wide, composed of a base consisting of crushed rock and gravel with a wearing surface of 2 inches of asphalt. Besides the 307 miles to be built with the proceeds of the bond sale, the road fund of the county will be relieved from its usual burden, and its contents will supply additional mileage of permanent thoroughfares.

Ventura County, adjoining Los Angeles County to the north, is preparing to call an election to authorize an expenditure of $610,000 for permanent roads. Within twelve months a thousand miles of good roads will be under construction in southern California, and their cost will reach the ten million mark.

Rapid Progress in Road Building in New York.

Deputy State Engineer A. L. Getman believes this will be a record year in the extent of highway improvement. As against 311 miles of highway improved in 1907 a full 700 miles will be improved in 1908. The total mileage of improved roads since the work began will be at the end of this year nearly 1,700. Mr. Getman says no more contracts will be let till October 1 because the appropriation for new work will not be available till that time. He declared that the season was a good one for the contractor, bids made up last year having been based upon a scarcity of building material and unusual wage for laborers, while owing to the falling off in the building trades there is plenty of material, and labor is at $1.50 per day. The State Engineer's force is now busy on field work, although plans for works ordered by various boards of supervisors are now being drawn. The large appropriation of last year has enabled the State Engineer to award many contracts, work on which is progressing fast.

"Licensed" Association Meeting.

Col. George Pope was unanimously elected treasurer of the Association of Licensed Automobile Manufacturers at its meeting in New York city on August 6. He succeeds H. H. Franklin, who was treasurer of the association for the past three years, and who tendered his resignation at this meeting.

A recommendation of the rim and tire committee that a standard quick detachable rim be adopted was accepted. The Mechanical Branch of the association, with the cooperation of the tire and rim makers, has evolved a rim which will take both a clincher and a quick detachable shoe of any make. This rim will be known as the standard universal quick detachable, and is the same rim which received the approval of the National Association of Automobile Manufacturers at its meeting on August 5. M. J. Budlong and R. D. Chapin were appointed additional members of the tire and rim committee of the Licensed Association, of which A. L. Pope is chairman.

At the next general meeting, early in September, spaces for the Madison Square Garden Show will be allotted. Probably the same method as in previous years, depending upon the amount of business done for the year ending July 1, will be followed. Work on the 1909 handbook is to be begun at once.

Rifle Range Used as Testing Track.

The testing corps of the Packard Motor Car Company recently obtained the privilege of driving on the embankments of the new Michigan State Rifle Ranges, near Detroit. These embankments, or butts, as they are called in military parlance, are clay and gravel hills, 40 feet high and with stiff grades, the steepest of which is 45 per cent. They form an ideal hill climbing course, with ordinary rough road conditions. The Packard testers are now busy on 1909 cars, of which approximately 100 already have been delivered to purchasers. The factory is running a full force of 2,500 men, and this is being increased each week. When two additions now in construction are completed the number of employees will be larger by several hundred.

Testing a Car on a Rifle Range.

Grand Central Palace Show Plans.

Designs for the decorative part of the Grand Central Palace Show were submitted to the show committee of the American Motor Car Manufacturers' Association at its meeting in New York last week. E. Rand Hollander, a member of the committee, representing the importers, is in Europe at present, arranging for foreign exhibits. It was decided that a trade ticket plan would be followed this year that would be more liberal to the exhibitors. The plan for the demonstrators that worked so well last year will be retained.

It was decided to have all the main floor and part of the first gallery occupied by American and foreign pleasure vehicles. The taxicab division will be on the first balcony along with the commercial vehicles and the motorcycles. The motor and accessory manufacturers will be on the first and second balconies. There is no cellar or basement in connection with the show, the lower part of the Grand Central Palace being a station of the New York Central Railroad.

One Chicago Show Only.

That there will be only one automobile show held at Chicago the coming winter was decided by the National Association of Automobile Manufacturers and the American Motor Car Manufacturers' Association in New York on August 5. The committee of the N. A. A. M. held its regular monthly meeting on that date. The Chicago show question was one of the important matters on the agenda. The show committee, which during the morning of the same day had had a conference with the committee of the American Motor Car Manufacturers' Association and a representative of the Motor and Accessories Association, made its report. The following plan for the allotment of space, which plan has the approval of the American Motor Car Manufacturers' Association, was adopted:

Space will be divided into four classes, as follows:

Class A—Twenty-four central spaces in the Coliseum, each containing approximately 800 square feet.

Class B—Thirteen wall spaces in the Coliseum, varying in size from 617 to 1,276 feet.

Class C—All spaces in Coliseum Annex, and central space in the First Regiment Armory.

Class D—All other spaces.

Order of selection of positions will be determined by lot in the manner hereafter provided. If there are more applicants for space in any class than can be accommodated, the executive committee of the N. A. A. M. will classify the applicants, and in so doing will take into consideration whether the applicant is a member of the N. A. A. M., who will be given first choice, or of the A. L. A. M. or the A. M. C. M. A., who will be given second choice, and will be guided further by the number of models produced by the applicants, the number of earlier shows at which the applicants have exhibited and the size of the space occupied thereat.

The allotment of space will take place at the offices of the N. A. A. M. Each applicant will be entitled to attend in person or by proxy and take part in a drawing for order of allotment, subject to the classification arranged by the executive committee.

After the drawing applicants may, in their turn, make selection of space. Should the executive committee place in any class applicants who are members of the N. A. A. M., and other applicants who are not members, the members of the N. A. A. M. shall draw first; members of the A. M. C. M. A. and the A. L. A. M. second, and other applicants last.

Any applicant may, in his turn, select a space in any class lower than that to which he has been assigned by the committee or any space in a higher class which has not been previously selected.

An agreement was also concluded whereby the facilities of the transportation department of the N. A. A. M. will be extended to all members of the A. M. C. M. A. Sanctions were granted for the shows to be held at Madison Square Garden the third week of January by the Association of Licensed Automobile Manufacturers, and at the Grand Central Palace the first week of January by the American Motor Car Manufacturers' Association.

Demountable Rim Test.

The first test ever held in this country for stability and time required to change tires mounted on demountable rims was held on August 6 by the Chicago Motor Club, over the Chicago, Elgin and Aurora "century" course. The rims represented were the Diamond fitted to an Isotta Fraschini touring car, the Continental fitted to a Packard runabout, the Fisk fitted to a Chalmers-Detroit and a Knox roadster and the Nadall fitted to a Pierce Arrow. Under the rules of the contest each car had to change all four tires on the way to Elgin, and on the way back to Chicago by way of Aurora the rims were tested for slippage and loosening of nuts. After the test for slippage and loosening of nuts the rims were examined and any slippage or loosening of nuts compelled another adjustment with a penalization of double time. This proved the undoing of the Fisk rims, as up to this they had made the best time in changing rims, with the Diamond third and the Continental and Nadall fourth and fifth respectively. After the examination, however, the Fisk rims on the Chalmers-Detroit were penalized 3:06 2-5, the Fisk rims on the Knox 1:53 1-5, the Nadall 1:20 4-5, the Continental 0:32 and the Diamond only 0:24 2-5 seconds, thus practically reversing the score, making the Diamond the winner by 11 3-5 seconds, with the Continental second, the Fisk third and fourth respectively, and the Nadall fifth. The Fisk people announced their intention of protesting the decision on the ground that the Diamond crew used a special tool and that they (Fisk) had not been given allowance for putting the tire tool back on the running, which the others did not do. The best time for changing on rim was made by the Fisk crew on the Knox car, a right front rim being changed in 53 1-5 seconds. The technical committee was composed of David Beecroft, chairman; F. E. Edwards, A. T. Edmondson, Dr. Weintraut and Bick Edwards. Timers, F. H. Trego and C. C. Tilt. Referee, F. C. Donald. The table below gives the time required for changing each rim, penalty incurred for slippage or lossening of nuts and total time:

Diamond, Isotta-Fraschini, 1:01 2-5, 1:26 2-5, 1:45, 0:59 2-5; penalty, 0:24 2-5. Total, 5:36 2-5.

Continental, Packard, 1:02, 1:58 1-5, 1:05, 1:10 2-5; penalty, 0:32. Total, 5:48.

Fisk, Knox, 1:07 1-5, 0:57 2-5, 0:53 2-5; penalty, 1:53 1-5. Total, 5:49 4-5.

Fisk, Chalmers-Detroit, 1:11 3-5, 0:57, 1:01 1-5, 0:54; penalty, 3:06 2-5. Total, 7:10 1-5.

Nadall, Pierce Arrow, 2:02 2-5, 1:17 2-5, 1:25 2-5, 1:29 4-5; penalty, 1:20 4-5. Total, 7:35 4-5.

E.-M.-F.—Studebaker Sales Alliance.

An alliance has been formed between the Everitt-Metzger-Flanders Company, of Detroit, and the Studebaker Automobile Company, of South Bend, Ind., whereby the latter company will sell, through its large sales organization, comprising eight branch houses and over 4,000 retail dealers, one-half of the product of the E.-M.-F. factory, said to be 12,000 cars. By the terms of the alliance the Studebaker Company handles all of the foreign trade and the United States trade in the West and South. Both Col. Geo. M. Studebaker and Walter E. Flanders confirm the formation of the alliance, expressing it as their opinions that it will work to the best interests of all concerned. Hayden Eames, manager of the Studebaker Automobile Company, and Wm. E. Metzger, sales manager of the E.-M.-F. Company, will co-operate in marketing the E.-M.-F. output.

Automobile Enterprises in Japan.

At the conclusion of the Russo-Japanese War several attempts were made to introduce automobile services in Tokio. Of the companies organized for this purpose, the Japan Automobile Company and the Automobile Traffic Company in Tokio have failed, while the Imperial Automobile and Transportation Company still survives. It was originally organized with a capital of 2,500,000 yen, but the capital stock was later reduced to 1,500,000 yen and finally to 500,000 yen (1 yen = 50 cents), of which one-quarter is paid in. The firm of L. Suzor, Yokohama, which is said to have taken over stocks, has imported some fourteen French automobiles. But as the cars imported from Europe come too high in price, members of the company consider it advantageous to build the machines in Japan. Whether this is possible remains to be seen. The present time is not particularly favorable to company promotion in Japan, however.

MINOR MENTION

G. P. Wells, San Francisco manager of the Neustadt Company, is now occupying new quarters at 558 Golden Gate avenue.

The Four Traction Automobile Company, of Mankato, Minn., are putting through a lot of twenty-five cars, and also a number of motor trucks.

The California Chauffeurs' Association held a meeting recently in San Francisco and reorganized. Efforts will be made to get rid of the grafting chauffeur.

The Eureka Manufacturing Company, Rock Falls, Ill., will exhibit a motor buggy of their manufacture at the coming Great Northwestern fair in Sterling, Ill.

The Rainier Motor Car Company have reduced their force at their Saginaw, Mich., plant prior to taking an inventory and preparing for work on next year's models.

A Chicago automobile concern manufacturing a car with a double friction drive is negotiating with Janesville (Wis.) business interests, with the idea of removing its factory there.

The Newcastle, Ind., plant of the Maxwell-Briscoe Motor Company was shut down for two days last week for the annual inventory. It resumed on August 4 with 750 employees.

The Guenther oscillating vane circulating pump, which was described in THE HORSELESS AGE of January 8, 1908, has now been placed on the market by the Circulating Pump Company, 1693 Broadway, New York.

The Blomstrom Manufacturing Company, Detroit, Mich., announces an increase in its capital stock to $500,000. It is stated that the new issue of stock has been underwritten by Pittsburg capitalists. An addition to the factory is to be erected.

The Jackson, Church & Wilcox Company, Saginaw, Mich., who have recently engaged in the manufacture of automobile parts, are erecting an addition, which will be ready for occupancy in sixty days and will double the capacity of their plant.

The Fisk Rubber Company have obtained a five year lease for their Seattle, Wash., branch, of which Robert Dowie is manager, of a new three story brick building in course of construction at 1010 and 1012 East Pike street. The new premises will be occupied about September 1.

Members of the firm of the Fisher Wagon and Carriage Company and other Detroit carriage concerns have incorporated the Fisher Body Company, of that city, with a capital stock of $50,000, of which $30,000 is paid in. A. Fisher is president, Fred J. Fisher secretary-treasurer and general manager and Charles Fisher vice president. The company has purchased a factory site containing a two story building 70x100 feet, and will immediately erect a two story addition 230x50 feet, to be used as a mill and dry kiln room.

Otto Heisser, a chauffeur employed by Vice President Charles W. Fairbanks, was in the Indianapolis police court last week on a charge of violating the speed law. He was fined $1 and costs. Vice President Fairbanks was not with Heisser when the latter was arrested.

At a recent meeting of the Minnesota Republican State Central Committee it was proposed to use automobiles for campaign purposes. It is said that the suggestion has not been lost on the automobile manufacturers and dealers, who have deluged the chairman of the committee with advertising matter.

The Warner Instrument Company, of Beloit, Wis., now have a direct branch house at 550 Golden Gate avenue, San Francisco, in charge of W. H. Hallowell, who has begun a movement to demonstrate to the police the inconsistencies in the enforcement of the laws regulating the speed of motor cars.

A large section of one of the walls of the garage building being built for the Fisher Automobile Company at Indianapolis collapsed without warning a few days ago. Three workmen were painfully but not seriously injured. The garage is of concrete construction, and occupancy of the building will be delayed because of the accident.

The Heizer Magneto Company has been formed at Anderson, Ind., with a capital stock of $5,000, to manufacture an ignition magneto with a one piece armature, invented by Alexander Heizer. The officers of the company are: P. L. Phillips, president; J. E. White, vice president; D. M. Sisson, secretary and treasurer, and Alexander Heizer, general manager.

Last year's death rate in London was lower than it has been in fifty years, and a physician commenting on the subject asserts that this is due to the decrease in horse traffic and increase in motor traffic in the streets of the city. He claims that the exhaust gases of motors are an efficient disinfectant and the carbonaceous products of incomplete combustion are a splendid antiseptic.

The Electric Vehicle Company, Hartford, Conn., is now running with about 100 men, and will put on more as soon as castings and other materials are received. Fifteen drop forgers will be added in a short time. The receiver is empowered by a court order to proceed with the manufacture of cars, and it is his intention to start work on the 1909 models, both gasoline and electric, as soon as possible.

The Driggs-Seabury Ordnance Company, Sharon, Pa., referring to an item in our last week's issue, are of the opinion that this might give the false impression that the erection of an addition for the manufacture of automobile parts represented a new venture on their part. As a matter of fact, the building to be erected is only an addition to their pressed steel department, which is already quite extensive. This company has also been equipped for some time to do drop forging and machine work of all kinds.

Automobiles may now be driven to the summit of Mount Wachusett, Mass., between the hours of 12 and 2 p. m. and 5 and 7 p. m., according to a recent decision of the reservation commission. If motor parties desire to stay at the summit over night special permits to make the descent in the morning before the regular hours will be issued.

The Westcott Carriage Company, Richmond; Studebaker Brothers Manufacturing Company, South Bend, and the C. H. Stratton Carriage Company, Muncie, are Indiana concerns that will bring out motor buggies next season. The Studebaker Company have just placed a large order for the chasses to be used on their motor buggy with the Speed Changing Pulley Company, Indianapolis.

We have received a copy of a booklet on the mechanical properties of Shelby seamless steel tubing, which contains a number of tables on the properties of this tubing which have not been published before, and embody the results of several years' investigation and experiments. Copies of this booklet will be sent by the National Tube Company, Pittsburg, Pa., to chief draughtsmen, master mechanics and managers who may apply for it.

The Bendix Automobile Company, of Chicago, is negotiating with the Logansport Industrial Association, Logansport, Ind., for a site and factory in that city. It is stated that the company agrees to build a factory employing 200 men by January 1, provided Logansport citizens will subscribe for $75,000 worth of stock, which is guaranteed to pay 6 per cent. dividends. It is stated that the company now has 1909 orders amounting to $50,000.

It is stated that the Swayzee & Elwood Traction Company, with headquarters at Elwood, Ind., will use gasoline motors exclusively on their cars when the line is opened for business next year. A four cylinder gasoline engine, such as is used on heavy motor trucks, will be used instead of electric power, which is usually employed on Indiana interurban lines. The proposed line is to be 17 miles long, and it has already been granted a franchise through Grant County.

The Overland Automobile Company, Indianapolis, has signed contracts for parts for a minimum of 1,500 cars in 1909, and within a few weeks will decide whether the new plant will be located in that city or elsewhere. A plant with three times the capacity of the present one is to be built this fall. Next season the company will build four cylinder roadster and touring models and a six cylinder touring car, the latter to cost about $2,000 and to be completed about September 1.

Charles B. Shanks, until recently sales manager of the Winton Motor Carriage Company, has accepted a similar position with the F. B. Stearns Company, of Cleveland. He will conduct the agency for the Chalmers-Detroit car for northern Ohio as an independent business, in charge of R. H. Williams, formerly of Baltimore.

The Standard Roller Bearing Company, of Philadelphia, is reported to have signed a contract for parts with the Chalmers-Detroit Motor Company amounting to $433,000. The company has increased its force by 200 during the last two months.

The Joseph Dixon Crucible Company, of Jersey City, N. J., have registered the word "Flake" as applied to graphite. The word "Flake" as applied to the thin, tough, foliated form of Ticonderoga graphite was originated by the Dixon Company to distinguish it from the thicker, foliated form of Ceylon graphite, and for many years the word "Flake" has been used by the company on its goods and its printed matter as a distinctive mark.

Club Notes.

The Mercer County (N. J.) Automobile Club has voted to give to the county two carloads of oil for sprinkling roads so as to suppress the dust nuisance.

For the Algonquin hill climb of the Chicago Motor Club, which is to be held the 14th inst., forty-three entries had been received up to last Saturday.

The Long Island A. C. has issued its year book for 1908. It contains the constitution and bylaws of the club, the house rules, the garage rules, a membership list and a list of officers.

The Oklahoma A. A., with a membership of about 200, has been admitted to membership in the American Automobile Association, forming the twenty-fifth State organization affiliated with that body.

Thirty automobile owners of Dallas County, Texas, met at Dallas on August 3, with the object of forming a club. Dr. E. V. Dickey was elected temporary chairman, and the date for another meeting was set.

The Council Bluffs, Ia., Automobile and Motorcycle Club was permanently organized on July 31 and elected the following officers: Dr. Donald Macrae, president; Dr. T. B. Lacey, vice president; Thomas Farnworth, secretary; J. G. Wadsworth, treasurer; Maurice Wollman, executive.

The Automobile Dealers' Association of California will hold a run from San Francisco to Los Angeles (475 miles) and back in September. An entrance fee of $50 per car is required, but will be refunded if the car qualifies. The rules to govern the run will be decided upon at the monthly meeting for August.

The Automobile Club of America has issued a circular to members containing a list of all the dangerous railroad grade crossings in the vicinity of New York city. The club has recently put up quite a number of danger signs at such crossings, painted in red and bearing the inscription in white letters, "Dangerous Crossing." They are usually set several hundred feet along the road from the crossing, so as to give timely warning. The club feels that every grade crossing in the State should be abolished and that the annual cost to railroads of maintaining gatemen or flagmen would probably not equal the interest on the damages recovered from the railroads for accidents at the crossings.

The Denver Motor Club was organized at Denver, Col., on July 31, most of the charter members being connected with the local trade. It is the intention to hold some sort of contest on Labor Day. The following committee on constitution and bylaws was appointed: Dr. Ralph Taylor, E. R. Cumbe, W. D. Nash, Ralph Smith and F. L. McFarlan.

The Chicago A. C. has made application to the A. A. A. for a sanction of the DeMont Thompson Cup race, which the club expects to hold over a circuit extending from the southern limits of Crown Point, Ind., through Lowell, along the eastern shore of Cedar Lake, some time next fall. The A. A. A. is said to be opposed to the holding of the event, as it would be apt to detract attention from the Vanderbilt Cup race. The matter is still under discussion.

Commercial Notes.

Posten Brothers, Wilkes-Barre, Pa., have ordered three motor taxicabs, which they will operate in place of their horse cabs.

An automobile service between Red Jacket and Laurium, Mich., was inaugurated by the Calumet Motor Company on August 4.

One of the several Brush delivery wagons which left Detroit on August 1 arrived at Chicago on August 7, carrying the driver, an observer and 500 pounds of load.

R. A. Simpson, of Ferndale, Cal., has completed a 6 ton truck equipped with a 50 horse power motor of standard make, which he intends to use for carrying freight between that town and Eureka.

Langston Haygood, owner of the Montgomery (Ala.) Transfer Company, will establish an automobile line between Montgomery and Wetumpka. Cars will start from both ends every two hours.

The motor garbage truck which has been in use in Cincinnati for some time was destroyed by fire while standing at the Gest street dump on August 5. It is stated that the driver was absent at the time the fire started.

Motor cabs were formally introduced for of Philadelphia on July 29, when President Claude S. Jarvis, of the Quaker City Cab Company, had Mayor Reyburn and two score other prominent persons as guests on a short run for a luncheon. The cabs, which are of the locomotive make, have dark yellow running gears and dark brown bodies.

We are informed that the War Department, after some experiments made by the United States War College, Washington, D. C., has purchased a Pope-Waverley electric delivery wagon for official service. The car will have a single motor and a double side chain drive, all mechanism being carried on the running gear, so that an open body can be easily substituted for a closed one. The capacity is 400 pounds.

The Cortland Transportation Company, of Cortland, Ohio, has placed an order for a Plymouth commercial car, which will be placed in service between Cortland and Warren the coming month.

A. L. Scott, president of the Pacific Hardware and Steel Company, has purchased for the corporation a 20 horse power roadster, equipped with a special box tonneau for carrying salesmen's samples from Sacramento through the mountainous region to Nevada City, Cal. The route to be traversed is known as the southern mine trip.

An automobile stage line between Sacramento and Fair Oaks, Cal., has been in operation for about six months. In order to accommodate twelve persons the chassis of a touring car was fitted with a specially designed body. The distance between Sacramento and Fair Oaks is 18 miles, and the motor stage has made three trips each day for the past half year.

Pope Receivers' July Report.

Following is a résumé of the monthly statement of the receiver for the Pope Manufacturing Company for July:

Balance in banks and cash in office June 30, 1908	$587,338.47
Total receipts during the month	121,658.30
Total	$708,996.77
Refund of deposits	$1,643.51
Payrolls, supplies, selling expenses and royalty	76,871.83
Receivers' fees	1,000.00
Payments to receivers in other States	3,118.14
Funds transferred to New Jersey	300,000.00
Total	$382,633.48
Balance in banks and office	$326,363.29
Accrued liability of receivers	43,031.48
Balances due receivers, accounts receivable from July sales, sales for July	183,372.96
Less cash collected and deposits credited to accounts receivable	113,709.74
Balance	$69,663.22
Balances due from receivers in other districts	4,671.00

Electric Vehicle Receivers' Report for July.

According to the monthly report of the receivers for the Electric Vehicle Company for the month of July, no less a sum than $236,915 of Selden royalties was collected during that month, of which $95,533 was paid to the A. L. A. M. Following is the complete report:

SALES.	
Charges on account and cash sales	$33,803.76
PURCHASES.	
On account	$5,836.96
Cash	148.47
	$5,985.43

CASH STATEMENT.

RECEIPTS.

Cash on hand July 1	$121,196.64
Collected on E. V. account	86.03
Collected on receivers' account	31,968.02
Selden royalty	236,915.77
	$390,166.46

DISBURSEMENTS.

Pay roll	$13,404.72
Traveling expenses	50.00
Purch. creditors	14,092.89
Freight and express	122.24
Commissions	100.00
Petty cash	148.47
Telephone and telegraph	10.09
Storage	75.00
G. B. Selden	11,776.68
A. L. A. M	95,533.59
Taxes	12,082.55
	$147,396.23
Cash receipts	300,166.46
Cash disbursements	147,396.23
Balance on hand August 1	$242,770.23

Garage Notes.

Edward Odegaard and Will Cameron are planning to start a garage at Fasston, Minn.

The City Garage at Fremont, Ohio, operated by Fuller & Yeager, has been opened for business.

The Reo Automobile Co., Albuquerque, N. M., have moved from their former location on Copper avenue to their new garage on Fifth street.

William A. Heacock has purchased the Standard Auto Garage on Main street, in Buffalo, N. Y. Orville Tate has been appointed manager of the garage.

The Standard Automobile Co., Washington, D. C., composed of H. H. Tanner and Fred C. Berthel, will open a garage at 29 East Wheeling street.

C. Zamboni & Sons have opened a garage at Owatonna, Minn. The building is of brick, 44x70 feet, one story high, and will accommodate from twenty to thirty small cars.

The Olds Motor Works, Detroit, Mich., will establish a branch office at 2031 Michigan avenue, Chicago, for the sale of their 1909 cars. The branch will be in charge of Lafayette Markle.

A modern garage building is being erected for Allison Hitch on East Monroe street, Bloomington, Ill. The building wil be 53 feet on Monroe street by 104 feet deep, and will be faced with pressed brick.

Bert A. Bone has purchased the garage business of Charles Maynard, Commercial and Park streets, Kewanee, Ill. He will handle automobile supplies and secure the agency for several makes of cars.

A pretentious garage is to be erected for the Cincinnati Automobile Co. at Race street, north of Ninth street, Cincinnati, Ohio. According to the plans, the building will be 65x95 feet, four stories high and cost $35,000.

The Southern Motor Car Co., of Houston, Tex., on July 28 elected the following officers: M. E. Foster, president; E. M. Pavey, vice president and manager; E. E. Parson, secretary and treasurer, and George E. Ayres, superintendent.

W. L. Hess & Co., implement dealers at Clyde, Ohio, who are also local dealers for the Reo and Brush cars, have decided to give up their implement business and devote their whole time to the automobile business. They are located on Buckeye street.

The garage of Theodore Heilbron, 770 Franklin avenue, Brooklyn, a one story frame building, was destroyed by fire early in the morning of August 5. Fifteen automobiles in the place were ruined, and a total loss is estimated at $22,000. Only three of the cars stored in the place were insured.

An addition to the Rambler Garage in Chicago is now in the course of construction, which, it is claimed, will make it the largest public garage in this country. The garage, which is located at 1280 Sheridan road, now has 100 feet frontage; the addition will add 45 feet to this, will be three stories high and cost about $20,000.

The Utica Motor Car Co., Utica, N. Y., has purchased the Genesee Automobile Co., of Syracuse, N. Y., and taken possession of the business on August 1. The company will handle the Peerless, Pope-Hartford and Cadillac cars at Syracuse, and the Peerless, Stevens-Duryea, Thomas and Cadillac cars at Utica. The directors are F. T. Miller, E. J. Otis, G. H. Norris, C. H. Norris, T. H. Ferris and A. B. Maynard.

The Sid Black Automobile Co. and the Auto Motor Car Co., both Cincinnati garage operating firms, have been combined under the name of the Sid Black Automobile Co. The two garages, one on Walnut street and the other on Sycamore street, will both be continued, but the Sycamore street garage will be the headquarters of the company, which is capitalized at $50,000. The Walnut street garage will be used as a livery and taxicab station. The merger of the two firms was the result of a lease negotiated on the Sycamore street garage, this lease running for five years, and involving a consideration of $17,000 for the term.

New Incorporations.

Automobile Sales Corporation, Philadelphia, Pa.—Capital stock, $30,000.

Western Multi-Motor Co., Los Angeles, Cal.—Capital stock, $200,000.

Fisher Body Co., Detroit, Mich.—Capital stock, $50,000. Incorporators: A. Fisher, Fred J. Fisher and Charles Fisher.

McKeen Motor Car Co., Jersey City, N. J.—Capital stock, $1,000,000. Incorporators: G. E. Dons, B. F. Russell and T. F. Barrett.

The Auto General Supply Co., Denver, Col.—Capital stock, $18,000. Incorporators: J. C. McGill and George H. Phelps (incorporated in Utah).

Twentieth Century Wheel and Tire Co., Willmar, Minn.—Capital stock, $100,000. Incorporators: Andrew Nordloef, Julius Jueson and Walter Delahunt.

Standard Automobile Supply Co., Chicago, Ill.—Capital, $10,000. Incorporators: W. F. McCarthy, George B. Levy and A. S. Henley. To manufacture and deal in automobiles.

Detroit-Cadillac Motor Car Co., New York.—Capital stock, $5,000. Incorporators: Wm. H. Murphy and Wilfred C. Leland, of Detroit, Mich., and Henry B. Potter, of New York.

Crescent Motor Car Co., Chicago, Ill.—Capital, $100,000. Incorporators: F. D. Moon, C. P. Hatter and W. J. Crumpton. To manufacture and deal in automobiles and auxiliary machinery.

The Auto Co., Wilmington, N. C.—Incorporated in Virginia. Capital stock, $10,000. Incorporators: A. B. Skelding, George B. Elliott, C. E. Taylor, Jr., W. D. McMillen, Jr., and Morris Bretzfelder.

Broc Auto Ignition and Supply Co., New York.—Capital stock, $5,000. Incorporators: Paul L. Snutsel, 116 Nassau street; James Parkes, 15 Wall street, and Albert DeBarres, 1692 Broadway, New York.

Calmon Asbestos and Rubber Works of America, New York.—Capital stock, $25,000. Incorporators: Edward H. Garcin, 144 East Twenty-second street; Rudolph Gaertner, 290 Broadway, and Rudolph Gruber, 25 Broad street, New York city.

Everlastic Co. of America, New York.—(Pneumatic tires.) Capital, $50,000. Directors: Oscar Siesel, 40 and 51 West Sixty-sixth street; Edward C. Siesel, 64 and 66 East Eleventh street; Gustave Siesel, 588 and 590 Broadway, New York.

Knickerbocker Tire and Repair Co., New York.—Capital stock, $10,000. Incorporators: Wm. J. Staunton, 321 Pacific avenue, Jersey City, N. J.; John J. Walsh, 220 West 148th street, and Charles P. Bispham, 603 West 169th street, New York.

Downingtown Motor Co., Downingtown, Pa.—Capital stock, $[illegible]. Incorporators: Edward Kerr, [illegible] Miller, H. B. McFarlan, William H. Carey, Samuel B. Bicking, Frank P. Miller, Joseph A. Bicking, Dr. J. G. McIlvain and Theodore Hallman, of Downingtown.

Trade Literature Received.

Barrett Manufacturing Co., New York.—"Tarvia, the Dust Layer."

The Dayton Rubber Manufacturing Co., Dayton, Ohio.—Catalogue of Dayton airless tires.

The White Co., Cleveland, Ohio.—White Route Book, No. 7. This book covers routes from Cleveland to Chicago, Niagara Falls and Harrisburg, Pa.

Coming Events.

August 14—Algonquin, Ill., Hill Climb of the Chicago Motor Club.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

September 11—Hill Climb of Springfield (Mass.) A. C.

September 14—Annual Economy Run, Chicago Motor Club.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

Patents Issued August 4, 1908.

894,866. Dry Battery.—George M. Wheeler and Henry Wilhelm, Brooklyn, N. Y. Filed October 12, 1907.

894,931. Trolley Car for Electric Motor Vehicles.—Riccardo Arno and Luigi Negro, Turin, Italy. Filed June 14, 1906.

894,958. Friction Drive Mechanism for Motor Cars.—Charles C. Keyser, Washington, D. C. Filed December 16, 1907.

894,972. Automobile Goggles.—Philippe C. M. Montbarbon, Paris, France. Filed September 19, 1907.

894,978. Internal Combustion Engine.—James C. Peache, Rugby, England. Filed January 2, 1908.

894,980. Running Gear for Vehicles.—George M. Phillips, St. Louis, Mo. Filed May 19, 1906.

895,030. Spark Plug.—James Lang, Cavalier, N. Dak. Filed November 25, 1907.

895,069. Folding Platform for Operators of Motor Trucks.—Tracy V. Buckwalter, Altoona, Pa. Filed December 10, 1907.

895,099. Explosion Engine.—Thomas J. F. Moldon, Peterborough, Ontario, Canada. Filed August 3, 1905.

895,111. Vehicle Wheel.—Nicholas Schenk, St. Louis, Mo. Filed December 22, 1906.

895,113. Shock Absorber.—James A. Scott, Los Angeles, Cal. Filed April 11, 1907.

895,127. Vehicle Wheel.—Gabriel G. Trannoy, Charenton, France. Filed May 31, 1906.

895,140. Universal Joint.—Maurice E. Bloed, Kalamazoo, Mich. Filed May 17, 1905.

895,155. Gas Engine.—Charles Burgess, Jr., Wenona, Ill. Filed November 16, 1907.

895,184. Internal Combustion Engine.—Orin Kelly, Wellston, Ohio. Filed April 19, 1907.

895,194. Internal Combustion Engine.—Carlton R. Radcliffe, New York, N. Y. Filed August 3, 1907.

895,202. Compensating Gearing.—David E. Ross, Brookston, Ind. Filed October 27, 1906.

895,205. Water Radiator for Automobiles.—Charles F. Sebell, Buffalo, N. Y. Filed January 9, 1907.

895,222. Multiple Cylinder Two Cycle Explosion Engine.—Alexander Winton and Harold B. Anderson, Cleveland, Ohio. Filed April 13, 1908.

895,245. Elastic Suspension for Vehicles.—Claude L. le Duc and Louis Garchey, Paris, France. Filed June 18, 1906.

895,301. Tire.—Alfred G. Ritchie, San Jacinto, Cal. Filed August 7, 1907.

895,328. Starting Device for Explosion Engines.—Howard C. Bailey, Philadelphia, Pa. Filed May 18, 1905.

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An Investigation of Fuel Flow Through Carburetor Nozzles.

By P. S. Tice.

A short time ago the writer had occasion to perform a series of experiments calculated to throw some light upon carburetor nozzle action as affecting the vaporization of the fuel and upon the laws governing the proportioning of the mixture in the typical constant level device. In the following will be set forth the facts established by experiments covering the discharge of gasoline of .71 specific gravity from several forms of so called spraying nozzles. Before going further it must be stated that the term "spraying nozzle," as applied to carburetor fuel discharge passage, is a misnomer. In all cases the liquid enters the air either as a solid stream or as a sheet, depending upon the form, location, etc., of the nozzle and needle valve parts with reference to each other. Thus no spray, in the proper sense of the term, is formed by the nozzle. It is true that the stream may be broken up more or less finely by impingement and be then carried along by the air column; but there can be no fine division thus caused, since the force with which the liquid can impinge upon an object in its path is very slight, because of the small pressure difference causing the flow.

FUNCTION OF SUPPLEMENTARY VALVE.

Everyone is familiar with the function of the auxiliary air valve. Its sole object is to obviate a richening of the mixture as the engine demand increases. Without such an air port the ratio of fuel to air in the mixture would increase directly as the engine demand.* In all written or oral discussion that has come to the writer's attention this phenomenon is explained on the ground that the laws governing the flows of the liquid and the air are different and are such that, for given areas of air and fuel passages, the flow of air will increase with a given increase in pressure difference at a much lesser rate than will the flow of liquid.

In such discussions, it is assumed that the flow of air will follow the law of orifice discharge, and that the fuel flow is directly proportional to the pressure difference causing the flow. The above assumption as regards the flow of air through carburetor ports and passages is correct; but the latter assumption as to the character of the fuel flow is not absolutely correct.

DISCHARGE FROM ORIFICES.

When a gas expands adiabatically, i. e., without receiving or rejecting heat, from a region of constant pressure through an orifice into a region of lower pressure, the discharge is proportional to the square root of the work of expansion, and is therefore proportional to

$$\sqrt{\frac{P_1 V_1}{r-1}\left[1-\left(\frac{P_2}{P_1}\right)^{\frac{r-1}{r}}\right]}.$$

Thus, with frictionless and perfectly adiabatic flow of any gas through any orifice, the weight discharged is

$$W=A\sqrt{2g\,\frac{r}{r-1}\,\frac{P_1}{V_1}\left[\left(\frac{P_2}{P_1}\right)^{\frac{2}{r}}-\left(\frac{P_2}{P_1}\right)^{\frac{r-1}{r}}\right]}.\;(1)$$

in which

W = Weight of gas discharged in pounds per second.

A = Area of orifice in square feet.

P_1 = Pressure on entrance side of orifice, pounds per square foot.

P_2 = Pressure on exit side of orifice, pounds per square foot.

V_1 = Specific volume of gas on entrance side (cubic feet per pound).

r = Ratio $K_p/K_v = \frac{\text{spe. heat at con. pres.}}{\text{spe. heat at con. vol.}}$ per lb.

For air this expression becomes:

$$W=.07058\,d^2 P_1\sqrt{\left(\frac{P_2}{P_1}\right)^{1.425}-\left(\frac{P_2}{P_1}\right)^{1.712}}.\;(2)$$

in which

d = diameter of orifice in inches.

P_1 = pressure on entrance side of orifice, pounds per square inch.

P_2 = pressure on exit side of orifice, pounds per square inch.

The above formulæ are exact expressions, since they embrace all the variables affecting the flow. However, when the pressure difference $P_1 - P_2$ is less than 20 inches of water (.732 lbs. per sq. in.), it is possible to use a much simpler expression than (2). Such an expression has been evolved and used by Prof. R. J. Durley (Trans. A. S. M. E., Volume 27, p. 193) in his work on the measurement of air flow through orifices under small pressure differences:

$$W = .01369\,d^2\sqrt{\frac{iP}{T}}\;\ldots\ldots\ldots\ldots\ldots\ldots\;(3)$$

in which

$i = P_1 - P_2$, measured in inches of water.

T = absolute temperature of the air, °F.

P = mean pressure of the air, lbs. per sq. ft.

If P in the above be taken as 14.7 lbs. per sq. in. = 2116.8 lbs. per sq. ft., as it well may with the small pressure differences used in carburetor action, the formula (3) becomes

$$W = .6299\,d^2\sqrt{\frac{i}{T}}\;\ldots\ldots\ldots\ldots\ldots\ldots\;(4)$$

which is very simple indeed.

In equation (4) it is assumed that the temperature of the air remains the same throughout its passage through the port, that the velocity of flow is uniform over the whole area of the port, and that the specific volume of the air (cu. ft. per lb.) remains constant during its flow. Results calculated from (2) and (4) agree to within a few ten-thousandths of a pound for pressure differences below 20 inches of water; above that pressure difference the results begin to appreciably diverge, those calculated from (4) being then the higher, since that equation ignores changes in density, temperature, etc., due to the expansion through the orifice.

From the close agreement of (2) and (4) up to the pressure difference cited, it follows that in considering air flow through carburetor ports, where with well designed apparatus the pressure difference is never greater than 12 to 14 inches of water, changes in the temperature and density of the flowing air, due to expansion through the port, may be neglected without error.

ACTUAL RATES OF DISCHARGE.

The above equations give the theoretical or ideal discharges. Actual discharges can only be obtained from these expressions by the introduction of a numerical coefficient of efflux, C, which must be determined experimentally, and which embraces friction losses, orifice form characteristics, contraction of the air vein and the deviation of the actual discharge from the true adiabatic. While, as a matter of fact, the value of C varies also with changes in the pressure difference with the same orifice, its changes with pressure difference are quite small and fail to appreciably alter the characteristics of the discharge curve. For this reason, only characteristics being desired here, C will in the following be omitted.

From the foregoing it appears that for small pressure differences the weight of air flowing through a carburetor port is proportional to $\sqrt{\frac{i}{T}}$. Such an air discharge curve is shown in Fig. 1, the pressure drop in inches of water being abscissæ and the weight of air in lbs. per min. being marked off as ordinates at the right.

Knowing the characteristic curve followed by the air flow, it is at once apparent that a similar or identical curve for the nozzle discharge would best maintain proportions in the mixture, provided no other influence disturbed the action.

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* The term engine demand, as here used, is meant to cover the rate at which mixture is supplied the engine, and to embrace such changes in the rate of supply and character of the demand as are occasioned by variations in load, speed, throttle opening, or the various combinations of all three which occur in engine operation.

From inspection, it appears that the law of liquid flow through orifices is the one most nearly coinciding with the above law of air flow. This law of liquid flow states that the velocity of the liquid particles through the orifice is the same as that which a freely falling body would have on reaching the orifice after having started from rest at a point H feet above the orifice, H being a measure of the head or height of the liquid above the orifice; thus $V = \sqrt{2gH}$ ft. per sec. When the flow takes place under a pressure caused by some other condition than height of the liquid above the orifice, that pressure is expressed in the above equation by its equivalent in terms of H.

The velocity of the flow being $\sqrt{2gH} = 8.02 \sqrt{H}$ ft. per sec., the quantity delivered in cu. ft. per sec. is $Q = 8.02 A \sqrt{H}$, in which A is the area of the orifice in sq. ft. The quantity delivered in cu. ft. per min., expressing the area of the orifice in sq. in. and the head or pressure difference in inches, becomes $Q_1 = .965 a \sqrt{h}$; and the weight discharged per min. is then expressed by $W = D Q_1$, D being the density of the liquid. In the case of gasoline of .71 sp. gr., the weight delivered per min. is therefore

$$W = 4.2746 a \sqrt{h} \qquad (5)$$

Equation (5), like those for air in the above, also requires the introduction of a numerical coefficient, C, in order that actual discharges may be determined from it, since the actual discharge is always less than the theoretical because of frictional and vein contraction losses.

In (4) and (5) the terms *i* and *h* will be seen to be identical. In Fig. 1 an air discharge of 1.5 pounds per minute is indicated with a pressure drop of 1.5 inches of water. Since the weight ratio of gasoline to air in the theoretically best mixture is very approximately 1 to 16, the weight of fuel necessary to give the above ratio with 1.5 inches pressure drop is 1.5 ounces. Since the weight of fuel delivered is proportional to $\sqrt{h}$ for orifice discharge, knowing or assuming the weight delivered at any one value of *h*, the weight delivered at any other value of *h* can be determined. In this way the weights in ounces per minute have been calculated from 1.5 inch *h* with 1.5 ounce delivery and are plotted in Fig. 1, as there indicated, the ordinates, expressing ounces of fuel per minute, being marked off on the left of the figure.

Up to a pressure drop of 15 inches of water the two curves coincide exactly. This seems to indicate that enriching of the mixture with increased pressure drop, due to increased engine demand, cannot be due to a difference between the laws of flow of the two fluids, if the liquid discharge be governed by the law of orifice flow.

The experimental work, described in the following, was undertaken for the purpose of establishing definitely just what law or laws are followed by the discharges of several nozzle forms in actual use in carburetors. To this end actual carburetor nozzles, as fitted in nominal 1.5 inch carburetors, were secured and their discharges measured. In Fig. 2 are shown those forms tried which gave the most significant results.

EXPERIMENTAL APPARATUS.

The apparatus used in making these measurements is shown in Fig. 3. A bottle A, holding about 3.5 pounds gasoline of .71 specific gravity, was suspended from one arm of an accurate balance B. A siphon C, supported in such a manner that it cleared the neck of the bottle, dipped well into the gasoline in A and served to convey it to the Mariotte bottle D, without interfering with the action of the balance. From the lower neck of D the gasoline was piped to the passage below the float valve E, as shown. From the float chamber F the fuel was conveyed to a tube in the bottom of the glass discharge chamber G, which tube communicated with the nozzle H. The glass tube G, gasketed at each end to make it air tight, was clamped between the top and bottom caps by four rods with threaded upper ends. The adjusting needle I was threaded through the upper cap and placed absolutely central with the nozzle opening. A small pointer J indicated the number of turns the needle was off its seat in the nozzle. The tube K acted as a drain for G and conducted the discharged liquid to the bottle L. The water manometer M had one leg communicating with G by means of the tube N, and thus served to indicate the difference in pressure existing between the interior of G and the atmosphere. An aspirator O, operated by compressed air and controlled by the valve V, created the desired pressure drop within G and L. With the piping connections between O, G and L as shown, the discharged fluid flowed freely and evenly into L by the action of gravity alone. One accessory not shown in Fig. 3, and which it was found absolutely necessary to employ, was a small electric buzzer attached to the top of the float chamber for the purpose of maintaining an absolutely constant level in that chamber and a uniform flow of the fuel from A through C and D and past the float valve E. The head h_1 on the float valve was approximately 2 feet. Fig. 3 is approximately to scale, except that the sizes of F, G and M are exaggerated.

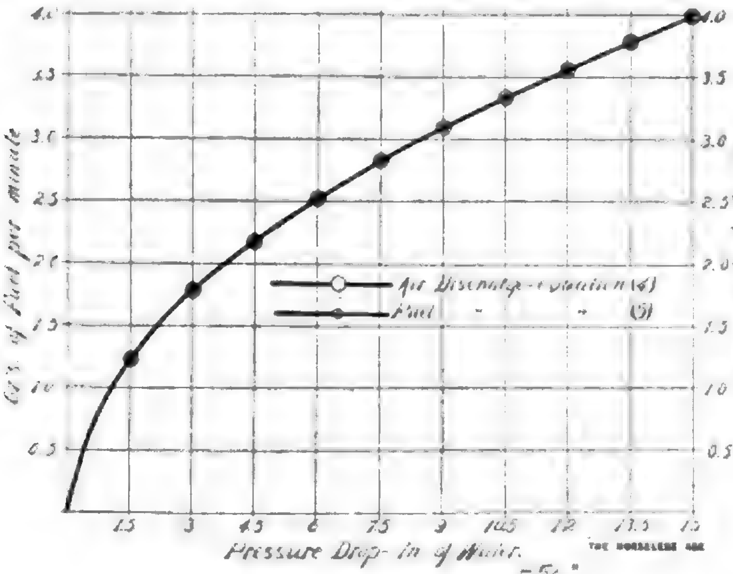

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FIG. 1.

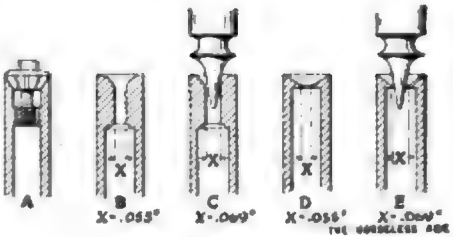

FIG. 2.

METHOD OF TESTS.

The method of making a run is as follows:

A being filled with gasoline, the small glass plug *x* is removed from the stopper of D and the siphon started by suction. When the level in D has arisen somewhat above the lower end of the siphon tube, *x* is replaced and the level in D then remains constant, no matter how much or how little liquid may flow through, because of the entrapped air. The float chamber being filled, the relative heights of F and G are adjusted so that the liquid just shows level with the top of the nozzle opening. The buzzer is then started and the valve V opened sufficiently to give the desired pressure drop in G, as shown by the difference between the levels of the water in the manometer legs. The liquid discharged from H then flows into L, as mentioned before. Weights are placed in the scale pan depending from the right hand arm of the balance beam until the bottle A is nearly balanced. When the balance beam swings past the centre a stop watch is started and a weight of known valve removed from the scale pan, which causes the bottle A to again overbalance the beam. When the beam again swings, due to the removal of gasoline from A, the watch is stopped and the elapsed time noted. From the weight of fuel discharged and the time taken for the discharge the weight per minute is found. In successive runs of upward of seven minutes' duration the readings of time checked to within one second.

(To be continued.)

The Government of Montenegro has concluded a contract with the Austrian firm of Laurin & Klement, according to which the latter will operate a motor mail service throughout the principality for fifteen years, with a bonus from the Government, and will also acquire the monopoly of supplying and running public motor vehicles of every kind.

A deputy from the Department du Nord recently introduced in the French Chamber a bill placing a tax of 10 francs per 100 litres on gasoline of a density of less than .765. The object aimed at is to encourage the use of denatured alcohol as motor fuel, particularly automobile fuel. The largest alcohol distilleries in France are found in this department, and beets are raised there in great quantities. It is therefore only natural that the population of this district is endeavoring to extend the market for one of its most important products, whose sales are at present limited by its price. If the above tax were levied on gasoline, alcohol would be lower in price on a volumetric basis. The bill was, however, strenuously opposed by the automobile interests and defeated.

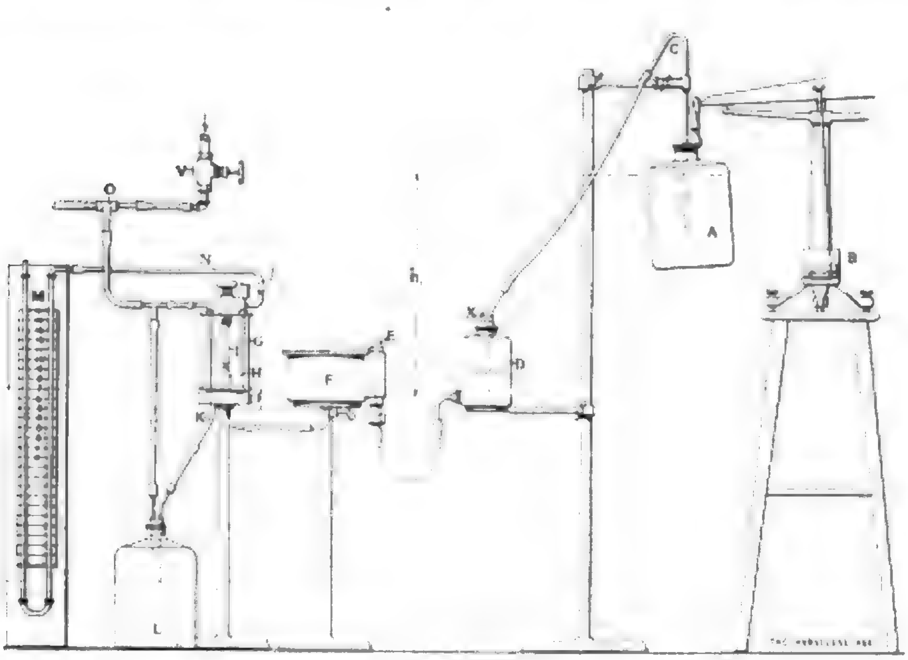

Fig. 3.

Shaft Driving Systems.

By Albert L. Clough.

In the design of the shaft drive systems of pleasure cars there are many interesting diversities which are well worthy of study. Although the field has been very sedulously canvassed practice has not as yet become by any means standardized. The shaft drive involves the engine, the flywheel, the clutch, the gear set, the propeller shaft and the axle, together with flexible joints of various kinds, and members for resisting driving stresses. The various methods of grouping of these elements are the main subject of this article.

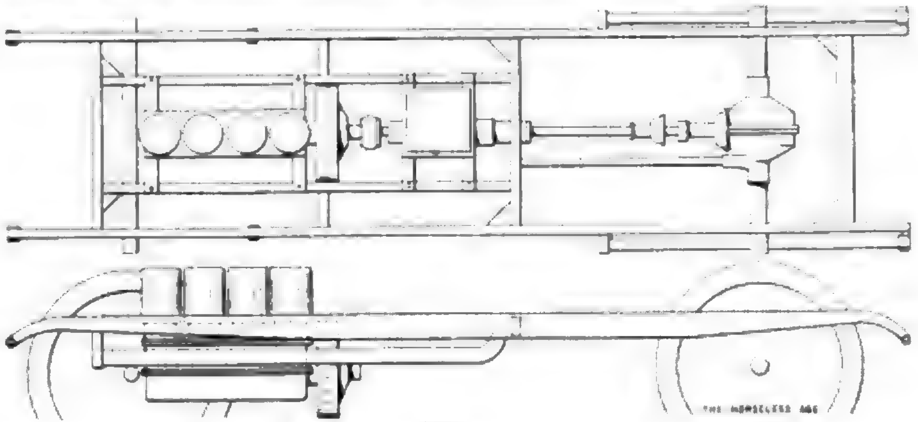

Fig. 1.

UNDERLYING PRINCIPLES.

The "bottom facts" underlying these diverse methods of shaft driving are that there is necessarily a considerable change of position between the rear axle and the motor due to road inequalities, and, further, that as the vehicle frame is not a perfectly rigid construction there may be changes of the relative positions of the elements mounted upon it, due to the frame's distortion. To secure an efficient transmission of power despite these changes of relative position of the parts is the main problem in shaft driving. The problem would be a simple one if all the parts involved were located upon the same perfectly rigid bed plate. Either one of two methods is always adopted in securing such driving relationship between any two power transmitting parts of the system. Either adjacent parts are secured together in a relationship so rigid and free from the liability of distortion that there can be no binding of the connected moving portions of the same, and the necessary change of relative position is completely allowed for elsewhere, or adjacent power transmitting parts are mechanically connected by devices affording complete flexibility in every plane in which relative motion may be called for. The shaft drive is a succession of extremely rigid elements with perfectly universal motions allowed between them.

TYPICAL ARRANGEMENTS.

The various typical arrangements of the elements of a shaft drive are as follows:

(1) Engine (and clutch) and the gear box arranged as two separate rigid units, flexibly connected together, with the propeller shaft flexibly connected to the gear box.

(2) Engine (and clutch) forming a rigid single structure, integral with the gear box, the propeller shaft being connected to the gear box by a universal joint.

(3) Gear box and rear axle casing a single rigid unit, with the flexibly connected drive shaft between it and the engine.

(4) Engine and clutch one unit and the gear box, drive shaft housing and rear axle casing another unit, the gear box being located near the middle of the car at the front end of the shaft housing with a flexible connection between it and the engine.

(5) Engine (and clutch) with gear box in a subframe, the rear end of which is fast to the rear axle tube and the front end supported by the main frame, no universal joints being used in the drive shaft.

THE CONVENTIONAL ARRANGEMENT.

The arrangement referred to under (1) is the most commonly accepted type, Fig. 1.

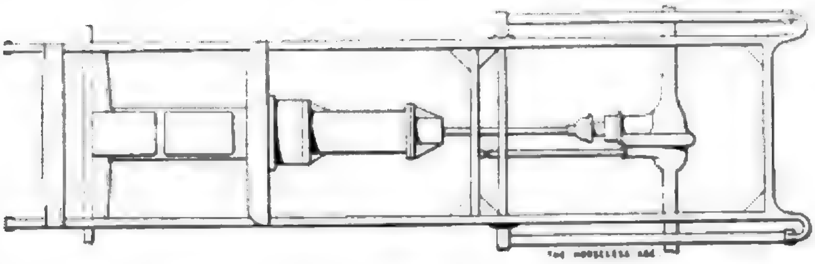

FIG. 2.

The engine and gear box may be secured directly to the main frame or to a subframe. In the former case the frame is greatly stiffened against distortion by the engine base and the gear case acting as very strong cross members. This, of course, transfers road stresses to the engine base and the gear housing, and may warp them or even break their supporting arms under very arduous conditions. The tendency is for the frame to be subject to heavy distorting stresses at a point between the engine base and the gear box, and it is a fact that frames have developed serious permanent sets or have actually failed at this point. It is an open question whether the housings of the power plant should be made to play the part of structural members.

If the engine and gear box are set upon a subframe of the usual construction, hung from the main frame, the main frame itself gains very little support from the strut action of the engine base and gear case. These latter elements are therefore less stressed by road shocks than in the former case. Considerable flexibility is afforded by the hangers of the subframe and the subframe itself, and the layout of the power plant is, in general, more adaptable to other conditions. The subframe carrying both engine and gear box may be of the three point type instead of the ordinary style, with one point located at the front cross member and the other two at the junctions of the side members of the subframe with the main side members. In this case the distortion of the subframe due to road irregularites is slight. The location of the three points may of course be reversed. A separate, three point suspended subframe may be employed for engine and gear box, the subframe of the gear box usually having its single point of support at or near the cross member forming two points of the engine support. Both engine and gear box are thus supported free from any stresses derived from road vibrations. The engine may be supported on the main frame and the gear box on a subframe, or the engine may be three point supported and the gear box not. American cars show a great diversity of construction in this respect, but the differences mainly arise from a consideration of whether the frame stresses may profitably be communicated to the engine and gear box structure or whether these should be free from such stresses. The desired position and direction of the shafts also enter in determining the method of support.

So long as the engine and the gear box are constructed as separate units, no matter how they are supported, some sort of a universal or semi-universal joint is employed between them, except in a few instances. This may be a simple Oldham coupling or a jaw clutch with rounded teeth. It may be a short shaft of hexagonal or square section with rounded extremities having its ends fitting somewhat loosely in sockets in the clutch and gear box shafts. A single universal joint of the accepted type may here be used or even two regular universal joints a short distance apart. The joint should provide not only for a difference in direction between the clutch and gear box shafts, but also for the possibility of their adjacent ends not coinciding. Either a double universal or a coupling allowing of a certain amount of lateral distortion as well as change of direction between the two shafts is preferable. In this form of shaft drive the clutch may be in the rearwardly mounted flywheel, as usual, in a separate housing close to the flywheel, if a multiple disc arrangement, or it may be within the gear box, if of this latter type. With the engine and gear box separate units, the gear box may be well toward the rear of the chassis and less weight thus concentrated toward the front of the car. It involves extra frame arrangements, an extra universal connection in the power transmitting system and additional work in the assembling process. Probably, also, some extra weight, in a separate gear housing.

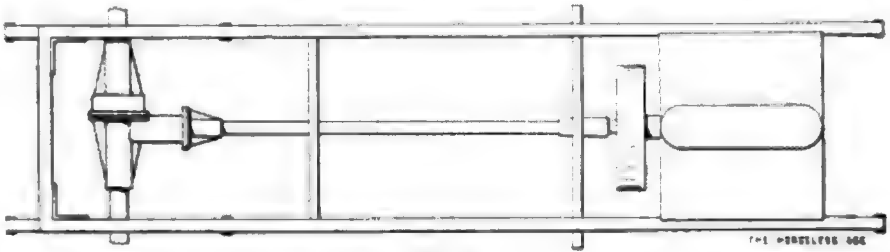

FIG. 3.

ENGINE GEAR BOX UNIT.

In the second class (Fig. 2), in which the engine and the gear box are structurally a unit, there are two types. That in which the flywheel is front mounted and that in which it is mounted in the ordinary position. In the former the gear case is bolted rigidly to the rear end of the crank case, and usually contains the multiple disc clutch. In the latter type the flywheel may be housed in the forward portion of the gear case, which is given a sufficiently large diameter to receive it, or the gear case may be secured to the crank case by a massive horizontal yoke which encircles the flywheel, and to the rear of which the gear box is bolted. In this design the flywheel is not enclosed by the housing of the gear box. A three point support is almost universally employed to carry the engine transmission unit, and this triangular support may have its apex either forward or to the rear.

The advantages and defects of the flywheel in front and the flywheel in the rear arrangement will be found well stated in an article by Warren Noble on page 655 of Volume 18 of THE HORSELESS AGE, in which the question of weight distribution in several types of shaft driven cars is also taken up.

Briefly recapitulated, the advantages of the integral engine and gear box are: Rigidity against binding of shafts and freedom from consequent power losses, compactness, its natural adaptability to three point suspension and ease of assembling. Its chief disadvantage is that it concentrates the weight quite far forward on the chassis.

CHANGE AND DRIVING GEAR UNIT.

(3) In this type (Fig. 3) the gear set and the rear axle housing form a unit, and thus a considerable increase of dead weight is brought upon the rear axle. It affords the opportunity of employing either an ordinary sliding gear combination or one of the gear sets giving a more direct drive on the lower speeds, or the so called "direct drive on every speed" transmissions. These gear combinations, as a class, make use of the driven gears on the axle for the added purpose of change speed gears. The centre

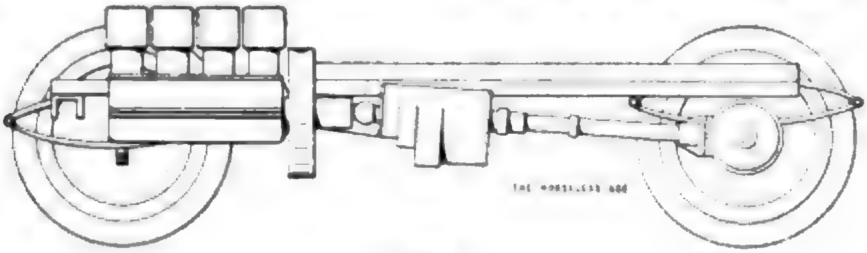

FIG. 4.

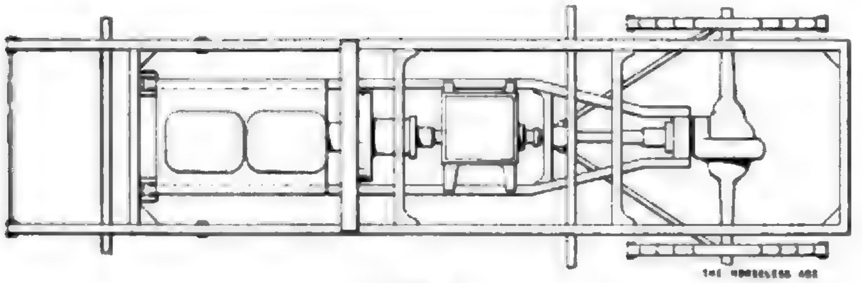

Fig. 5.

of gravity is obviously brought further toward the rear when this arrangement is used. A flywheel clutch with a universal within or just to the rear of it is the practice here followed, but it is interesting to note that if the change speed gear is of the planetary type the clutches are in the rear axle unit, and nothing intervenes between the engine and the rear axle combination but the universals. One fact of interest in this type of shaft driven car is that the driving torque on the propeller shaft and joints is no greater on the lowest than on the highest gear. A very long drive shaft is called for by this arrangement, and the straight line drive is thus easier of attainment than in some other combinations. A little more care is required in the design of the gear shifting linkage, as the gear set which it controls is subject to considerable movement relative to the rest of the chassis.

GEAR BOX DRIVE SHAFT CASING UNIT.

(4) In this type the rear axle housing, the drive shaft housing and the gear box form a unit, with the gear box at the front end, supported at its forward end by a ball joint, the socket of which is carried by a frame cross member. The weight distribution with this arrangement is quite similar to that of (1), but the dead weight imposed on the rear axle is less than in (3). In fact this arrangement seems to possess rather more merit than is usually accorded it. The drive shaft housing must be very staunch in order to withstand the "pound" of the gear box, but this is not unsprung weight. The universal support of the front end of the gear box must also be substantial. A single universal joint between the engine and the gear box is required, and the clutch may be either in the flywheel or, if of the multiple disc type, in the gear box. This arrangement of parts is as truly a two unit combination as is (2), and should be very easy to assemble.

SEMI-SUSPENDED SUBFRAME.

(5) In this construction, which has been but little used, the attempt is made to mount the engine and the whole power transmission system on a subframe which is supported by the main frame at its front end and at its rear ends by the rear axle structure. The intention is that all elements of the power plant shall thus bear a constant relation each to the other. The subframe may be two point supported at the front, and drawn together to a single point at the centre of the rear axle where the drive shaft enters the rear axle housing. The engine and gear box are both carried on this frame, and no universal joints are used between the gear box and rear axle or between the engine and gear box. Some form of slightly flexible coupling may, however, be used at these points. As an alternative construction the subframe may be single point supported from the main frame at its forward end, and secured at the rear to the two ends of the rear axle housing, near the spring clips, thus making a three point suspension. The gear box may be a unit with the rear axle housing and a rigid shaft housing with enclosed shaft then intervenes between the engine and the rear axle unit, or a very slight amount of play may be allowed for by some form of coupling. This method is an extreme case of applying dead weight to the rear axle. As the rear end of the subframe is rigidly attached to the axle housing, the whole motive power plant is raised and lowered whenever the axle rises and falls, the parts toward the rear moving most. The subframe must be exceedingly rigid if universal joints between engine, gear box and axle are omitted, and, if the subframe is thus extremely stiff, the blows struck by the rear end of the frame upon the axle, due to the weight of the power plant, must be very severe upon the axle structure, as well as upon the tires.

Universal joints are in themselves not desirable elements of the car structure, but there is such a thing as exchanging one kind of evil for another that is much worse.

In methods 1, 2 and 3 either the single or the double universal type of drive shaft may be used. In method 4 a single universal is necessarily used, and in method 5 no true universal is required.

DOUBLE UNIVERSAL JOINTS.

The use of a universal at each end of the drive shaft, with a slip joint at one of these points, and the shaft housing absent or performing no other function than to enclose the shaft, leaves the shaft free to assume a position in which it is subject only to the torsional stresses of power transmission and its housing free from stress. The torsional reaction tending to rotate the rear axle in a direction opposite to that of the driving wheels and the tractive effort of the wheels upon the road tending to push the axle forward or backward relative to other parts of the chassis during forward or backward vehicle motion must be resisted by special provisions. The magnitude of the two above mentioned stresses is well brought out in a Horseless Age editorial on page 263, Vol. 20. These two stresses may be borne entirely by the vehicle springs, as in certain runabouts and some heavier cars, in which case half elliptic springs are generally employed, the forward half of each spring acting as a somewhat flexible distance rod when the car is moving forward and in tension when the car is backing, thus resisting the tractive effort. If the spring seats are fast upon the rear axle casing the springs also act to flexibly resist the torque reaction, each spring acting in halves with the turning effort applied at or near the centre. Very severe and unusual service is demanded of a spring under these conditions, and it is probable that the regular spring action is somewhat interfered with. It is hardly practical to employ full elliptic springs under these conditions, even though the upper halves are rigidly secured. Special torque and distance rods are, of course, eliminated, with their liability to wear and rattle, but it is doubtful if much weight is saved, as the springs must be stronger.

If a torque rod is employed secured to the centre of the shaft housing, and bearing upon a cross member of the vehicle frame, the springs are relieved of the torque reaction, but not of the tractive reaction, and if distance rods are secured to the ends of the axle housing and to the frame, the springs are spared the stresses due to tractive effort. The torque rod is commonly supported be-

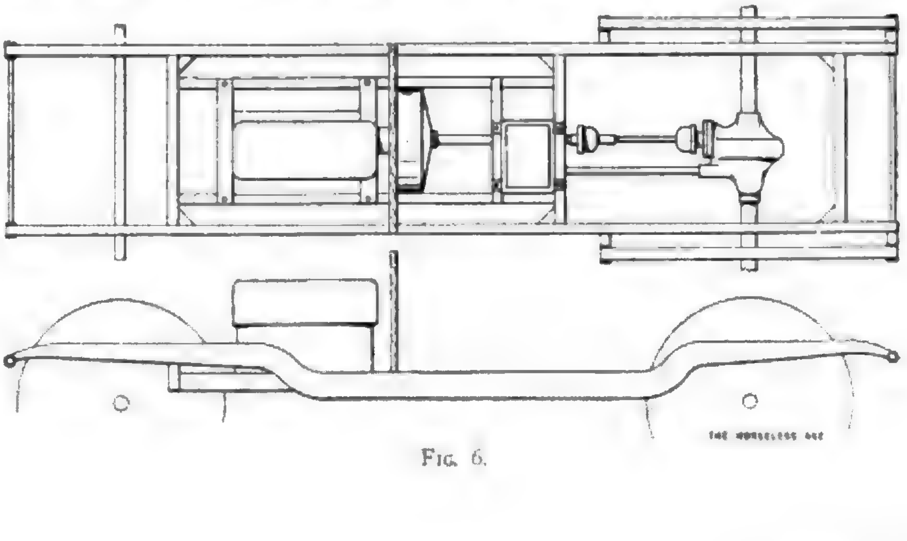

Fig. 6.

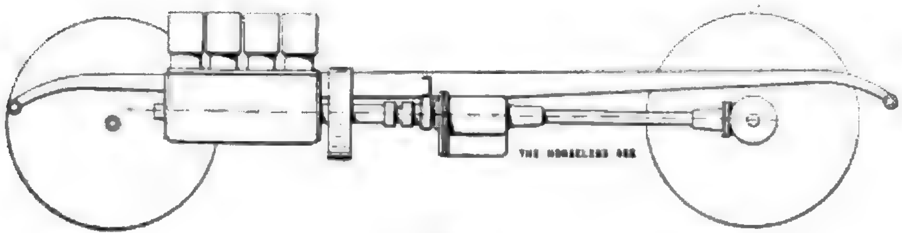

FIG. 7.

tween two stiff springs at its forward end to cushion starting and braking shocks, or it may be made in the form of a leaf spring, its rear end fast to the axle housing and its front end hung from a frame cross member. A single tube is generally used as the torsion member, but it is not the best form, as a tube is ill adapted to resist flexure. An I section member is better and a tapered I section with its large end fast to the axle housing and its small end spring supported on a frame cross member is excellent. A similar effect is produced by the double tubular torsion rod, forming a V in a vertical plane, with the rear ends of the two tubes rigidly connected to the drive gear housing and the forward ends of the tubes fastened together at the front point of support. In this construction one tube is always in tension, which it is well adapted to resist. A combined distance and torsion rod may be used on each side of the axle housing, consisting of a member secured against turning on the axle housing and forwardly secured to some point on the frame. If both torsion and tractive reaction are taken care of by special members, the spring seats may be free to rotate on the axle tube, and the springs are thus largely free from all unusual constraint. Full elliptics are then permissible. The writer believes that a torque rod should be used on all cars of considerable power, and that distance rods should also be used unless the rear axle ends are stayed by special rods to a frame cross member at practically the same point where the front universal is located. The stresses arising when one rear wheel strikes an obstacle at speed are very severe upon the rear axle construction when only the springs are used to keep the rear axle in line. Among American cars one can find examples embodying the widest diversity of practice in regard to torque resisting and tractive effort resisting provisions.

SINGLE UNIVERSAL JOINTS.

In the single universal joint method the shaft housing, being fast at the rear in the axle housing, and supported at its front end from a cross member upon a swivel with which the single universal joint of the shaft is as nearly as possible concentric, the housing acts as the torque and distance member and the drive shaft is perfectly free, assuming that the housing is sufficiently rigid. Full elliptic springs are desirable when this arrangement is used. When half elliptics are employed, unless the drive shaft is nearly horizontal, the front spring support must be nearly in line with the forward support of the shaft housing, or else the parts may be severely stressed. When full elliptics are used their lower seats should be free to turn on the axle casing. As the action of the shaft housing as a distance rod is only effective at the centre of the axle, it is common to run two tubes from the rear axle spring seats to the forward end of the shaft housing. This construction relieves the neck of the axle housing from stresses due to one wheel striking an obstruction. The elimination of one universal joint and a separate torque member is an important advantage of this construction. The shaft housing and parts of the axle housing must be made unusually rigid, and it seems important that the structure should be braced as above indicated. The front support of the shaft casing requires to be substantially constructed. In order to insure a straight line drive two expedients are adopted. The engine crank shaft may be dropped to practically the same level as the centre of the rear axle and a double dropped frame used (Fig. 6), or the engine crank shaft may be inclined slightly toward the rear, with relation to the frame line, so that it points toward the centre of the rear axle when the car is normally loaded (Fig. 7). In the first case large diameter wheels and outside hung springs must be used, in order that road clearance may not be too much reduced. The recent increase in the diameter of wheels has greatly reduced the difficulties attendant upon securing the straight line drive. The use of a long drive shaft, as required when the engine and gear box unit or the gear box and axle unit construction are employed, and the adoption of long wheel bases are factors which have tended toward drives of practically the straight line type. There is no question but that anything which can reduce the obliquity between shafts joined by universal joints is of great advantage as regards efficiency and durability. A drive shaft which is nearly horizontal calls for very little action on the part of the slip joint, which is usually integral with the forward universal joint. The motion of the axle being in a nearly vertical plane, the motion required at the slip joint is only the difference between a short arc and its chord in a circle of considerable radius.

CONCLUSIONS.

In conclusion it may be said that the use of the single universal joint method offers no serious difficulties, and, furthermore, that the duty of this joint can be reduced to very small proportions by means of a straight line arrangement. At present the universal joint is the bugbear of the shaft drive system, and, while it cannot be eliminated entirely, it is to be shunned as far as may be without getting the designer into trouble of other kinds.

Book Review.

"The Amateur Motorist," by Max Pemberton. Published by A. C. McClurg & Co., Chicago, Ill. Price, $2.75.

Mr. Pemberton, motoring editor of the London *Sphere*, has written this book specially for the amateur motorist, although it might also benefit a large number of professionals to absorb its contents. Beginning in the first section with some reminiscence and glances into the future, there then follow most instructive chapters upon purchasing cars, the amateur driver, and a beginner's chapter full of simple explanation. This is followed by two chapters upon driving which might be read with advantage by all motorists. The personal equation and the chauffeur question are also touched upon.

The second section of the work deals with the car, its housing, maintenance and repair, and contains descriptions of its accessories and their functions. The small car is treated in a short chapter which is of no great interest, but the chapters on bodies and the sale of the car are worth reading, being as adaptable to American as well as British conditions. The third section comprises brief descriptions of a number of makes of cars either made in England or imported there. The fourth section is devoted to touring, its needs and pleasures, with good chapters upon luggage and insurance. Motorcycles and motor boats make up the final section, hints as to upkeep, purchase, etc., being included therein. The Motor Union and other clubs and associations are also referred to, and the work terminates with driving maxims, knowledge of which should be universal among motorists of all classes. The book is finely illustrated throughout.

French Tire Pump Competition.

The Automobile Club of France is organizing a competition for tire inflating apparatus, which is to take place during the coming Paris automobile show. A sum of 2,000 francs is available for prizes. The touring committee of the club will be in charge, and the jury will comprise members of the club's technical committee. So called air bottles or other pressure storage apparatus will not be admitted. Each manufacturer may furnish the jury with one or two devices, and if it is to be driven by the motor, it must be presented fitted to a vehicle. The jury will take into account the reliability, structural strength, adaptability to various types of cars, facility of use, bulk and weight, facility and rapidity of taking off and replacing the device, price and rapidity of inflation. A 935x135 mm. tire will be pumped up to 6 atmospheres pressure during the trials.

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The Plight of Nassau County, Long Island.

The board of supervisors of Nassau County, Long Island, last week called a meeting of representatives of motor organizations at Mineola, at which counsel for the board solemnly announced that automobile speeding on the roads of the county must stop. No less than sixty persons, he said, had been killed or injured by automobiles in the county since May 1, and the people were now thoroughly aroused. If motorists did not moderate their pace the law would be invoked, and this would be most obnoxious to them.

As is well known, Nassau County is the scene of the next Vanderbilt Cup race. Only fourteen days ago we announced that this same board of supervisors, which is now pretending to make a crusade against speeding, had given its consent to the use of Nassau County roads for the Vanderbilt race and for the American elimination trials. Did a public body ever act more inconsistently? The Vanderbilt Cup race is nothing but a glorification of speed. Its effect on the attending public will no doubt be to inoculate many more with the speed craze, and its effect on motoring in general can only be to accentuate the speed nuisance.

The board of supervisors must have known of this deplorable effect of automobile racing. They must have known of the great danger incurred by the drivers and mechanics in these races—that it is the exception rather than the rule that none of them is killed. But, probably, the supervisors do not care whether a few of the drivers are killed in the race, for their counsel stated at the meeting that it didn't matter to them whether automobilists came out there and committed suicide by running into a wall. What they were concerned about was the safety of the public. But it is precisely the public safety they are jeopardizing by giving their consent to a road race.

It is said to have been agreed that the promoters of the race will engage 12,000 armed men to guard the course on the day of the race. This, of course, will lessen the danger to the public along the course during the time of the race. But what precautions will be taken to prevent accidents while thousands of high powered automobiles are being driven to the course and back home again? What safeguards against accidents have been adopted during the long period of training? But suppose even that there are no accidents, either on the course during the period of training or in driving to and back from the race, the race will still ever after be a great incentive to reckless driving, with its attendant dangers.

In connection with the announcement of the course for the Vanderbilt race, it was heralded far and wide that it was the fastest course ever laid out—that the roads were absolutely level and smooth, and that an average speed of 70 miles an hour could be maintained on it. No more alluring advertisement ever met the eye of the speed-mad motorist. No wonder if every owner of a 50 to 80 horse power car in neighboring New York—where, by the way, more speed monsters are owned than in any other city—is trying to verify for himself the speed qualities of the course. Nassau County has become a veritable Mecca for moribund scorchers. Who is to blame for all these evils but the board of supervisors, who failed to make use of their vested power to forbid the race? Having sown the seed of speed madness, they must now reap the whirlwind.

Conservatism Again Prevalent.

Some weeks ago, when three or four manufacturers announced in quick succession that they contemplated turning out cheap touring cars in tremendous numbers during the coming season, 10,000 or more each, those who had closely watched the development of the American market asked where these enormous numbers of cars were to be sold. One firm was reported to be figuring on a season's production of 25,000, a second on 13,000, a third on 12,000 and a fourth on 10,000. This, together, makes 60,000 cars, or far more than last year's total production of gasoline cars in the whole country. Besides, quite a number of other firms are known to be figuring on a production of from 1,000 to 3,000 cars each. Of course, each of these manufacturers laid his plans with no or little knowledge of the plans of his competitors, and it was the part of wisdom to revise the plans after something had been learned of what others intended to do. There is still one other factor which may likely have influenced some of these manufacturers to cut their intended productions.

To manufacture 10,000 automobiles in a season requires an enormous working capital, and up to now money has been anything but easy. Not only new concerns, but also those which have already been operating on a fairly large scale, would have to obtain a great deal of new capital to launch out on such a tremendous undertaking. Although conditions in the money market are rapidly improving, it is to be presumed that investors for some time will shun investment propositions that are the least bit speculative in character, and money for automobile enterprises will probably be rather scarce.

But whatever the underlying causes may be, we have credible information that the manufacturers above referred to, in contracting for parts, are proceeding on a very conservative basis; in fact, are becoming more conservative as time goes on. In one case where bids on parts for 5,000 cars were originally asked the figure was later changed to 2,500. In another case bids for 5,000 cars were solicited first, but now bids for parts for 600 cars are sought. It appears that these two instances are characteristic of the situation all along the line. Mass production will evidently not yet be carried on to the extent contemplated at the beginning of the season, but, what is of much greater importance, the danger of a much more serious crisis than the automobile industry has yet faced, through overproduction of a particular type, seems to be happily averted.

The Tire Price Cutting Situation.

Although representatives of the leading tire manufacturers have held a number of sessions to discuss ways and means for putting a stop to price cutting on tires, absolutely nothing has been achieved so far, except, perhaps, a general recognition of the fact that any relief must come from reduction of the commissions allowed. It is understood that the chief complainants are the big, centrally located garages, who, on account of their high rent and general expenses, must either do a large business or make fairly large profits on all sales. These cannot compete with small garages and dealers in suburban towns and in the country, whose fixed expenses are very low, and who may, therefore, content themselves with a small margin of profit.

In respect to many of the supplies needed by the motorist, the central location insures for the large garage the bulk of the business. The motorist must purchase his gasoline and oil where he keeps his car or wherever he may be when he runs short of these supplies. Likewise, he will not drive miles to secure a possible slight advantage in the purchase of such small accessories as spark plugs, for instance. But in the case of tire covers conditions are different. These are nearly always purchased some time before they are urgently needed, and the values involved are sufficient to justify going some distance if better terms can be obtained thereby. The central location is, therefore, no guarantee of a large tire business.

The simplest plan for the tire makers to stop the price cutting nuisance would be for all of them to agree and bind themselves to a certain commission, low enough to render price cutting by dealers impossible. But it seems that the time is not yet ripe for such drastic action. In fact, the smaller and newer manufacturing concerns regard an increased dealers' commission as their most effective means for securing a share of the market, and if any agreement as to commission is reached it will certainly not be subscribed to by all interested makers. The above suggested remedy practically amounts to this, that all tires would be sold at the same profits as are now taken by the price cutters, and it seems rather doubtful whether this would satisfy the complainants.

The tire men will hold one more meeting, but the prospect of finding an effective remedy for the present unsatisfactory situation is not bright. At any rate, they have shown their willingness to endeavor to correct the evils of price cutting.

The "Bicycle Type" Ball Bearing.

In the search for ultra refinement of detail which has marked the past two years, the cup and cone type of ball bearing, or, as it is often called, the "bicycle type," has been discarded by many makers. There are indications, however, that more of these bearings will be used the coming season than for some time past. Probably the production of low priced models has forced the makers to again consider these bearings, which can be produced at a moderate cost.

While these bearings have given a great amount of trouble in many makes of cars, makers and users should remember that most of the failures were due rather to poor design and workmanship than to inherent faults. Of course, in theory these bearings are far from perfect, but, like many other constructions which are theoretically faulty, they are capable of giving good service if correctly made.

Failures of these bearings usually result from one or more of the following three causes: Too small balls or balls that are imperfect or not properly graded for size; poor material in cups and cones, particularly the former; poor workmanship. It is easy to see that if the bearing surfaces are not accurately ground wear will be uneven, and friction will be greatly increased. If the balls are not all of the same size, and are not true spheres, some of them must carry excessive loads and are liable to break. If cups and cones are made from a cheap grade of low carbon steel, carelessly case hardened, or, perhaps, only cyanide hardened, this hard surface may be ground through in places, leaving soft spots.

Troubles of this sort have been all too common in the past, and their remedy has been found to lie partly in increased size and partly in better materials and workmanship. Of course, the question of how large a bearing should be, and how well it should be made, are matters which depend largely upon its location and its effect upon the design of adjacent parts.

There are many places where the annular bearing is preferable to the bicycle type; but there are other parts for which the latter are good enough and for which they can be made at a lower cost than either good annular ball or roller bearings.

Chain Cases.

It has always been generally recognized and freely admitted that driving chains would be more satisfactory if protected from the mud and dust and run in an oil bath. A year ago it seemed that quite a number of chain cases would be brought out for the 1908 season, but practically none materialized. Now that the season for the announcement of new models has arrived, we again hear rumors of apparently successful chain cases which are being tested out for the coming season.

There appears to be no reason why a good chain case cannot be made, although the matter is manifestly one which requires considerable experiment. Much of the popularity of the bevel gear drive is undoubtedly due to its quietness and the small amount of care it requires. Mechanics, as a rule, dislike the bevel gear, and there is little doubt but what the production of practical oil tight chain cases would result in an increased use of chain driven cars; particularly of the small machines with single chain drive.

Articles for Our Runabout Number.

A good deal of matter for our Runabout Number is already in hand, and more is promised, but we are still looking for more contributions from all classes of business users of runabouts. These contributions, if available, will be paid for at our regular rates. We want the experiences of salesmen, contractors, inspectors, mail carriers and farmers who have been using automobiles in their work. What we want to know about your automobile experience is those things that would most interest other users and prospective users of automobiles in your line of business—the cost, the advantages, the dependability, the manner of caring for the car, etc. If you have used a runabout in any of these lines your experience will be of interest to the readers of our Runabout Number. Let us hear from you.

At the last race meet on the Brooklands track a Mercedes car was completely reduced to scrap and a Napier was also wrecked. These motor tracks undoubtedly are a boon to the old iron business.

Motor Cars in China.

By G. Wilkins, Shanghai.

Shanghai, the New York of the Far East and one of the most important ports in China at the present time, is offering a rich field for motor cars of all descriptions. The motor car is still for the favored few, but is steadily growing in favor, and the number here, which at present is about 150, is being constantly added to. Owing, however, to the narrowness of the roads and the congested state of the traffic, there have been, and still continue to be, numerous collisions, some of which have been attended with loss of life and the demolition of the motor car. Most anyone can drive a car under ordinary conditions, but in Shanghai there is such a congestion of traffic, consisting of tramcars, carriages, wheelbarrows, rickshas, pedestrians, etc., that one must first get accustomed to the local conditions. The best car that could possibly be used in Shanghai for all practical purposes would be a steam car, as it is always under control, which is most essential, owing to the continual stoppages that have to be made. A gasoline car must be controlled by means of the clutch, and cannot be driven at so low a pace. However, the high price of gasoline (50 cents a gallon) practically prohibits the use of steam cars, which are not economical of fuel. The majority of cars now in use here are two and four seated machines of French make, principally De Dion, Cotterau, Renault' and Richard-Brasier, of 10 to 40 horse power. The British cars consist of the Earl, Johnson and Wolseley, with a couple of Humbers, while the Americans are represented by the Columbia, Cadillac, Reo, Maxwell, Rambler and a few Oldsmobiles. There are also a number of German cars, which are gaining in favor, owing to their cheapness and good finish.

There is about 50 miles of perfectly macadamized road leading to many of the pleasure resorts and points of interest in the outlying suburbs. The roads are composed of crushed stone and gravel, with a mixture of sand and broken tiles, and are rolled smooth; they are very hard on tires, even of the best make. The roads are as level as a billiard table, there being no hills of any kind, and the only grades are those over the various bridges spanning the Soochow Creek, and only amount to about 1½ to 2 per cent. The character of the road surface makes it absolutely necessary to fit tire protectors of some kind.

At present there is no speed limit in force here, but this is a matter that will soon engage the attention of the city fathers, as, owing to the many accidents and collisions that have occurred of late, many with fatal results, and owing to the extreme recklessness with which some drivers speed their cars (the doctors and brokers being the greatest sinners in this respect), it has almost been decided upon to establish a speed limit in order to, in a measure, put a stop to the furious speeding and the habit of only "hitting the high places." A quarterly license fee of 6 taels, equal to about $3.50 gold, has to be paid. Each car has to be supplied with two headlights and one tail light to shine on the car number. The average speed maintained is about 12 to 15 miles per hour, it being impossible to attain a greater rate owing to the traffic. Most of the cars here are used for pleasure by the wealthy taipans and rich Chinese, though a number are used by doctors and business men in their vocations. They range in price from 1,300 to 8,000 taels, some of them being superb cars of the finest French manufacture, richly finished and having most elaborate and up to date fittings and accessories. A few of the cars with six cylinders and driven by foreign chauffeurs are fit to be used by royalty. At present French and German cars are selling best, owing to their supposed superior construction and the great attention paid to detail. Most of the American cars sent to the Far East are of inferior workmanship.

CLIMATIC CONDITIONS.

The climate is another thing that has to be taken into consideration. Both winter and summer the weather is moist and causes the tires, no matter how good they are, to rot very easily. Many experiments have been tried to overcome this, but so far nothing has been found that will successfully withstand the moist climate of Shanghai and the river ports. American makers should send out nothing but the very best tires that can be procured. It has happened that a whole set of tires has had to be replaced in less than three months after having only been moderately used. American makers should also endeavor to devise some other means of sounding the horns than a rubber bulb. They should either supply the horns with a bellows or a piston arrangement to be worked by the foot, so as to leave the hands of the driver at liberty to handle his machine. The bulbs now in use only last a couple of months, when they become useless, owing to the dampness of the climate rotting the rubber, and also from being constantly handled by moist, sweaty hands.

The carburetors should be so arranged that during the cold winter months a supply of warm air could be drawn into them from around the exhaust pipe, and in the summer time cold air direct. Jump spark ignition is most generally used here, the current being taken from accumulators, as the ordinary dry batteries used deteriorate so rapidly that they are of absolutely no use whatever here. Spark coils should be of the very best type and thoroughly protected from all dampness. The vibrators should be of the compound adjusting type and made of the very best material procurable.

BALL BEARINGS AND STORAGE BATTERIES.

Most of the French cars in use here are fitted with ball bearing steering pivots,

One of the Finest Cars East of Suez, But Far Too Big for Shanghai Streets.

New Rubber Tired French Rickshas.

which can be readily adjusted when found necessary. American cars generally have plain steering pivots, in some cases brass bushed, and as a result the bearings wear away very quickly, the majority of drivers never paying any attention to them. With the ball bearing pivots all wear and tear is done away with, and only one dose of oil is required in a year. Storage batteries are greatly in demand, and French ones can be bought here much cheaper than American ones. Every car that is brought to Shanghai fitted with dry batteries is speedily supplied with either French, German or Swedish accumulators of 4 volts and 20 ampere hours, which in strong and durable celluloid cases can be bought for from 10 to 15 taels, and each recharging costs only 1 tael.

The great difficulty with the American cars sent out is that the tread is far too wide for Shanghai roads. The American cars are made to fit American roads, which call for a 56 inch tread, which is greatly in excess of what is required in Shanghai. Here all the roads are somewhat narrow, so that a car fitted with a narrow tread has far less difficulty in getting through the traffic than one with the wide tread of the American cars, and there are no hills to negotiate. An American car fitted with a single cylinder, 6 to 8 horse power motor, which would be ample, would be received with great favor.

GLUED PARTS NOT DURABLE.

The bodies should be narrow and so made that the damp climate would not readily affect them. The less glue used in their construction the better. The bodies and mud guards should not be sent out here in layers or laminated, as owing to the moisture they become loose and drop apart quite readily. They therefore should either be metal or solid wood, so as to stand the changes of climate.

A planetary gear is preferable to all others, especially a sliding gear, as it is more readily under control than the ordinary sliding gear. The ordinary wheel steering gear is the one most in demand and gives the best satisfaction to users. The engine should be placed in front of the car under a hood, as it is so easily accessible to the operator. A chain should not be fitted on cars sent here, but there should be a direct shaft drive to the rear axle. Powerful emergency brakes should be attached to the rear wheel hubs, where they would do the most good. Steel wheels of the Midgley pattern will be found preferable to all other wheels now on the market. If American makers intend to compete with French and English makers in this market they must make up their minds to turn out better finished work in the line of small runabout cars than at present. There is in Shanghai only one air cooled engine at present, which is of German make. It is, however, impossible to operate it in warm weather, although it is fully equipped with fans, etc.

SPECIFICATIONS OF A SUITABLE CAR.

A good car, and one that would about meet all the requirements of the average Shanghailander, would be one constructed as follows:

Runabout style, fitted with 34 inch wheels, having generous cushion tires and long resilient springs. Single cylinder motor in front, direct gear drive of the planetary type. Main engine clutch to be operated by the foot. Transmission, giving three speeds forward and one reverse. High speed operating lever attached to the steering post. Jump spark ignition, with a thermo-siphon cooling system and pump oiling gear direct to the engine. The reservoir should be on the dashboard, with a small pump for oiling both the engine and transmission; the commutators to be so arranged as to be easily accessible to the driver. Carburetor fitted so as to draw hot air from around the exhaust pipe, and able to take cold air at the will of the operator. The wheel base should be about 84 inches, with the tread about 4 feet. Powerful hub and emergency brakes to be fixed to the rear wheels, and an auxiliary brake attached to the transmission. The front wheels to be ball bearing, with roller bearings for the rear wheels. The steering pivots should also be ball bearing, with a means of adjusting same at will. A plain rack and pinion steering gear would fill all the requirements. A first class coil with a compound adjustment should be so placed and arranged on the dashboard that it could be easily adjusted. Every car should also be fully equipped with a top and glass shield so arranged as to be easily detachable at will, as owing to the sudden changes of the weather, the occasional intense heat and the clouds of blinding dust, a top and shield are absolutely necessary, while sometimes one can go for weeks without either hood or shield.

An Oldsmobile in Use in Shanghai.

Should American makers decide to turn out a car of the above description it is certain to find a ready sale if properly advertised.

All the high powered cars here are fitted with magnetos as well as accumulators; in some instances the magneto is used alone.

GARAGES WELL EQUIPPED.

Garages in Shanghai compare most favorably with those elsewhere, and can supply any class of fittings or execute the most difficult repairs at short notice, and at no higher prices than those charged in America. Damaged tires can be repaired at short notice. Messrs. Bell Brothers have a small plant where they can retread, repair or revulcanize a tire so that it is equal to a new one, and will stand the same test as a job done at home.

One of the disadvantages that owners of French cars have to contend with is that all French cars are built on the metric system, and most of the repair shops and garages are accustomed to the American and English standard, and are equipped accordingly, so that it is often found very difficult to execute the repairs.

Most of the chauffeurs are Chinese, and as a rule are very careful, but if they see anything coming anywhere near them they lose their heads. The tram drivers are all Chinese, and they handle the cars very well on a clear road, but as soon as the traffic becomes congested they become nervous.

The saving in the cost of running a motor car over that of a horse and carriage averages about $15 per month, where a single horse is used. The monthly cost of keeping a carriage is about as follows: Fodder, $14; wages for the No. 1 Mafoo, $12; No. 2 Mafoo, $7; shoeing, $2; clipping, $2; extras, $4, making a total of $41, while running a motor car, including wages, only averages about $26 per month, thus effecting a saving of about $15 monthly (quite an item these hard times of poor exchange). The wear and tear of a motor car and carriage is about the same.

VIEWS OF A LOCAL MOTORIST.

A large number of users of motor cars have been questioned as to the local conditions and the type of car best suited for Shanghai, and the following by one of the leading municipal officials, who is continually using a car, is representative of the views of all: The large majority of cars now running in Shanghai appear in many respects to be unsuitable to the conditions of traffic which prevail in this densely populated port. They are too heavy and unwieldy, and have far too wide a tread. Nothing larger or more powerful than from 8 to 12 horse power is required in Shanghai for all practical purposes. There are no hills to negotiate, and the traffic is so congested that a high rate of speed is impossible. Nor is the noiseless car desirable, as the ordinary Chinese coolie is generally more or less deaf, and as a rule is always looking in every direction except the right one, and the driver of a high powered and silent car will experience considerable strain on his nerves. The roads in Shanghai and the suburbs are, for the most part, good and well looked after. They dry quickly after wetting, and make very smooth running. Outside Shanghai the roads are such as to make comfortable driving, even in a heavy and an expensive car, an impossibility. The traffic in the International Settlement offers more difficulties than that of any large town in the world. The many different classes of vehicles in use here, and the stupidity of the natives in charge of these vehicles, are chiefly accountable for this fact. Every car sent out for use in Shanghai should be fitted with extra powerful brakes, as this is most essential for the safety of the driver.

Cars intended for export to Hongkong should be of a medium tread, medium wheel base and especially adapted for hill climbing. Hongkong is very hilly, and the roads, while good, are very limited. There is also a good market awaiting dealers in this place for a good, cheap, strong and well finished car, if it is only properly introduced and proper attention paid to detail.

The following are the principal dealers in cars in Shanghai, either direct or through agents: E. Pinguet & Co., International Cyclery, American Trading Company, New York Import and Export Company, Sennet Frères, Arnhold, Karberg & Co. and Mustard & Co.

For automobiles imported into Turkey, which are to be re-exported within six months, an import duty is levied at the port of entry, which is based on the price given in the bill of sale, or, if that is not at hand, on the basis of a value of 25,000 to 45,000 piasters. A receipt is given for the amount, which also contains a description of the vehicle. Upon leaving the country, 10-11 of the duty deposited is returned, the remainder of 1-11 being retained as a tax.

A Cheap Auto House.

By 6663 Mich.

Now that the market affords low priced runabouts and touring cars of modest pretensions, many people of moderate means are looking forward to permitting themselves the luxury of owning an auto. One of the first questions which arises when this subject comes up for serious consideration is the best method of housing the car. Usually this may conveniently be settled in any of three ways: By keeping it in a public garage, by using some adjacent barn or outbuilding, or by erecting a private garage.

To the owner who wishes to care for and repair his own car the latter is usually by far the cheapest and most convenient alternative. At least this was the decision I came to. The next point to decide was the cheapest method of getting the auto house. To anyone living upon rented or leased property a portable auto house is a necessity, so I naturally thought of the attractive advertisements of the people who sell such buildings. The first step was to write for the catalogues of all the companes whose addresses could be obtained. A perusal of these showed that portable auto houses might be divided into two classes: The fancy but flimsy, and the plain and durable. The former had walls and floors that were not thick enough for the service imposed upon them. The latter cost more than I cared to pay. Being reasonably handy with carpenters' tools I concluded to build the house if lumber was obtainable at a reasonable price.

To find out what the lumber would cost it was necessary to know what size of house was required. This was determined by measuring the length, width and height of the car to be stored, and allowing a reasonable amount of space for working around the car. As it was desired to keep the cost as low as possible, convenience was sacrificed to cheapness, and the house was laid out as small as could well be used.

The quotation for lumber was satisfactory, so a rough sketch of the necessary framing was made, the lumber ordered and construction begun.

As shown in the drawing the construction adopted is very simple. While the house is not readily portable, it is what might be termed "collapsible." The floor, each wall, gable and roof side are units. And these units are held together by three-

One of Shanghai's Automobile Depots.

eighths inch carriage bolts, so the house may be packed flat.

The material used was of the following sizes:

Studding, 2x4 inch spruce.
Corner posts, 2x4 inch spruce, double.
Rafters, 2x4 inch spruce.
Floor beams, 2x6 inch spruce.
Roof, 1 inch hemlock, rough.
Floor, 1 inch matched pine.
Doors, 1 inch matched pine.

Wall and gables were covered with the long, wide, overlapping clapboards that are generally used in the construction of light cottages. They are called "German siding," "novelty siding," and various other names in different parts of the country.

SECTION OF SIDING USED ON AUTO HOUSE.

When the lumber arrived I carefully piled it so that each kind was by itself. Selecting the "two-by-fours" according to the lengths needed, I cut them to size, and did the same with the 2x6 inch beams.

I then nailed four of these together with 50 penny wire nails to form the frame for the floor, and placed them in the position which the house was to occupy. The floor beams C were then spiked in place, also the two-by-fours, D, which support the ends of the floor boards. These boards were now nailed down, and the floor unit was complete.

Before proceeding further it was raised a few inches from the ground, leveled and supported upon stones at the four corners, the middle of each side, and the centre of the floor. Using the floor to work on, the studs A for one wall were laid out, and the bottom two-by-four was nailed to them. One of the sidings was then nailed across, about 3 feet below their upper end, and the wall was boarded over from there to the bottom. After sawing off the ends of the boards the wall was complete except for a few siding at the top. It was tipped on edge, moved into place, squared with the floor, and secured to the floor by boards nailed diagonally to the ends. It was then fastened at the bottom with lag screws. The other wall was made and put in place in the same way, and the two were connected by two-by-fours nailed across in several places, about 4 feet from the floor. The roof boards were placed on these, making a staging on which to work while putting on the roof sides.

The frames for these were put together on the floor and raised to the staging. They were loosely bolted to the studding, which on account of the top boards not being on could be easily bent to make up for inaccurate placing. Their ridgepole sides were then lifted up, like a pair of double doors being opened one before the other, and brought down together and bolted. The roof boards were next put on, beginning at the eaves.

To make the roof water tight it was covered with a heavy roofing paper which is impregnated with asphalt and coated with fine gravel. In applying this an outside staging was needed, so a few more siding were put on and boards placed across their top so that a staging could be laid on their ends, just under the eaves.

After the roof was completed the gable ends were made up on triangular frames and bolted in place. One inch by 4 inch boards were screwed to the edges of the roof, and to the vertical corners of the walls to cover the rough edges.

It was necessary to have doors at each end. Both of these were made to swing. The one at the front was about 2 feet narrower than the width of the house and cleated with inch boards, as shown by the dotted lines. That at the rear end was framed with two-by-fours and diagonally braced each way; it covered the full width of the end.

The hanging of these doors completed the house.

The following is a bill of the material entering into its construction:

Lumber	$46.08
Two rolls flint top roofing	4.50
Four large angle braces	.60
One pair T hinges	.39
One pair T hinges	.60
Two hasps	.50
One ⅜ inch bit	.20
Three pounds 50 penny wire nails	.11
Three pounds 40 penny wire nails	.12
Twelve pounds 10 penny wire nails	.43
One pound 20 penny wire nails	.04
Twenty-five ⅜x6 inch carriage bolts	.46
Six ⅜x3½ inch carriage bolts	.08
One box No. 12x1½ inch screws	.35
Eight pounds 8 penny nails	.28
Six ⅜x4 inch lag screws	.15
Total	$54.89

The time consumed was fifty-six hours. Most of the work was done in the morning and evening, working two and three hours at a time.

Of course I had help for a few minutes while leveling the floor and moving the walls. And a neighbor kindly assisted me for three hours while getting the room together.

As the cheapest house which I could buy at that time was quoted me at somewhat more than $130, the time spent brought in over a dollar an hour.

The low cost is made possible by the simple system of framing, which avoids all difficult joints. Everything is nailed, bolted or screwed.

As in all other first jobs a number of improvements have suggested themselves. The house is hardly wide enough; indeed I intend to make it at least 3 feet wider if it is ever moved.

My machine has only a 50 inch tread, but with a standard tread a house should be at least 12 feet wide. The length is all right for the 90 inch wheel base.

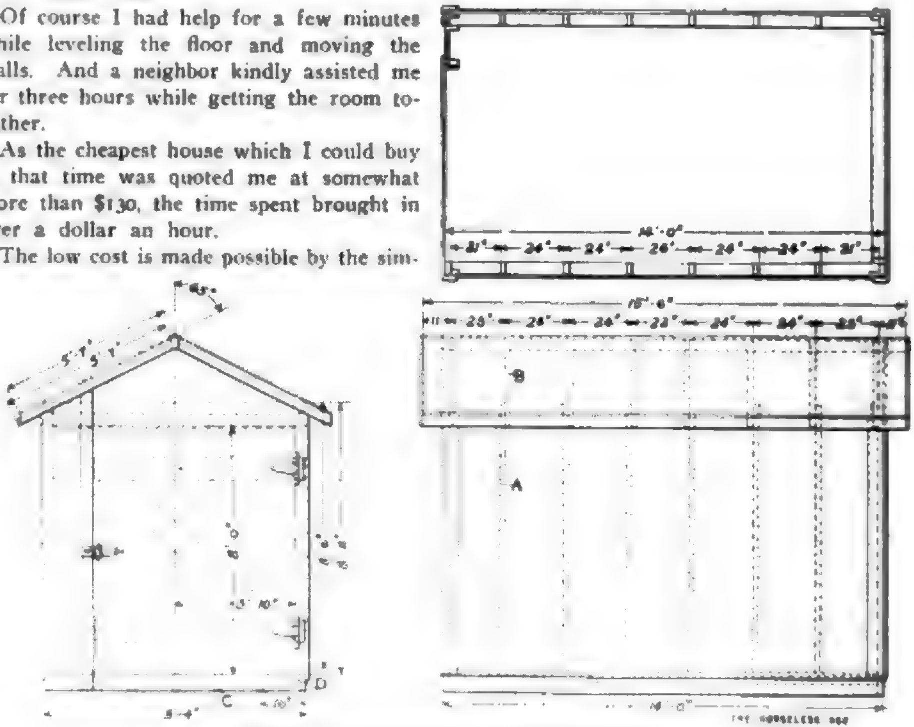
It is convenient to have room for a work bench with vice, but like many other conveniences it is not such necessity as one is apt to think.

Windows are also an advantage, but one needs a number of them to get good light, and my plan is to leave the door wide open.

The rafters are the only part of the framework which I should change if building again; 1x4 inches is heavy enough for them unless the house is made wider.

An even cheaper building can be constructed by using galvanized sheet steel for a covering material. I think that this can be done very satisfactorily, as it can now be obtained in a variety of patterns. In this connection I may add that while I was building this house I noticed the advertisement of a Buffalo company which was selling a very attractive sheet steel garage for a price lower than I could buy the material. I thought at the time that it was an instance of the advantages of quantity production, and felt bad at building when I could buy cheaper. Later I was comforted by hearing that the company sold houses, but didn't deliver them.

In conclusion I would say if you want to get an auto house cheap, build it; if you want to get it easy, buy it.



PLAN AND ELEVATIONS OF AUTO HOUSE.

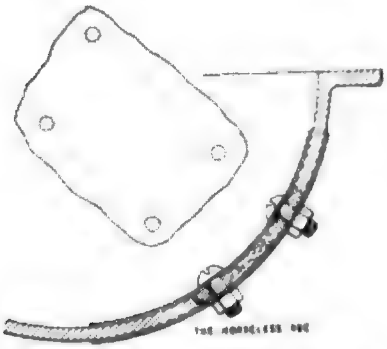
Maintenance and Repairs

Repairing a Crank Case.

By 6603 Mich.

Recent developments in brazing and welding have rendered it possible to make good and permanent repairs on cracked and broken cases, no matter of what kind of metal they may be. But since there are as yet only a few shops which have facilities for making such repairs, and as many motorists cannot reach these, and would not find it convenient to send the parts, the following may be of some interest.

The case in question was a gray iron casting and formed the oil pan and bearing support for the motor, the case for the flywheel and the bottom part of the change gear housing. The front connecting rod had broken, and one of the pieces pushed through the side of the case, leaving an irregular hole 2¼x3½ inches. This hole did not affect the strength of the case to any considerable extent, so its repair was merely a matter of making the case oil tight. It was accomplished in the following manner:



Two scraps of sheet steel about a sixteenth of an inch thick were found, each large enough to considerably more than cover the hole. One was bent to fit the inside of the case and the other to fit the outside, using a ball pein machinist's hammer and pounding the steel to shape against the case. Four quarter inch holes were drilled in each piece, so that when bolts were passed through them the two pieces could be clamped firmly in place against the case.

The lower piece and the bolts were put in place and the hole in the case was filled with "Smooth-on" cement. Before this had time to harden the upper plate was put on, the bolts were reversed (so as to bring their heads inside the case) and the nuts tightened. Then the edges where the plates rested against the case and cracks around the bolts and nuts were liberally smeared with the cement.

After being allowed to dry for twenty-four hours as much of the cement as possible was scraped off. The outside was then coated with aluminun paint. As I had found meanwhile that this cement is affected by the oil in a crank case, I covered the inside with several coats of shellac.

To all appearances this repair, which was made several months ago, will be permanently satisfactory.

Two precautions are necessary in making such a repair: First, to see that the connecting rod will not strike the bolt heads; second, to clean the case and patches where the cement is applied, preferably with an acid or alkali strong enough to remove all grease, rust, etc.

Spring Tempering Kink.

It sometimes happens that the spring controlling the make and break on the magneto becomes weakened and fails to perform its duty, and where the engine depends on the magneto alone for its ignition this means that the car is stalled unless another spring happens to be in the tool box. On one occasion an extra spring wasn't at hand, and we were far from any garage, so something had to be done. We first drew its temper by holding it in the flame of one of the oil lamps and then bent it to its proper shape. We then heated it in the flame of the acetylene lamp and tempered it by plunging it in the kerosene of one of the oil lamps. It served its purpose and brought us home without further trouble, but we took the precaution to replace it at once, and now always carry an extra one in the tool box.

Proper Maintenance of Coach Work and Accessories.

The following hints as to the proper maintenance of the paint work, bright work and upholstery of motor cars are taken from the book of directions of one of the best known French coach and body builders, and are applicable to American practice in painting, upholstery, etc., as well as to French practice.

With regard to paint work, after the car has been out on a run it should be washed immediately upon its return to the garage, as mud and dirt will affect the paint if allowed to cake upon it. Starting with the mud guards and wheels, these should be hosed to loosen the mud, which can then be removed by means of a spoke brush. The stream from the hose should not be strong, but only of sufficient strength to soften and loosen the mud. If a strong stream is allowed to strike the paint work upon a wooden body the panels will be swelled, developing cracks and seams, and the paint will flake off, to the detriment of the looks and service of the body. The body, then, should be lightly run over with a dripping sponge to remove dirt, etc., and then with a clean wet chamois leather, after which it is dried by means of another clean dry chamois. Under no circumstances should gasoline, kerosene or siccatives of any nature be mixed with the water, as they are harmful to the surface of the paint. Dust can be readily removed by means of a feather duster used for the purpose.

If a standing top is fitted, this should be carefully gone over, the leather roofing being wiped down or dusted, as the case may require. Care should be taken when using the hose to avoid wetting the tire cases and the various pockets and receptacles, on account of the tendency to rot and crack them. A damp cloth followed by a dry one should be used for cleaning them. The splashing of water from the hose into the interior of the body should be avoided. Stains and small scratches are removed by the application of a preparation recommended by the coach builder, this being applied by means of a pad of cotton wool and dried up by a similar clean pad. The importance of performing the above every time the vehicle arrives in the garage after a run cannot be too greatly emphasized.

The interior of the car should always be neat and clean; the carpets, therefore, should be removed and beaten after each trip, and the hangings carefully brushed with a silk or other soft brush. Leathers should not be washed, but simply well wiped off; brocades should be given over to the coach maker, and their cleaning not be attempted in the garage, as the use of benzine and other stain removers tends to cause the material to become streaky. Grease spots may be treated by the application of gasoline and removed by rubbing when dry. Floor boards should be examined as to their fit, whether they have warped, etc., as if they show cracks or spaces between them the heat and odor of the motor, mud and even grease may come into the car. When the body is of the landaulet type it is essential that the leather head or heads should always be kept closed when in the garage, to prevent cracking and bulging. As soon as the car has returned from a run the head should be closed and wiped over with a flannel dampened with linseed oil. A thorough washing with the oil should be given once a month to the head as well. All bright work, such as lamps, horns, rails, etc., of copper, brass or nickel plating, should be taken special care of, the polishing powder or fluid being applied immediately after the parts have been wiped dry with a flannel, as soon as the car is in the garage. The parts are then polished with a soft flannel or other polishing cloth. Oxidized or silver plated parts should be lightly wiped with a chamois or clean flannel and not rubbed briskly. Rubber foot mats, treads on the running boards, etc., should be scrubbed with water and black soap, using a stiff scrubbing brush, and afterward wiped dry with a cloth. To prevent their decay particles of oil and grease thereon should be immediately removed, but not with gasoline or the like, as this rots the rubber.

When a tire, bolt or mud guard is removed the paint at the junction is broken; this should be renewed when the operation is completed by means of a camel's hair brush and the necessary paint, which can be got from the coach builder.

On the Best Ratio of Bore to Stroke.

(After Gerard Lavergne in *Omnia*.)

One of the earliest formulæ for the power of an explosion engine is that given by M. Witz, which is as follows:

$$P = 4 K p \frac{\pi D^2 \ L w}{4 \times 60 \times 75},$$

in which P represents the maximum horse power (for four cylinder motors); K, the mechanical efficiency of the motor, which it is advisable to place not above .75; *p*, the mean effective pressure in kilograms per square centimetre; D, the bore of the cylinders, and L, the stroke of the pistons, both in millimetres; *w*, the angular speed in revolutions per minute.

As it was rather inconvenient to apply this formula in practice, it has been customary to eliminate the mean pressure *p*, the angular speed *w* and the length of stroke L. The mean pressure was dropped on account of the impossibility of determining it conveniently. This factor is probably one of the most interesting ones of all affecting the power of a motor. Nevertheless, for a given compression and with the same system of ignition (the low tension and high tension magneto systems have become almost universal) the mean pressure of one motor is quite closely comparable to that of another.

In eliminating the angular speed and the stroke, the idea was that only their product, *w* L, enters into the formula, and with the same linear piston speed, if the stroke L increases, the angular speed *w* diminishes, so that the product *w* L remains practically constant. Guided by these considerations the technical committee of the Automobile Club of France adopted the formula $P = 0.0028 D^2$, and M. Arnoux suggested the formula $P = 0.0025 D^2$.

Since that time other formulæ have been proposed. M. Varlet started from the fact that every relation of parabolic form ($P = K D^m$), like the two above formulæ, when transformed into a logarithmic equation

$$\log D = \frac{1}{m} (\log P - \log K)$$

may be graphically represented by a straight line, whose angular coefficient is 1/m, and whose point of intersection with the axis of abscissas furnishes the value of K on the logarithmic scale. Plotting the decimal logarithms of the powers and the bores as abscissas and ordinates respectively, he found that the points representing the characteristics of 105 four cylinder motors were practically all comprised between two straight lines, corresponding respectively to the two parabolic equations:

$$P = 0.044 D^{2.2}$$
$$P = 0.107 D^{2.38}$$

This diagram is very clear and may be used to great advantage in making a comparison of the experimental data obtained from different types of motors. Unfortunately every formula of the form $P = K D^m$, in which only the bore figures, and which does not take account of the influence of the factors K, *p*, *w* and L, except combined in a numerical coefficient, is not exact. In order to prove this, we need only recall that in eliminating the factors *w* L from the Witz formula we supposed the product *w* L (the piston speed) to be constant.

Now from a table of ninety-six four cylinder motors, given by M. Arnoux in his article on "The Predetermination of the Maximum Power of Explosion Motors," published in the *Bulletin* of the technical committee of the A. C. F. for November, 1906, I have extracted Table 1 herewith, which I have completed by adding the piston speed and the ratio of bore to stroke. From this table we see that the linear piston speed varies from 3.62 metres to 8 metres per second; it increases with the bore and the power of the motor. Now, while this speed thus varies in the ratio of 1 to 2.2, the number of revolutions *w* (if one neglects in the Arnoux table the only motor turning at only 950 r. p. m.) varies only from 1,100 to 1,650, or in the ratio of 1 to 1.5. Consequently the product *w* L, under these conditions, assumes for motor No. 1 of the table the value of 3.62 × 1,450 = 5,249, and for motor No. 26, 8 × 1,200 = 9,600. It will thus be seen that the piston speed is far from being constant, and that it is very important in predetermining the power of a motor that one should take account of the piston stroke.

The necessity of taking account of the stroke is now so well recognized that several authors have proposed formulæ which, though still neglecting the direct influence of the angular speed *w*, place in relief that of the stroke L. Thus in 1904 M. Favron proposed the formula $P = 0.007 D^m L^n$, in which $m = 2.1 - 2.15$ and $n = 0.6 - 0.8$, according to a series of tests made on Aster motors, the bore of which varies between 80 and 140 millimetres. Later on, in order to avoid the use of logarithms, he proposed to substitute the following formula for the preceding one: $P = 0.007 D^2 L^{0.5}$. But as the range of application and the precision of this latter formula are less than that of the

..1 Cut and 2 tables....

former, M. Favron in 1907 produced a small slide rule by means of which the power can be directly determined according to the better formula.

M. Faroux has successively proposed the formulæ $P = 0.00002956 D^{2.4} L^{0.6}$ and $P = 0.00002956 D^{2.3} L^{0.7}$. It may thus be concluded that the influence of the stroke has been sufficiently demonstrated, and the object of this article is to investigate this influence.

TABLE I—FOUR CYLINDER MOTOR DATA.

Max. Brake Horse Power.	R. P. M.	Piston Speed Metres P. S.	Bore in Mm.	Stroke in Mm.	Ratio
10	1450	3.62	65	75	1.15
12.5	1600	3.66	65	70	1.07
20	1400	5.60	90	120	1.33
18	950	4.11	90	130	1.44
22.5	1500	5	90	100	1.11
24	1600	5.06	90	95	1.05
33.5	1350	5.85	104	130	1.25
31.8	1250	5	104	120	1.15
27.7	1550	5.68	104	110	1.05
25.4	1500	6.00	104	120	1.15
43	1250	5.83	120	140	1.16
40.5	1150	5.55	120	145	1.20
47	1300	5.63	120	130	1.08
52	1330	5.40	120	122	1.01
67	1300	6.28	140	145	1.03
70	1380	6.44	140	140	1
60	1150	6.13	140	160	1.14
63.5	1260	6.30	140	150	1.07
76	1400	6.44	140	138	0.98
82	1250	6.66	155	160	1.03
91	1400	7.00	155	150	0.96
70	1150	6.13	155	160	1.03
82	1350	6.75	155	150	0.96
86	1250	7.16	160	172	1.07
96	1300	7.15	160	165	1.03
101	1200	8.00	160	200	1.25
101.5	1350	6.20	160	140	0.87
90	1350	7.68	160	170	1.06
80	1200	7.20	160	180	1.12
105	1350	7.11	160	158	0.98

THEORETICAL DISADVANTAGES OF A LONG STROKE.

There are some undeniable disadvantages connected with the use of a long stroke, as follows:

1. A long stroke increases the bulk of the motor. This is of no consequence in connection with stationary motors, which are always given a long stroke, and for which the long stroke is universally conceded to be advantageous. But it is an important consideration in connection with automobile motors, which are always mounted vertically at the front of the car (the horizontal motor, which has been unjustly relegated by fashion, is free from this disadvantage). In fact, it has been calculated that a four cylinder motor of 155 mm. bore, like those which took part in the Grand Prix race, if given a stroke of 240 mm., which would probably be very advantageous from the standpoint of power and efficiency, would necessitate a bonnet about 1.60 metres high. Such an increase in the height of the centre of gravity would insufferably reduce the stability of the vehicle.

2. A lengthening of the stroke and, in consequence, of the crank (which is equal to one-half the stroke), results, with a connecting rod of the same length, in an increase of the obliquity of the rod. There is consequently more friction engendered in the motion of the piston in the cylinder, and there is greater need for offsetting the cylinders.

3. It also increases the weight of the motor and reduces the power obtained per unit of weight.

The technical committee of the A. C. F., when drawing up the regulations for its contest of light motors, instituted an inquiry among manufacturers, and the results of this inquiry were published in the *Bulletin* of the committee for February, 1908, in the form of a diagram and a table. From this latter we have taken our Table

Table II—Weight Per Horse Power.

Bore in Mm.	Stroke in Mm.	Ratio.	R. P. M.	H. P.	Weight in Kgs.	Weight Per H. P.
170	150	0.[illegible]	1300	102	370	3.62
150	150	1	1000	80	300	3.75
180	170	0.94	1100	127	480	3.78
160	98	0.61	1300	95	395	4.15
160	160	1	1100	90	380	4.22
155	175	1.12	1100	100	450	4.50
145	160	1.10	1360	84	412	4.90
102	116	1.13	1400	37	233	[illegible].29
120	140	1.16	1200	44	300	6.81
120	140	1.16	1200	60	420	7
150	138	0.92	1200	70	497	7.01
110	130	1.18	1500	43	311	7.24
112	130	1.16	1200	38	368	9.68
110	120	1.09	1100	35	350	10.00
110	130	1.18	1300	35	353	10.08

II, in which the sixth column gives the weight of the motor inclusive of the carburetor, ignition system in running order, cooling connections, pump, radiator, water tank and lubricating system, but exclusive of the weight of the gasoline piping, muffler, water, gasoline, grease and oil. The motors are classed in the order of decreasing specific power.

In this table we see the first five places occupied by three "short" motors and two "square" motors. As a matter of fact, a "short" motor only comes in eleventh place, after several "long" motors. Nevertheless, the table proves in a general way that the power per unit of weight decreases as the length of stroke increases. Practical experience thus confirms theoretical deductions.

This disadvantage of a long stroke should, however, not be exaggerated. As we have pointed out, the weight of the motor from which the specific power was calculated does not include the weight of supplies, particularly that of gasoline. Now, touring cars must be fitted with large fuel tanks, in order that they need not have their fuel replenished very often. On the other hand, as will be explained further on, the "short" motor does not take the same advantage of expansion as the "long" motor, and should, therefore, consume more fuel. If, therefore, it is desired that with the "short" motor the fuel supply need not be replenished any oftener than with the long motor, the volume and weight of the former's fuel tank must be made greater. Everything considered, the weight per horse power of the motor fuel tank combination should be about the same in the case of the "short" motor as in that of the "long."

4. By increasing the length of the cylinder (with equal piston speed) the duration of the various phases of the cycle is increased. The inflammation and expansion of the gases take therefore longer in a "long" motor; consequently the period of heat absorption is increased, as is the loss of heat.

M. A. Witz long ago drew attention to the important influence of wall action in explosion engines. At the conclusion of experiments made with a motor whose speed could be accelerated and decelerated at will under the action of the expansive force of the combustible gases, he proved that the cooling of the gases in contact with a greater or smaller surface modifies the rate of combustion and expansion. By reducing this cooling action to a minimum the efficiency is materially increased, and the heat abstracted from the burning gases by the cold water and given off to the air circulating around it is diminished. It is, therefore, advisable to operate with the walls at as high a temperature as possible, and to complete the combustion and expansion in the shortest possible time, which is not possible with the long stroke.

But, since it is here a question of time, by increasing the linear speed of the piston this objection to the "long" stroke, which is really its only disadvantage from a thermodynamic standpoint which it possesses, is partially overcome.

THEORETICAL ADVANTAGES.

1. Owing to the increase in time consumed by each phase of the cycle, assuming the piston speed to be the same, the combustible mixture is more intimately mixed in the carburetor, the piping and the cylinder, where it remains for a longer time (of course, in greater quantity, as the cylinder volume is greater). The ignition and explosion take place under better conditions. Finally, and most important of all, the expansion is more complete, a greater proportion of the heat contained is utilized, and a smaller proportion of the heat is passed to the atmosphere with the exhaust gases.

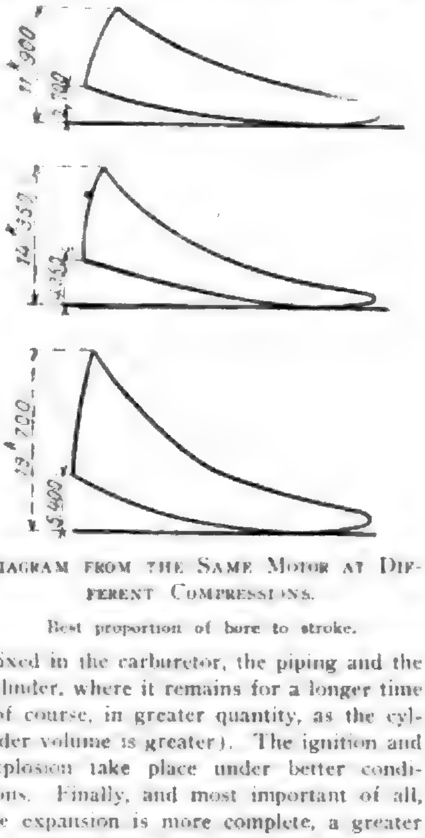


Diagram from the Same Motor at Different Compressions.

Best proportion of bore to stroke.

The exhaust takes place under better conditions, and the cylinders are more completely evacuated, for a larger charge of new gases.

2. From the standpoint of mechanical construction of the motor the "long" stroke also has the advantage. The strength of the parts of the mechanism must be calculated to conform to the maximum stresses to which these parts will be subjected, which in this case depend upon the pressure exerted on the piston head by the explosion. On the other hand, it is not so much the maximum pressure as the mean pressure which determines the power, and it may be said that the mechanism is used to greater advantage the nearer the maximum and mean pressures are to each other. By diminishing the piston head area and increasing the length of the stroke this ratio is diminished.

3. With an equal density of charge introduced and the same volume of compression chamber, the compression for a given bore is proportional to the piston stroke. The advantages of high compression are well known:

(a) It increases the temperature of the mixture prior to ignition, and increases the certainty and rapidity of ignition, thus ensuring more complete combustion and more efficient use of the fuel.

(b) Let us compare the diagrams of Fig. 1, which were taken from the same motor, supplied with the same combustible charge and operating with an increasing compression pressure, amounting to 2.70, 4.25 and 5.40 kg. per square cm. respectively. The portion of the diagram representing the explosion becomes more erect and longer the higher the compression pressure. The pressures at the end of the stroke amounted to 11.90, 14.35 and 19.70 kg. per square cm. in the three cases respectively, and the mean pressures were 5.04, 6.00 and 6.94 kg. per square cm. The area of the diagram, which is a measure of the work done during the stroke, increases in a similar progression. The same holds true of the indicated efficiency, since the gaseous mixture introduced changed neither in quantity nor in quality, and with the same amount of gas consumed a greater amount of work was done.

(c) An increase in the compression reduces the duration of the explosion, as pointed out above, and therefore permits of using a higher piston speed, thus shortening the duration of the period during which heat is abstracted by the walls, combining the advantages of moderate cooling and a long expansion, and minimizing the importance of the only objection that can be made to the long stroke from a thermodynamic standpoint.

But what compression pressure should be adopted? M. Marchis asserts that the pressure at present used, viz., 2.5 to 5 kg. per square cm., could be increased to 6 and even 7 kg. per square cm. without the necessity of materially changing the parts of the motor.

The latter figure is probably too high. In fact, there is no advantage in an increase of compression as soon as preignition can only be prevented by a dilution of the charge. Customarily 13.5 parts of air are mixed with one part of gasoline; it seems advisable to increase the proportion of the air to 15, when the compression may approach 6 kg. per square cm. without danger of preignition. However, as the high compression hinders the "picking up" of the motor, it will be prudent to stop at 5 kg. per square cm. for touring car motors.

4. For a given piston speed the "long"

motor is subjected to less wear than the "short" one, for the very simple reason that in it there are fewer reversals of motion of pistons and connecting rods in a given time, which reversals are always abrupt and tend to destroy the mechanism. A long stroke and small number of revolutions also decrease the friction, and thus should increase the efficiency.

5. A motor running at high angular speed is more difficult to control than a motor running at a low speed of revolution.

Theoretical reasoning is, therefore, entirely in favor of the "long" motor.

EXPERIMENTS WITH LONG STROKE MOTORS.

A "short" motor of 152 mm. bore and 110 mm. stroke, with a piston speed of 7.33 m. p. s., rotating at 2,000 r. p. m., develops at most 100 horse power. During one minute it draws in 1,000 cylinder volumes of charge, equal to 8,000 litres, which is equal to 80 litres per horse power minute.

A "long" motor of 130 mm. bore and 150 mm. stroke, with a piston speed of 6 m. p. s., rotating, consequently, at 1,200 r. p. m., draws in 600 cylinder volumes of charge, and develops 70 horse power. The consumption per horse power minute is, therefore, only 68 litres, which is considerably less than that found for the "short" motor.

M. Faroux reports, as having been determined by himself, that a large manufacturer of small cars, confronted with the problem of designing a single cylinder motor of 100 mm. bore, built several models and submitted them to searching comparative tests. With a stroke of 140 mm. he obtained 14 horse power, which is already more than the power given by the ordinary 100x120 mm. motor. By increasing the stroke to 150 mm. the power was increased to 15.5 horse power. Finally a stroke of 170 mm. gave a power of 18 horse power, and this last motor showed a lower fuel consumption per horse power hour than the 100x140 mm. motor, which developed only 14 horse power.

Experience thus confirms our theoretical deductions.

Rival California Associations.

Two "California State Automobile Associations" have been formed, both using exactly the same name as quoted above. One of the associations was organized by the directors of the A. C. of Southern California, with headquarters in Los Angeles, and the other one has its offices in San Francisco. Though the Los Angeles State association is the youngest of the two it resents the invasion of the southern part of California by the San Francisco organization, and Secretary Charles C. Hopper, of the A. C. of Southern California, is asking the automobilists of his territory not to join the northern body, claiming that it has never done anything to promote good roads or to benefit the automobilists, while the southern club has erected hundreds of sign posts and has contributed to the victory of the recent $3,500,000 good roads bond election in Los Angeles County.

The Speed Craze on Long Island.

By "Owner."

A recent decision of the New York Court of Appeals (192 N. Y., page 193) determines that cities and villages have no power to enact laws affecting motor vehicles except in conformity with the motor vehicle law. (Laws of 1904, Chapter 538.)

In the opinion of the court, written by Judge Chase, a comment is made on the use of automobiles which should be given careful thought by all automobile owners. It is as follows: "Automobiles have but recently come into common use. Within the last few years their use has not only greatly increased but tours therewith have been extended through many municipalities. Good judgment has not always been exercised in their use, and the rights of others have sometimes been overlooked by their owners and drivers, and principally in consequence thereof more or less opposition has arisen to their unrestricted use upon the publis creets and highways. The opposition to such use has frequently found expression in local restrictive rules and ordinances."

This aptly sums up the state of mind of the general public regarding the automobile and the owners and users thereof.

The viewpoint of this clear minded jurist puts it in the power of the reasonable motorist to see himself as others see him, to know that he has unwittingly, perhaps, and knowingly sometimes, overlooked the rights of others, and has caused hatred to spring up in the minds of pedestrians and of the drivers of horses and other road users.

The unreasonable motorist is beyond argument; nothing can check his headlong course but the terrible end which he is sure to meet, which he and his ilk are meeting almost every day. What argument could appeal to the speed mad maniac who hurls his car along the highway at express speed? With shrieking siren and crashing exhaust his car tears madly along the roads, skidding around corners, tearing past carriages and through villages, making the public roads a place of terror to the peaceful and pleasure loving citizen. The calm words of warning of the Court of Appeals have no effect upon such as he; he heeds them not; they are not for him, for in his arrogant ignorance he sees no danger in tremendous speed; in fact, he boasts of his achievements in annihilating space and distance.

In the past ten days five persons have been killed outright and at least ten badly injured by the misuse of their cars or by the negligence of the drivers of other cars. Remember, these five persons killed and ten injured were motorists, not pedestrians, not drivers of wagons, but men and women, and (sad to say) little children, out for a day's pleasure in their motor cars, and all these accidents on the roads of Long Island, the paradise of motor drivers.

What can be done to cure this disease? No remedy has as yet been found. One thing can be done to help, and that is to let the sane and careful driver be extra cautious when running his car; let him exercise good judgment as required by the comment of the Court of Appeals; let him by his example show to the unreasonable one that he can have more real pleasure at 20 miles an hour than he could get at 50.

New York State Roads to Be Oiled.

As the result of experiments with various oils and other preparations, extending over two years or more, the State Engineer has decided to employ hereafter, so far as possible, the Raglan asphaltic oil, a crude petroleum, practicable for use and cheap. The use of tarvia will not be entirely abandoned, at least for the time being, but as little as possible of it will be used, because while its effect is more lasting, because of its heavier consistency, it is far too expensive as yet to be used in any great quantities, and the State Engineer is this year laboring under the difficulty of a shortage of funds.

The effect of tarvia is to produce a new and, as it were, separate coating to the road, though it is used both on new and old roads and on badly worn roads as well as those still in good condition.

The effect of the asphaltic oil is to solidify the whole road, and it is now being used extensively to repair damage caused by automobiles.

Complaints as to this damage have been coming in from all over the State, many of which concern not only the damage caused but the dust nuisance which always accompanies it. Recent investigations have been made of the effect of the use of automobiles and the results collated under the following heads: High speed; draught under the car, especially in cases where the box is low; the sucking action of the pneumatic tires and the centrifugal force at the centre of the revolving wheels, as being the chief causes of the damage.

The dust is merely the dressing of the road, which has been ground to powder. A preparation such as the asphaltic oil, therefore, is the most suitable. Already the new roads in the eastern division, that is, of counties east of Utica, bounded on the west by Franklin, Herkimer, Otsego and Delaware counties, have been treated with the oil. The plan is to treat the new roads with it as soon as they are complete, whenever the money is available. Some roads of Clinton County have been oiled, and those of Albany, Schoharie and Fulton counties will follow.

It is also planned to oil most of the old roads in Albany, Dutchess, Orange, Westchester and other counties, using the road maintenance fund, which has been largely employed heretofore for new surface dressings, for oiling, whenever the surface is not in too poor a condition.

This is the first time that the department has attempted to systematically oil the roads and the work of experiment is now about ended.

NEW VEHICLES AND PARTS

The Packard "Eighteen."

The Packard Motor Car Company, of Detroit, are making the first deliveries of the new Packard "Eighteen" town car. This new Packard is exactly like the 1909 Packard "Thirty" in design and construction, but of smaller proportions. It is furnished as a limousine, a landaulet, a runabout and with an open five passenger body.

The four cylinder, vertical, water cooled motor is of 4 1/16 inch bore by 5⅛ inch stroke, and is rated at 18 horse power by the European system. The cylinders are cast in pairs, with water jackets and valve chambers integral. The castings for cylinders, exhaust manifolds, pistons and piston ring blanks are made in France from especially adapted gray iron. The pistons are ground and fitted with four ground rings. Cylinders, pistons and rings are lapped together with a polishing agent to obtain a perfect fit.

The crank shaft bearing surfaces are ground. The shaft runs on three large bearings, bushed with Parsons white brass. The connecting rods are drop forgings. The crank pin bearings are bushed with Parsons white brass and the piston pins with Packard special bronze. The inlet and exhaust valves are on opposite sides of the cylinder, all mechanically operated and interchangeable. The cam shafts are enclosed within the motor crank case, being fully protected from dirt and certain of lubrication. All cam shaft, and magneto and water pump gears are contained in a separate but integrally cast oiltight extension of the crank case.

The crank case is cast of special aluminum alloy in three horizontal sections. The uppermost section forms the engine base and is supported directly on the side members of the main frame of the car. On each side, between the transverse supporting arms, is a horizontal, integrally cast web, entirely enclosing the space between the motor and frame, thus affording complete protection to motor, magneto and other parts. The crank shaft bearings are held between the uppermost and middle sections. Extreme rigidity of the main bearings is obtained by massive webs. The bottom section is an oil well, easily removable for inspection or adjustment of connecting rods, cam shafts, etc., without disturbing the crank shaft bearings. The crank case is divided into front and rear compartments by a central partition, which supports the middle crank shaft bearing.

The carburetor is of Packard design, with hand governed supplementary air inlet and warm water circulation. For starting in cold weather there is provided a primary air intake shut-off, operated from the front of the car near the starting handle.

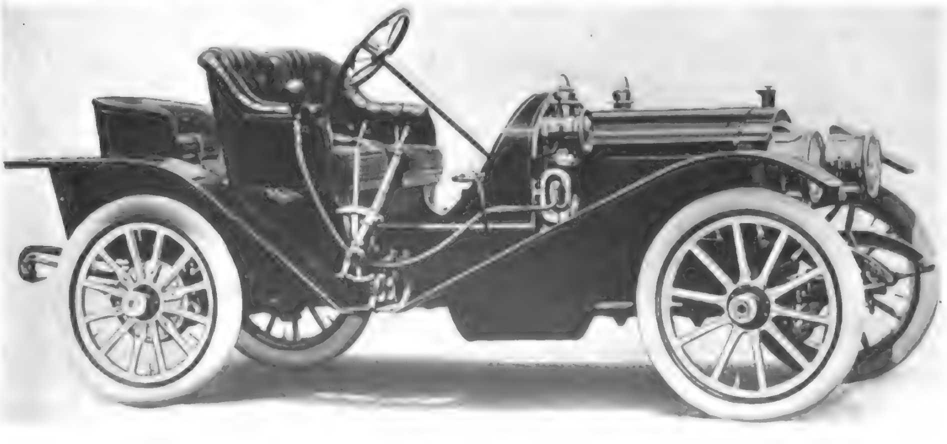
Water circulation is positive by means of a gear driven centrifugal pump. A special feature of this pump is its hydraulic pressure lubricated thrust bearing. The radiator is of the cellular type, combined with the tank. Forced draught to increase cooling efficiency is obtained by a belt driven, ball bearing fan adjustably mounted on the forward cylinder.

Ignition is by jump spark, the current being obtained from an imported Eisemann low tension magneto, mounted on the left side of the motor bed and direct gear driven by enclosed gears. A Fulmen imported storage battery, for starting the motor from the seat, is always in reserve. A transformer coil for the magneto current and a vibrator coil for the battery current is arranged as a unit in a box on the dashboard, with a single hand lock switch between. The commutator for the battery primary current is on a vertical shaft at the rear of the motor, and is driven from a cam shaft by enclosed bevel gears. The distributor, high tension wires and spark plugs are common to both magneto and battery systems. There are universally jointed knife switches at the plugs.

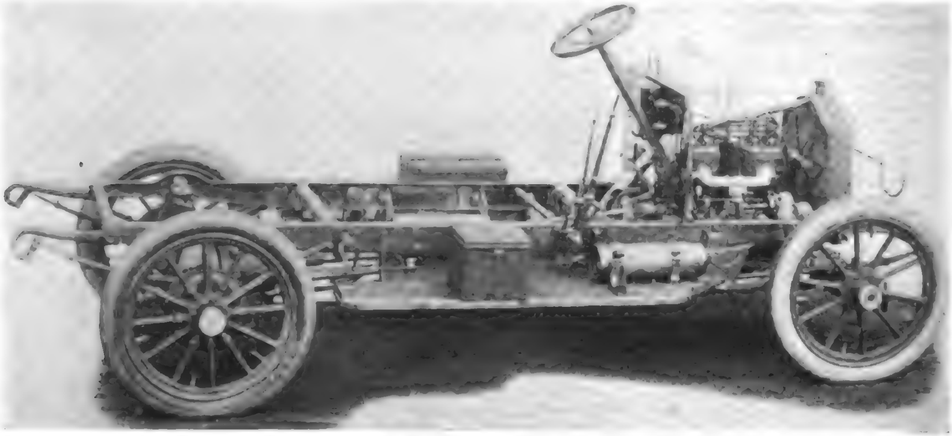
Lubrication is by splash, from the crank case to the cylinders and all motor bearings. Oil is pumped separately to the front and rear compartments of the crank case, in each of which is maintained an independent level of oil. The double plunger oil pump, with adjustable strokes, is accessibly located at the left of the motor, and is driven by a worm on the exhaust valve cam shaft. Oil is pumped from a vertical copper tank close to and between the pairs of cylinders, so that the oil will be warm and kept in fluid, easily flowing condition, even in the coldest weather. There are two drip sight feeds on the dashboard. The crank case drain cocks have anti-clogging devices.

The motor speed is regulated by an effective and easily controlled hydraulic governor incorporated in the water circulating system and acting directly on the butterfly throttle. A pedal cuts the governor out of action for instantaneous acceleration and high speed running. The throttle also is under control of a hand lever on the steering wheel. Another lever on the steering wheel advances and retards the spark.

The drive is through a Packard type internal expanding clutch. The propeller shaft, connecting the clutch with the transmission gear, has an encased universal joint at each end. The speed changing set, bevel gear final drive and differential gear are contained within a rigid aluminum housing forming a rear axle unit. The housing is internally ribbed and is provided with inspection holes. The differential gear unit is supported by its own bearings, so that the live rear axle may be withdrawn without disturbing the gears. Three forward



Packard "Eighteen" Runabout.



Packard "Eighteen" Chassis.

speeds and reverse are obtained by sliding gears, the third speed forward being a direct drive. The actuating slide rod is annularly grooved to correspond with spring retained spacing dogs, which determine the correct positions of gear engagement. The single speed change lever gives the reverse by a lateral movement. All gears in the transmission, final drive and differential and the rear axle run on imported annular ball bearings.

There are four brakes, all acting on rear wheel brake drums. The external contracting brakes are operated by a pedal, for regular use, and the internal expanding brakes are operated by an emergency hand lever. A drum disc entirely encloses and protects each internal brake.

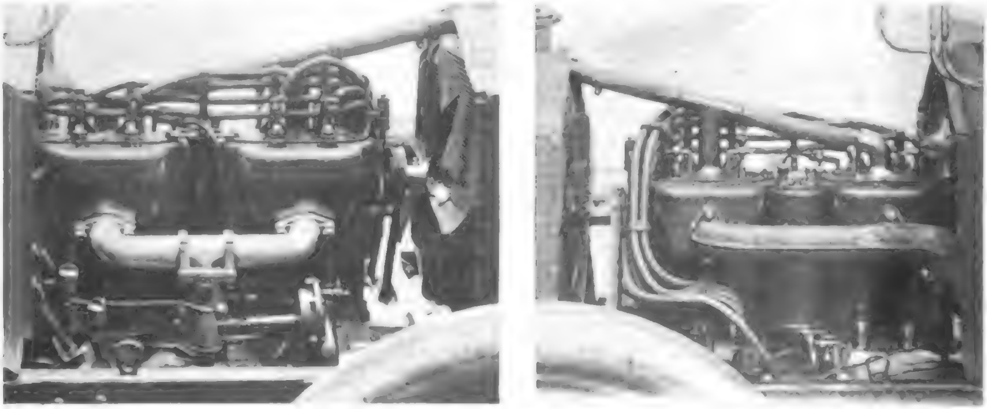
Steering is by a large hand wheel, on a large, rigid column, with worm and sector gear. The worm and sector are forged integrally with their respective shafts. The steering spindles and jaw type yokes are drop forgings. The steering connecting rod between the hand wheel gear and the steering knuckles is placed above the front axle to minimize jar on the hands. The steering knuckles have imported ball thrust bearings. All steering connections have grease cups and the steering rod universal joints are encased.

The running gear is of channel section, pressed steel; it is arched above the rear axle to provide ample spring action without raising the body. The top and bottom flanges of the side bars have integral gussets for the reception of the cross members. All rivet and bolt holes are drilled in full length jigs. There are four wide, semi-elliptical springs 40 inches long in front and 50 inches long in the rear. The front axle is steel tubing of large diameter and heavy gauge. The stationary sleeves of the rear axle are steel tubes pressed into and riveted within flanged collars bolted to the differential housing.

The wheel base is 112 inches and the tread 56½ inches. The tires, front and rear, are 34x4 inches.

The copper gasoline tank is under the front seat. A reserve gasoline supply is contained in the main tank and is available by means of a convenient gasoline valve. The total capacity is 18 gallons. The capacity of the water circulating system is 4½ gallons, and of the copper oil tank 2½ quarts.

All bodies are made of sheet aluminum panels over wood framework. The seats of the five passenger open body and of the runabout are upholstered in black hand buffed leather, over curled hair and with spiral spring support throughout. The limousine and landaulet bodies are upholstered in goatskin. The open car tonneau is provided with brass foot rail and pockets for small articles. The bonnet is aluminum, opening from either side and readily removable, and is secured by hand latches.



Right Side. Packard "Eighteen" Motor. Left Side.

The fenders are aluminum. The front fenders are easily detachable and provided with integral aprons preventing mud and water from splashing between fenders and car. There is also a metal apron between the frame and running board on each side. In the standard finish the entire body, bonnet and frame are Packard blue, with black moldings and fine cream yellow striping. The wheels, axles, springs and other running gear parts below the frame are cream yellow, striped with Packard blue.

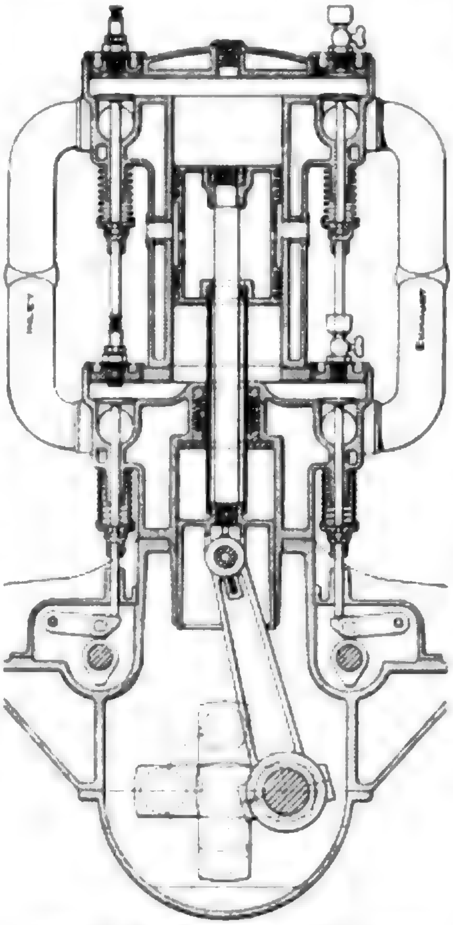
The runabout wheel base is 102 inches instead of 112 inches. The motor and driver's seat are farther back on the frame than in the open car, to properly distribute weight. The steering post has greater rake, and the divided front seat is lower. The gasoline tank is on the rear of the frame, the gasoline feed being by a simple automatic pressure system. There is a rumble seat above the gasoline tank. The standard tire equipment is 34x3½ inches in front and 34x4 inches in the rear. There are irons for carrying two extra tires. Otherwise the runabout specifications are the same as the open car. The limousine and landaulet bodies are fitted to the standard chassis.

The Burgess Double Acting Gasoline Engine.

Charles Burgess, Jr., of Wenona, Ill., has recently patented a double acting engine with a novel cooling system. A sectional view of the engine, which is to be constructed in two, four and six cylinder types, is shown herewith. It will be seen that the working cylinder is closed at both ends and is water jacketed in the usual manner. It contains a trunk piston, closed at both ends, and provided with three packing rings near each end, the central portion of the piston being considerably reduced in diameter. Into the ends of the piston is secured a piston rod, and this is surrounded by a steel tube, between which and the rod there is a space through which air may pass from the crank case into the hollow piston and out through openings in the wall of the piston and the wall of the cylinder to the atmosphere. Air is constantly forced into the crank chamber by a mechanical blower, and passes through the space between the piston rod and concentric tube into the hollow piston as described. This air circulation serves a double purpose. In the first place it aids in cooling the piston rod packing, which consists of metallic rings, similar to cylinder packing rings. These packing rings are cooled from the outside by the jacket water, and from the inside by the air circulation. The second object of the air circulation is to keep the piston cool. The piston rod at its lower end connects to a cross head of trunk piston form, from which a connecting rod leads to the crank shaft. All valves are mechanically operated, there being two cam shafts, on opposite sides of the motor, completely enclosed in special housings. In the four cylinder motor the cranks are set at quarters.

Steamer Explosion.

About a week ago a news item appeared in various Eastern daily papers that the boiler of a steam automobile had exploded at the bottom of a hill 2 miles from Painesville, Ohio, and had killed two of the occupants of the car and seriously injured the others. A letter received from a reader urged us to make an inquiry on the spot as to the cause and the circumstances of the accident, and accordingly we sent our Western representative to make an investigation. He reports as follows:



BURGESS DOUBLE ACTING GAS MOTOR.

"An automobile accident which caused the death of two persons and serious, if not fatal, injury to two others, occurred on August 10 at the foot of Stickney Hill, 2 miles south of Painesville, Ohio. Mr. and Mrs. Fred Beckwith, their daughter Bessie, aged sixteen, and Mrs. Mary Rowdon comprised the party, who were touring from Windsor, Ohio, to Painesville. Mrs. Beckwith and Mrs. Rowdon were killed instantly. The car was a 'Geneva' steamer built in 1903, having an ordinary upright tank boiler, the shell of which was blown out in all directions, and little was left of it. It was found that the shell of the boiler was of copper, one-sixteenth of an inch in thickness. Stickney Hill is fully a mile in length, and the general impression is that when the steam was shut off from the engine as the car began to coast down the hill the fire under the boiler was not reduced and steam was consequently made rapidly. The safety valve, which should have relieved the boiler and prevented too great pressure of steam being attained, must have been out of order, and the pressure of steam went above what the light copper shell of the boiler would stand.

"It was almost at the bottom of the hill when the explosion took place, and the terrific force hurled Mrs. Rowdon fully 60 feet ahead of the machine. Mr. Beckwith operates a planing mill at Windsor and is more or less familiar with steam engines and boilers. But it is supposed that his attention was absorbed in steering the auto down the long and winding hill and he did not notice that the steam gauge showed a dangerous pressure."

The Geneva steam touring cars built in 1903 were fitted with so called semi-flash tubular boilers, and it is evident from the above that this car had been fitted with a new and different boiler of the familiar fire tube type.

Foreign Ball Bearings Well Represented Here.

At present there are as many foreign makes of ball bearings represented here as there are home manufactures of such bearings. The D. W. F. bearings, manufactured in Berlin, are also made in a factory in Philadelphia by an American firm. F. and S. bearings, made in Schweinfurt, Germany, are represented in the larger cities of the United States, the main American office being in New York. The M. and B. bearings, made near Paris, are also represented in New York and the larger cities. The R. I. V. bearings, quite new in the field, and manufactured by Roberto Incerti, of Milan, represent the Italian product. It is reported that the product of the Berliner Kugellager-Fabrik will be handled in New York in a short time by a well known firm of ignition specialists.

Decoration Work for Madison Square Garden Show.

The show committee of the Madison Square Garden Show on August 11 approved plans for the decoration scheme and awarded the contract for the decorative work to the S. R. Ball Company. The committee this year proceeded on different lines in making arrangements for the decorations. In the past the committee asked the various decorators for plans and estimates for decorations, but this year the supervision of the work was placed in the hands of an architect, W. W. Knowles. Plans and specifications were drawn by Mr. Knowles and approved by the committee, and after the acceptance of the plans they were submitted to various decorators for bids. The decorative scheme is said to be entirely different from that of previous years. Simplicity is the keynote of the general scheme, but a high standard is said to be maintained. Five thousand feet of additional floor space has been gained.

The Town Car.

By D. R. Hobart.

The town car, as its name implies, is a vehicle used in and around a town or city for shopping, calling, park riding, etc. It is essentially a private vehicle, although, as in the case of horse drawn vehicles, similar vehicles are operated by livery concerns, and when they are fitted with taximeters are known as "taxicabs." Town cars are driven either by electric or internal combustion motors, no steam driven town cars being in existence to the writer's knowledge. As the service of the town car consists in carrying one to five passengers at a fairly reasonable pace with comfort and safety, motors of from 12 to 20 horse power are usually fitted, the car is constructed with a moderately long wheel base, combining easy riding qualities with ready control in traffic, and the body is of the side entrance type, enabling the passengers to descend to the sidewalk at will without having to back the car thereto or have the passengers step into the muddy street, as with the rear or front entrance type of bodies. According to the taste of the owner, various types of bodies are fitted, the landaulet, brougham and phaeton types being the most popular.

BODIES.

Taking up the landaulet type of body, we find that it comprises the plain landaulet, the extension front landaulet, and a curious hybrid known as the limoulet. The plain landaulet is too well known to need description. The extension front landaulet resembles the plain landaulet, except that a sort of bay or "extension" is placed at the fore part of the body for the accommodation of an extra seat for two passengers. Facing the rear, this bay is provided with panes in sliding frames similar to those in the doors and the front of the landaulet or brougham, and enables the comfortable seating of four passengers in the interior, which is difficult with the folding seat for the extra two in the plain landaulet. The roof over this bay is fixed and cannot be folded back with the head, as in the plain landaulet.

This type of body has been developed like most of the others from the old stage coach bodies, and has been in use upon horse carriages for at least thirty years, being known in Europe as the "three-quarter landaulet." The limoulet is a combination of limousine and landaulet, and as applied to town car service resembles an extension front landaulet, with glazed windows in the sides of the leather head. These windows disappear within the body sides when lowered, the back frame of each folding back with the head, but the remainder of the body remains "standing," as in the case of a limousine. The area uncovered by putting back the hood of a limoulet is about one-half that in a landaulet. The limoulet body is used by parties in the immediate suburbs of large European cities, upon either town or touring car chasses, but is practically unknown in this country.

The landaulet types all have the advantage of a fairly light body, which may be opened or closed at will, thus avoiding the necessity of having an open and a closed body for the same chassis. From this point of view they are both time and money savers. On the other hand, the joint where the roof is attached to the upright or extension front can never be made tight, so that dust sifts through and rain enters, to the detriment of clothing and the upholstery of the car. When closed the bodies are stuffy, and uncomfortable with regard to seating the passengers. The limoulet is more comfortable than the other bodies of the type when the head is closed and the windows are all dropped, owing to the greater amount of air entering the body.

The brougham types, comprising the limousine, coupé and brougham, are all closed bodies, and with the exception of the brougham have only a single seat at the rear for the accommodation of two passengers. The coupé, often confused with the brougham, resembles the landaulet, except that the folding leather head is replaced by a permanent wooden head, and only the door glasses drop. The brougham is literally an extension front coupé, having a "bay" with a folding seat for two extra passengers with their backs to the driver. The limousine has glazed panels in the sides of the after-body and as applied to town car chasses seats only two passengers. A deck is usually fitted over the driver's seat on the limousine, but no such arrangement is fitted to any of the other types of body for private service. The brougham types are weather and dust proof, but are as stuffy as the landaulets when the windows are up.

The open bodies comprise the double phaeton, the cabriolet and the tonneau. The double phaeton just now seems to be very popular for touring as well as town service, and consists of but two transverse seats, the front one being divided. There are no side doors or panels, and a Cape or other folding top is sometimes fitted. The cabriolet with its different titles of mylord, berline and double victoria, consists of two transverse seats, either the front being of the plain type with a raised cushion for the groom and a victoria seat in the rear, or both seats being of the victoria type. In the first case the body is intended to be formal, for park and calling service, the driver and groom being accommodated upon the front seat, while in the second case the body is frequently used for driving by one of the family or less formal service. A victoria top is fitted with this type of body. The tonneau, as it is called here, is a double phaeton body fitted with side doors, and may have any variety of folding top desired. It is not a livery body, although often used as such.

The double phaeton and cabriolet types are made exceedingly comfortable as regards the appointments, but are exceedingly draughty, by reason of there being no panels or doors at the sides. The victoria top with the accompanying apron set is quite comfortable when it is raining, but, of course, does not give the protection of the brougham and landaulet types. The tonneau is the most comfortable of the open bodies, by reason of its better protection from draughts and its top and side curtains.

REQUIREMENTS.

The town car must be silent, comfortable, easy to control and very mobile. Most modern motors are sufficiently noiseless, and the fact that the town car needs only a medium powered motor, 16 horse power being about the average, and runs at moderate speeds, renders easier the designing of the motor for silence in operation. Shaft drive is generally used, as it is silent and clean and does not need frequent repairs. Comfort is obtained by the use of a fairly long wheel base, to give easy riding and to accommodate a roomy body. Cleanliness also tends to comfort, as a dirty chassis means a dirty body, which is reprehensible in a town car. Ease of control is obtained by the reduction of the number of operating levers and attachments, the simplest control being by accelerator pedal, the ignition being by high tension magneto with fixed sparking point. The frame in the best practice is of pressed steel, the longitudinals being straight or arched at the rear to allow of a "straight line" drive to the rear axle. Opinions differ as to the springing of the car, but either the full elliptic or platform springs ride easiest for the rear of the body, and even the "thorough-brace" type of coach springs can be used in addition for suspending the body, as the speed of the car is not high. This type of suspension, however, is uncomfortable upon roads, having a tendency to pitch about, to the discomfort of passengers.

Mobility is assured by a flexible motor and a good "angle of lock" to the steering wheels. The flexible motor, by "picking up" quickly, allows of ready movement in traffic, while upon the amount of lock given to the steering wheels depends the radius in which the car can manœuvre—another great point in traffic. The police regulations of a number of European cities prescribe a turning circle for taxicabs of 25 feet diameter (in the majority of cases) and a maximum displacement for these vehicles, such prescriptions having been found necessary on account of the width of streets, amount of traffic, etc. A similar set of regulations are proposed for New York city, but nothing has been done at the present writing. The town car, mobile as it necessarily must be, should have a sufficient "angle of lock" to at least enable it to turn in any fairly wide street of the city in which it is used. This naturally precludes a very long wheel base, although the car would ride easier therewith; but it has been found by two or three of the most prominent builders of town cars that a comfortably riding car may be built to turn in a 30 foot circle with a wheel base of not over 105 inches, and this with a normal "angle of lock." Considering the width of the streets of our large cities this is ample, vehicles not being often called upon to turn in such a circle. As to the amount of displacement, the traffic conditions as yet do not demand such a regulation.

ADAPTABILITY TO LIGHT TOURING.

The town car chassis is applicable to light touring as well as town service. In fact, of half a dozen models recently tried out all were found excellent cars for four or five passengers, but, of course, great speed could not be gotten with the the motors fitted. Tonneaus or runabout bodies were fitted, and the reduction being low (3½ to 1) a reasonable speed was maintained, and ability to climb the great majority of hills encountered in touring was demonstrated. These facts have been recognized by a number of suburban residents, who use a town car chassis fitted with a cabriolet or victoria body for going to the city for shopping, etc., thus saving their larger touring cars for other service, and at the same time presenting a good appearance. The use of such cars for the purpose not only is an economy from the owner's standpoint, but is a benefit to the community, as the car will be driven at lower speeds and not raise so much dust as the big car.

Reckless Driving at Railroad Crossings.

The president of the Long Island Railroad has issued the following self explanatory statement regarding accidents at the crossings of this road:

"In view of the frequency with which automobile accidents have occurred on Long Island this summer the management of the Long Island Railroad is to undertake to put an end to the reckless driving over railroad crossings by giving publicity to the names of the registered owners of all cars speeding across railroad tracks.

"The method to be employed by the railroad to obtain the identity of those speeding recklessly over grade crossings is to have specially qualified men stationed at crossings over which automobiles are accustomed to drive at reckless speed. These men will measure a course, one-half of which will lie on each side of the tracks, over which all automobiles will be timed; the license numbers will be taken and special notations made of those going at unusual speed, and also of those who are duly cautious. The number of persons in each car will also be noted. These checks will be continued regularly by the company with a view to keeping itself and the public informed as to reckless driving on Long Island. The names of the registered owners of automobiles driven at dangerous speed will be supplied to the newspapers in the hope of bringing home to the public the actual danger involved in this situation.

"The Long Island Railroad has gone to enormous expense in recent years to remove grade crossings on its lines. It has expended some $10,500,000 to this end, and 289 crossings—or 22 per cent. of its total number—have been eliminated. This is better than the record of any other railroad in New York State.

"The State of New York appropriates annually $300,000 as its share toward eliminating grade crossings on all roads, but as there are 6,703 grade crossings in the State it will be many years before all crossings over which there is frequent travel can be done away with. It is evident, then, that in the meantime greater care must be exercised by those running automobiles if the number of accidents is to be decreased.

"Of course conditions on Long Island are peculiar. In spite of all that has been done 429 crossings remain unprotected by gates, flagmen or bells. In view of this the Long Island Railroad has doubled the number of watchmen at many important crossings used by automobiles, but it is financially impossible for this to be done at all crossings. There is a large signboard as a warning at every crossing in the form prescribed by the railroad commission. These signs have been located with great care to make them conspicuous. As a matter of fact the entire Long Island Railroad was gone over, and all signs placed in particularly prominent places, and the trees were trimmed when they obstructed the view of the sign from any direction. The crossing signals are especially evident at night when illuminated by the lamps of the automobiles. Upon the sign is the legend: 'Railroad Crossing. Stop. Look Out for the Cars.' Those who do this are never hurt; those who disregard it disobey the law, and some of them have met with frightful accidents, for which the railroad company was in no sense legally responsible.

"In view of these accidents the company a few days go made a private check upon the number of automobiles proceeding over crossings at reckless speed. The records of the investigation show that 310 automobiles were reported as passing over a crossing on the Merrick road which is protected regularly by a flagman. Of this number 121 crossed the tracks without any regard for the crossing signal or flagman. One hundred and seventy-two slowed down but didn't stop, and seventeen came to a full stop. Of the latter number, however, eleven were prevented from crossing by trains standing on the track."

Chicago A. C. Warning Speeders.

By agreement with Judge Charles A. Allen, of Kenilworth, the Chicago A. C. during the last week of July sent out an expert timer to co-operate with the policemen of that suburb. The time of every automobile passing through that entire week, some 400 in all, was taken. The board of directors of the club held a meeting on August 13, and decided to send circular letters to all of the owners of the cars whose time had been taken. Those who complied with the law will receive commendatory letters, while those who violated it will receive warning letters clothed in more or less severe terms, according to the degree of the violation. All of the drivers will be assured that there will be no prosecution for violation of the law established unless other violations follow.

The Race Control Situation Muddle.

The situation with respect to the control of racing in this country was further complicated when the Lowell A. C. asked the Automobile Club of America whether it would disqualify cars partaking in the Lowell races on Labor Day. The answer given by the A. C. A. was that it would not. The meet had already been sanctioned by the A. A. A. and it appears that the Lowell club was induced to also obtain a sanction from the A. C. A. by a prospective entrant. The recently formed Motor Racing Association of New York, which will hold a twenty-four hours' race on the Brighton Beach track on September 18 and 19, in order to avoid any complication will not solicit a sanction from either the A. A. A. or the A. C. A. The Motor Racing Association at first prefixed the word metropolitan to its title, but has now dropped it, and intends to extend its activities beyond the limits of New York. Its members are representatives of the several manufacturing and importing firms which have been most conspicuous in races in this country. To judge from precedent, all of the makers taking part in this unsanctioned race might be expected to be disqualified by the A. A. A., but as the member clubs of this organization which hold races must depend on these makers for entries such an action of the A. A. A. would amount to a resignation of its race control. The Motor Racing Association seems, therefore, to be in control of the situation. Its officers are C. F. Wyckoff (Stearns), president; E. R. Hollander (Fiat), vice president, and W. C. Allen (Allen-Kingston), secretary.

One of the manufacturers of so called "block" motors meets the objection raised to such motors that renewal of a damaged cylinder casting is expensive with the argument that owing to the simplicity of the connections and the minimum amount of machine work required these quadruple cylinders are not at all costly as compared with single cylinders, and backs up the argument with the statement that the cylinder unit for his 30 horse power will cost only $35.

COMMUNICATIONS

Air Bottles.

Editor Horseless Age:

We notice your comment on tire filling tanks on page 207 of your issue of August 12. We wish to make a correction in regard to this. Tire filling tanks are of two kinds, gas tanks and air tanks. This company fills its bottles with nothing but compressed air at 2,000 pounds pressure. All our tanks are tested to over 4,000 pounds pressure. It is not necessary to keep the air tanks out of the sun, as there is absolutely no danger of explosion or material variation in pressure, due to the action of heat. This, however, is not the case with gas tanks, and the directions referred to by your correspondent were probably on a gas tank and not on an air tank.

The Goodyear Tire and Rubber Company,
By P. W. Litchfield, Supt.

Ohio's Reciprocity Clause.

Editor Horseless Age:

As we are located only about 35 miles from the Ohio line we desire to take a little tour through and in Ohio for a few days, possibly only a week; will you please advise us if we will be required to procure an Ohio permit to unable us to take this trip.

A. Krauss & Son.

[Ohio grants exemption to non-resident motorists only if the home State of the motorist makes similar requirements, and grants similar privileges, and as your State, Pennsylvania, does not grant any privileges to non-residents, you are legally required to take out a license if you want to drive in Ohio.—Ed.]

Hill Climbing Powers of Cars and Mules.

Editor Horseless Age:

I took twelve passengers up Barrett Hill in a trap weighing about 2,000 pounds, with a three abreast mule team, and having been taught that a man for a short time could develop a horse power and a mule 5 horse power I tried a steam auto rated at 18 horse power and a gasoline auto of like rating, neither of which could climb the hill. I went over the hill today in a six cylinder car rated at 40 horse power with five passengers. It is so much cheaper to test the hills with mule power than with an auto that I would like to know how to compare the two powers, and what extra power would be needed to increase the speed from 4 to 15 miles an hour.

Cortlandt de P. Field.

[We do not know of any satisfactory way in which this can be done and do not believe that it is generally possible. The maximum power a horse or mule can develop depends largly upon the length of time for which it must be developed, in other words, upon the length of the hill. Also, the average and maximum grades would have to be figured on, because a long hill with only a moderate average grade might contain a short stretch with an extremely steep pitch. It would also make a difference whether this steep pitch was near the end or the beginning of the rise. Besides, all horses are not equal as regards the power they can develop. We believe that in view of all these variable factors it would be far easier and far more certain to try a hill directly with the car than to try to predict the car's performance on the hill from trials with mules and calculation.—Ed.]

New Method of Dressing Platinum Points.

Editor Horseless Age:

Several of your recent articles from private owners mention the "filing" and "sandpapering" of platinum contact points. Let me suggest as a very successful improvement on this treatment the "riveting," as it were, of these points into shape, instead of filing, with its consequent loss of platinum.

The contacts on our commercial and pleasure cars are examined with fair regularity, and immediately on their showing signs of pitting we submit them to a very light tapping with a one ounce hammer, thus by a process of riveting overcoming the pitting, and by careful manipulation maintaining the original size of the platinums. This is a very easy matter once the knack has been obtained, and is done as quickly as filing. It is particularly applicable with the screw points, as the platinum can be readily riveted into a flattened, conical shape, which gives most excellent results. The loss of material thus is only that consumed by current.

L. H. Daloz Company.
Per L. E. Daloz.

Club Notes.

The Kansas City A. C. at a meeting on August 5 voted unanimously to withdraw from the Missouri State A. A.

The Columbus (Ohio) A. C. has taken clubrooms at the Northern Hotel, on the ground floor facing Goodale street.

A meeting with the object of organizing a motor cyclists' club was called by Max Ozersky, of Youngstown, Ohio, recently.

The Associated Automobile Clubs of New Jersey will hold a good roads convention at Atlantic City, September 25-26.

B. H. Tatem and Lewis Penwell have issued a call for a meeting, with the object of forming an automobile club at Helena, Mont. The meeting will be held in the rooms of the Commercial Club.

The A. C. A. is considering a plan to hold a small car race at Savannah, on the day previous to its grand prize race. The club is now sounding the manufacturers regarding their attitude toward the event.

The Morristown (Pa.) A. C. has decided to purchase a plot of land, 100x250 feet, along the Ridge Pike, upon which to erect a 40 feet square bungalow type of building to serve as a clubhouse. The estimated cost of the building is $3,000.

The Richmond County (N. Y.) A. C. recently held a meeting at Grant City, adopting a new constitution, and electing several new members. The club will hold a run through New Jersey in the near future.

The plan of an automobile boulevard, 100 feet wide, between Cleveland, Toledo and Detroit, is being discussed by the automobile clubs of these cities. It is said to have originated with the Board of Trade of Loring, Ohio.

The Ohio Valley A. C., Wheeling, W. Va., held a hill climb on Campbell's Hill on August 7. The course is 1.3 miles in length and winding. A total of eleven cars participated in the two events, a handicap and a free for all.

The Kansas City A. C. and the Railroad Club of Kansas City are trying to arrange for joint headquarters in the downtown district. The Railroad Club have recently moved to 1008-10 Walnut street, and the Automobile Club may decide to share clubrooms with them. A joint committee has been appointed.

The Minnehaha County A. C. has been organized at Sioux Falls, S. Dak., with R. J. Wells as president; Geo. T. Blackman, vice president; A. J. Keith, secretary, and Max Norton, treasurer. There are said to be fifty-one private automobile owners in Sioux Falls, and thirty of these have already joined the club.

The Butler (Pa.) A. C. was formed on August 9 with Charles W. Hosford as president; Wm. J. Troutman, vice president; Dr. W. C. McCandless, treasurer, and Wm. H. Larkin, secretary. The motorists of Butler complain that the highway officials of the district are prejudiced against automobiles, and in some instances purposely omit removing loose stones from the highways three times during the summer and fall, as required by law. The club will endeavor to correct these evils.

The Missouri State A. A., a member of the American Automobile Association, has been practically dissolved by the resignation of the Kansas City A. C., the other important member club, that of St. Louis, having stopped paying its dues. It is thought that the loss of interest of the St. Louis club in the A. A. A. is due to the fact that the latter body did not accept the club's plan for holding the Vanderbilt Cup race in Missouri last year.

The Automobile Club of America has issued the following pronunciamiento, which amounts to a ban on the Vanderbilt Cup race: "Pursuant to the agreement adopted at Dieppe by the International Association of Recognized Automobile Clubs it has been resolved that all participants, including the manufacturer, agent, private owner, driver and mechanician, taking part in any international race in America not sanctioned by the Automobile Club of America will be disqualified from competition in any future races held in this country and abroad."

Commercial Applications.

Motor Stage Line to Lick Observatory.

The Mount Hamilton Auto Stage Company was formed on May 27 last by H. M Johns, of San José, Cal., to operate an automobile service to the Lick Observatory, at the summit of Mount Hamilton. Originally the service was conducted with a 1906 model Locomobile, and on June 17 a two cylinder friction driven Cartercar was added. The Locomobile is a seven passenger car of 35 horse power, and the Cartercar a five passenger vehicle of 28 horse power. The round trip is made in a day, and from one to ten passengers are carried over one of the finest scenic routes in the West. The road is a wide mountain road, with about 7 per cent. average grade. In the last 7 miles the road rises 2,000 feet and contains 365 turns, four of which are hairpin turns. The total rise is 4,209 feet, and the total distance 30 miles.

The Lick Observatory is claimed to be the finest in the world, its telescope being the second largest in the world, being 58 feet long and having a 36 inch lens, weighing over 4 tons. The dome of the observatory is made of steel, weighs 110 tons, and rests on rollers; it is turned by electric power. The fare for the round trip is $6. Mr. Johns informs us that he expects to put on one or two more machines in the near future.

Motor Transportation of the Milk Supply of Berlin.

The present method of transporting the milk consumed in Berlin, by railroad, is said to be very unsatisfactory, for various reasons. Not only is much time lost by the switching of the trains in the yards and the loading of the milk cans on to the wagons which carry them to the milk depots, but the distance of the freight yards from some of the milk depots is so great that the transportation by wagon requires several hours, which considerably adds to the cost of the milk and certainly does not add to its quality. Another disadvantage of railroad transportation is the fact that large country districts at a considerable distance from railroad stations are unable to send any milk to the metropolitan market.

With these various disadvantages of the present system in view, the president of the Association of German Milk Dealers, J. Lulay, of Schoneberg, has made arrangements to carry out some experiments in the transportation of milk by motor trucks. Two motor trucks with trailer, capable of carrying a total load of 10 tons, are to be used for the purpose. The trials will begin during the fall, and it is planned to carry about 5,000 gallons per day from the vicinity of Anhalt to Berlin. It is calculated that the motor trains, which transport the milk directly to the selling depots, will require less time than the railroads and terminal transportation at the present. If the experiment proves successful the question of the general introduction of motor trucks for the transportation of milk to all the big cities will be brought up for discussion at the next annual meeting of the German Milk Dealers' Association. It is stated that the daily consumption of milk in Berlin alone is now approximately 200,000 gallons.

Commercial Notes.

The Water Department of the District of Columbia has placed in service a 3,000 pound Franklin motor truck capable of a speed of 20 miles per hour.

According to a report from Washington, D. C., the City Council of that city is contemplating the acquisition of a number of motor sprinkling cars at $2,500 each.

Several business men of Sherman, Tex., are trying to interest automobile dealers of the city in an automobile line from there to Club Lake, 7 miles west, where the Red River Gas and Oil Company is now drilling for oil. It is stated that many of the local population are daily visiting the scene of these operations out of curiosity.

The Newark, N. J., Board of Health recently made a test of an electric ambulance, and will shortly also test a gasoline ambulance, having practically decided on the purchase of a motor ambulance for the proposed ambulance station.

The Luitweiler Pumping Engine Company, of Los Angeles, Cal., is preparing to enter the automobile fire engine field. A chemical engine equipped with a Luitweiler pump is to be mounted on a chassis equipped with a motor designed for a 40 mile speed.

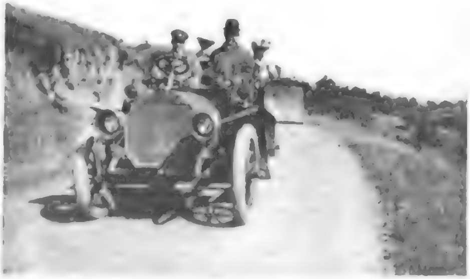
The Indianapolis branch of the Elgin Dairy Company has adopted motor trucks for making its city delivery. This is the second Indianapolis concern of its kind to adopt the service, the Glossbrenner-Dodge Company having used a motor truck for almost one year with satisfactory results.

Finch & Freeman, successors to Hill & Beeson, Indianapolis, have opened up new quarters at 33 South Capitol avenue, in that city, and will continue to represent the Auburn and Richmond in Indianapolis and vicinity. For some time the company has been located with the Indiana Carriage Company, but as that company expects to add a stock of automobiles, the change was made to make more room for the carriage company.

Stoddard-Dayton Newark Agency.

The Atlantic Motor Car Company, New York and New Jersey, agents for Stoddard-Dayton cars, expect to open their new garage and salesroom at 228 Halsey street, Newark, N. J., on September 1, 1908. This is a one story brick and concrete building, 40x104 feet, and so finished that another story can be added if necessary. The garage will have a complete equipment for the handling and repairing of cars. The offices will be at the front, and finished in Mission style.

On Top of Mount Hamilton.



On the Route of the Stage Line.

LEGISLATIVE and LEGAL

The Rushmore Injunction.

To the item headed "Rushmore Injunctions Sustained" in our issue of August 5 we have to add that the appeal case was heard by Circuit Court Judges Coxe and Noyes and District Judge Adams. The majority of the court decided that the order of injunction secured by Rushmore against the Manhattan Screw and Stamping Works should be modified by excluding from its provisions the prohibition against the use of the name "flare front," and as so modified the order was affirmed.

In the decision it is stated that the question involved in the suit resolves itself into the following: "Can one who manufactures and sells a well known article of commerce, like an automobile searchlight, enclosed in a shell of graceful but unpatented design, maintain a bill for an injunction, profits and damages against a defendant who sells automobile searchlights enclosed in a similar shell, with his name prominently appearing thereon as the maker and who has never represented that his lamps were made by the complainant?" This question is answered in the affirmative by the court, on the authority of certain previous decisions. The court holds that to answer the question in favor of the complainant carries the doctrine of unfair competition to its utmost limit, and that if it be pushed much further those engaged in trade will be encouraged to run to the courts with trivial complaints over the petty details of business, and thus will grow up a judicial paternalism which in time may become intolerable. The decision continues:

"This cause, or one involving the question at issue, may be easily brought here on appeal from final decree and heard at the next term. After the witnesses have been cross-examined we may be able to tell with much greater certainty whether the competition of which the complainant complains is produced by the similarity of the shells of the two devices, or by the fact that defendant is selling its lamps at a much lower price. * * * If it should appear, after full hearing, that the effect will be to stifle legitimate competition rather than to punish unfair competition, we will not hesitate to dissolve it * * *."

Connecticut Law May Be Repealed.

It appears that the State of Connecticut has received considerable undesirable free advertising from its recently adopted automobile law, which is very lenient with regard to speed limits. It is stated that many motorists from outside the State take advantage of this feature of the law for making Connecticut a speeding ground. The residents of the State are already considering a repeal of the law, and the automobile clubs of Bridgeport and Stamford have taken action on the matter and warn all automobilists using the roads of the State to drive at moderate speeds, lest the advantages now enjoyed by motorists in Connecticut should be taken away from them. Complaints are said to have been especially numerous in the towns and cities along the Boston Post Road, viz., Greenwich, Stamford, Norwalk and New Haven. The A. A. A. also has issued a warning to its members that unless the speeding on Connecticut roads is stopped the present automobile law of the State is likely to be repealed.

Charges of Graft Against New Jersey Justice Dismissed.

Four Philadelphia motorists, A. C. Mauscher, James Dickson, Morris Penrose and Bert Segal, were arrested by Justice of the Peace Conrad Waldvogel at Waterford, N. J., on August 8 while on their way to Atlantic City. Mauscher went into Waldvogel's office, and was condemned to a fine of $10 and $5 cost. The party admitted that they were running at 25-30 miles per hour, and did not object to the fine, but declared the $5 costs to be excessive. Another complaint against Waldvogel was made by James Speer, of 1014 Market street, Philadelphia, whom he fined $14 and refunded $10 when he was shown that Speer was not guilty of the charge of running a car without a license tag, but kept $4 "for expenses." Still another charge against the justice was that he wrote to the Keystone Motor Car Company, of Philadelphia, demanding a fine of $25 and $5 on a car bearing the New Jersey tag 102 M.

The Motor Vehicle Commission of New Jersey has investigated these charges, and finds that Waldvogel's act in the Speer case was due more to ignorance than to any desire to graft. He has been informed that he is not entitled to "expenses," and that he must return the $4 to Speer. In the Keystone Company case he was directed to retract the charge and give the company a hearing in the proper way.

Ohio Legal Matters.

Fred Caley, of Columbus, manager of Ohio's new automobile registration bureau, has called the attention of magistrates throughout the State, through the newspapers, to the fact that they are themselves violating the new State automobile law, which their constables and other officials are so zealously enforcing. The law requires that magistrates shall send the name of every person convicted of violating any portion of the law to the Secretary of State at Columbus, and in spite of many arrests and convictions but one name has thus far been received at the secretary's office.

An attack was made on the new law Monday when T. M. Drolesbaugh, of Bucyrus, was arrested for operating his car without a tag. He was fined $1 and costs, but will fight the case through to the Supreme Court on the ground that the law is unconstitutional.

Dr. Theodore L. Rankin, of Columbus, started another test case Monday when he was arrested for not having a city license tag. This case will be fought through the Supreme Court to see if the city can collect a license in addition to the one charged by the State.

M. L. Bigelow, of Columbus, was arrested Wednesday night both for exceeding the speed limit and failing to have proper lights exhibited, and his father, T. L. Bigelow, announces not only that he will fight the case through the Supreme Court on the ground of unconstitutionality, but that he will cause the arrest of the motor policeman who arrested his son for failure to have lights exhibited on his motorcycle.

Fined for "Kidnapping" a Policeman.

George A. Crane, a Chicago motorist accused of having "kidnapped" Policeman Frank H. Moor, of Glencoe, the Chicago suburb, was fined $50 by Justice Lane, of Glencoe, on August 12. The policeman claimed that he ordered the car stopped, and jumped on to give the driver a warning to proceed at slower speed, and was carried off in the car. The legal speed in Glencoe is 15 miles per hour. Motorists exceeding 20 miles per hour are arrested, and those driving at between 15 and 20 miles per hour are given a warning. A notice of appeal was at once given.

Legal Notes.

The City Council of Watertown, S. Dak., has passed an ordinance limiting the speed of automobiles to 6 miles per hour and requiring the signal to be sounded at every street crossing.

The City Council of St. Paul, Minn., has passed an ordinance similar to that in force in Minneapolis, which requires that the name of the owner of every automobile, the make and the manufacturer's number, be recorded by the city clerk when the license is issued.

City Controller Breunig, of Indianapolis, is now making a half price of $1.50 on city licenses for the balance of the year to people buying automobiles now. It is said that owners who have had automobiles for some time, but have not obtained licenses, are taking advantage of the half price offer.

The city of Roanoke, Va., has passed an automobile ordinance requiring all automobiles used in that city to be registered with the police, but exempts transients for one day. The speed is limited to 8 miles per hour within a limit of three squares from the corner of Jefferson street and Campbell avenue, to 12 miles per hour outside these limits, to 6 miles per hour at viaducts, bridges and corners, and 8 miles per hour when passing stationary street cars. No person under sixteen years of age is allowed to operate automobiles.

The Metropolitan Park Commission of Boston has passed an ordinance forbidding the use of spiked, chained or studded tires in the parks, and providing a fine of $20 for violations.

The New Jersey Motor Vehicle Department has promulgated a new rule, according to which, in all cases where chauffeurs drive either without a license or in an intoxicated condition, or where they use their employer's car without his consent, the chauffeur's license may be revoked without the usual order to show cause.

Dr. L. S. Colter, secretary of the Cincinnati A. C., recently procured an injunction restraining the city government from enforcing the automobile ordinance. The action was agreed upon between officials of the city and the Automobile Club. Dr. Colter holds that the ordinance is void, because it imposes a tax and not a simple license fee.

Col. Frederick Gilkyson, State Road Commissioner of New Jersey, recommends that the automobile law be so changed that the receipts from licenses be distributed among the counties according to the length of their improved roads under State control. At present most of the money goes to the big cities for their great lengths of brick, block and asphalt paved streets.

M. Otis Hower, of Akron, Ohio, recently drove in his car to Meadville Pa., with the object, it is said, of placing a large order with a malleable iron company in that town. While in Meadville he was arrested for failure to have taken out a Pennsylvania license, and was fined $13. Local business men who heard of the case considered that such a reception to a good customer was not entirely to their interest, and they decided to reimburse Mr. Hower.

Judge Steward, of Des Moines, Ia., last week decided that under the Iowa law automobiles must carry a distinct lamp at the rear, so placed as to illuminate the rear number plate, and fined each of seven motorists convicted of having violated this provision of the law $5 and costs. Counsel for the defendant motorists argued that the red prism of glass in the rear of the front lights was sufficient warning to any travelers coming from behind, but the judge ruled otherwise. Notice of appeal to the District Court was immediately given.

Joy Riding Chauffeur's License Revoked.

The first case under the new New Jersey law making it a misdemeanor for a chauffeur to take out his employer's car without the latter's consent came up at Atlantic City on August 11. Louis Hess, chauffeur for a Newark motorist, who had "borrowed" his employer's car, taken out some of his female friends and suffered a collision with a telegraph pole, was held in $200 bail. Later Hess was fined $100, and the Motor Vehicle Commission of New Jersey has since revoked his license.

The Algonquin Hill Climb.

The third annual climb of Perry's and Phillips' hills held at Algonquin, Ill., by the Chicago Motor Club, was run off on August 14 after having been twice postponed, on May 18 and 19 respectively. Perry's Hill was climbed in the morning, and Phillips' Hill in the afternoon. The most important prize, the Algonquin Cup, was to go to the contestant whose combined time for the two hills was the lowest. Classification was by piston area. There were to have been eight events in the morning, and also in the afternoon, but in two classes there were no entries. The fastest times for the contest were made by a six cylinder Stearns driven by F. Leland in the free-for-all event. He drove up Phillips' Hill in 29 2-5 seconds, and up Perry Hill in 24 3-5 seconds. A six cylinder Thomas driven by Salzmann, in the same class, came second, climbing Phillips' Hill in 30 seconds flat, and Perry's Hill in 24 3-5 seconds. The Algonquin Cup was, therefore, awarded to the Stearns car. Class A for motor buggies was won by a Holsman driven by J. M. Renegar, the hills being negotiated in 48 1-5 and 1.19 3-5 seconds respectively. A Brush runabout driven by Lobdell won in Class B, in 1.26 and 2.06 3-5 seconds for Perry's and Phillips' hills respectively. The winner in Class C was the 30 horse power Apperson driven by McLain, the times being 30 1-5 and 40 seconds. Miller's Cleveland and Hoffman's Pierce won in their classes in a shade over 27 seconds for Perry's Hill, and respectively 38 3-5 and 34½ seconds for Phillips' Hill. A Knox driven by Dennison won the free-for-all for motors under 90 square inches piston head area in 24 1-5 and 31 seconds. The amateurs' handicap was won by A. W. Greiner in a Thomas-Detroit in 25⅗ seconds on Phillips' Hill, as was also the amateur free-for-all in 25 seconds flat.

There were a number of accidents during the race, which resulted in the injury of three persons. A Jackson car driven by C. D. Paxon, an inexperienced driver, in the morning was driven into the officials' tent and timers' stand, injuring E. H. Trego, the official timer. Paxon is said to have lost control of the car. Notwithstanding the morning affair he was allowed to enter the event on Phillips' Hill in the afternoon, with the result that the Jackson again got beyond control and dashed into the crowd of spectators at the turn, two being internally injured, and a number of others bruised. In the event for motorcycles C. Van Sicklen on an Indian in trying for a record struck a rock and was thrown to the ground. He escaped with bruises, but the machine was entirely wrecked.

Following are the summaries:

CLASS A—MOTOR BUGGIES.

Car.	Driver.	Perry's Hill.	Phillips' Hill.
Holsman	J. M. Renegar	0.48 1-5	1.19 3-5
Holsman	E. A. Fairbrother	0.53 1-5	1.25 4-5
CLASS B—CARS WITH PISTON AREA UNDER 50 INCHES.			
Brush	B. Lobdell	1.26	2.06 3-5
Buick	J. R. Burman	0.32 2-5	0.46 1-5
CLASS C—CARS WITH PISTON AREA FROM 50 TO 65 INCHES.			
Apperson	N. McLain	0.30 1-5	0.40
Corbin	G. Bird	0.26 1-5	0.35
CLASS D—CARS WITH PISTON AREA FROM 65 TO 90 INCHES.			
Cleveland	J. Miller	0.27 2-5	0.38 3-5
Buick	J. R. Burman	0.26 4-5	0.35 4-5
CLASS E—CARS WITH PISTON AREA OVER 90 INCHES.			
Pierce	P. Hoffman	0.27 1-5	0.34 1-5
Apperson	E. Apperson	0.24 1-5	0.34
CLASS F—FREE-FOR-ALL, PISTON AREA 90 INCHES OR OVER.			
Stearns Six	F. Leland	0.24 3-5	0.29 2-5
Thomas Six	G. Salzman	0.24 3-5	0.30
CLASS H—FREE-FOR-ALL, PISTON AREA UNDER 90 INCHES.			
Knox	Dennison	0.24 1-5	0.31
Thomas - Detroit	L. Lorimer	0.25 1-5	0.31 4-5
CLASS J—AMATEUR HANDICAP.			
Thomas - Detroit	A. Greiner	0.25 3-5	Did not run.
CLASS I—AMATEUR FREE-FOR-ALL.			
Thomas - Detroit	A. Greiner	0.25	Did not run.

The motorcycle section summaries are as follows:

EVENT A—MACHINES OF 20.10 CUBIC INCHES PISTON DISPLACEMENT.	
F. Huyk (Indian)	0.40 4-5
T. Champay (Torpedo)	0.40 4-5
EVENT B—MACHINES OF 30.50 CUBIC INCHES PISTON DISPLACEMENT.	
C. Van Sickle (Indian)	0.33
F. Huyk (Indian)	0.33 1-5
EVENT C—MACHINES OF 61 CUBIC INCHES PISTON DISPLACEMENT.	
H. Bernard (Harley-Davidson)	0.31 4-5
C. Van Sickle	0.33 2-5
EVENT D—FOR MACHINES WITH FULL ROAD EQUIPMENT; PISTON DISPLACEMENT, 30.50 CUBIC INCHES.	
A. Lyon (Excelsior)	0.42 3-5
F. Huyk (Indian)	0.46

The motorcycle events were held only on Phillips' Hill.

New Agencies.

Chicago, Ill.—Walden W. Shaw, Thomas.

Sacramento, Cal.—E. G. Little, Tourist.

Columbus, Ohio.—R. O. Williams Automobile Co., 622 Oak street, Chalmers-Detroit and Thomas Forty.

Binghamton, N. Y.—Ellis W. Morse & Co., Overland.

Coming Events.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

September 11—Hill Climb of Springfield (Mass.) A. C.

September 14—Annual Economy Run, Chicago Motor Club.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

OUR FOREIGN EXCHANGES

Valve Arrangements.

Recently there has been considerable discussion regarding the advantages to be derived, with respect to efficiency, from the location of the valves in the cylinder head and regarding the influence which the rules of the Grand Prix race would have on the design of motors of high piston speed. So far as is known, these rules have encouraged the use of the above mentioned arrangement of the valves.

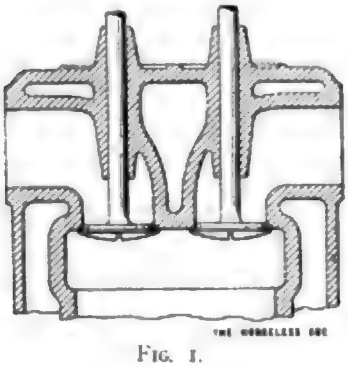


FIG. 1.

Fig. 1 herewith shows an ideal but practically impossible arrangement of the valves. The compression space is of a very desirable form; there is no difference in the cooling facilities for both the seat and the guide, as compared with the ordinary arrangement. This design is, however, not practical, for the reason that the machining and grinding of the valve seat and the introduction and removal of the valves could only be effected through the cylinder. With a motor of this kind the whole cylinder would have to be taken down if a valve developed a slight leak.

The next best thing is, therefore, to locate the valve seat in a special cage, which can be taken out together with the valve. Fig. 2 shows a design of this kind, which is taken from Maurer, of Nuremberg, and very similar to the design of the South German Automobile Works, of Gaggenau. This design is eminently suitable for inlet valves, as the incoming cool gases have a sufficient cooling effect on the guide and the seat of the valve. But there is some question as to the practicability of this design for exhaust valves, owing to the fact that by the addition of the wall thickness of the cage to the cylinder wall's thickness the action of the cooling water on the valve seat is diminished. The guide of the valve stem is directly in the path of the burning gases, so that lubrication of the guide is probably impossible.

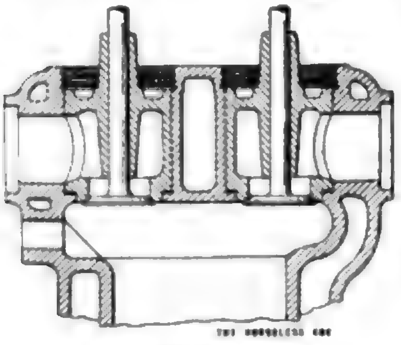


FIG. 2.

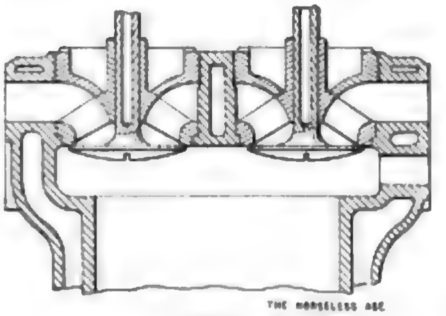


FIG. 3.

An improvement on this design is that shown in Fig. 3, which is borrowed from the Deutz motor. In this case the upper wall of the passage which carries the exhaust gases off to one side is brought down so low that only a very small portion of the valve guide is touched by the hot gases, the greater portion of the guide being cooled by the outside air. It is conceivable that the hollow valve stem induces an air circulation and tends to aid in cooling the guide.

It should be remarked that the arrangements Figs. 2 and 3 offer the advantage that the valve housings are very easy to construct, which may compensate for the chances of trouble inherent in these designs. The cheapness of construction and the simplification of the pattern are also important advantages.

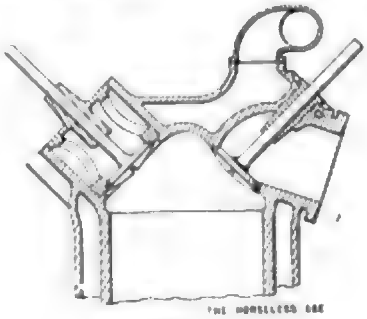


FIG. 4.

The arrangement shown in Fig. 4 was adopted for the Weigel Grand Prix racing cars, and offers the two last named advantages only in respect to the inlet valve. The exhaust valve, on the other hand, is very carefully arranged so as to be effectively cooled, both at the seat and at the guide. The greater reliability secured in this way is discounted by the fact that the seat of the exhaust valve is very difficult to machine, and that the exhaust valve must be introduced into and removed from the cylinder through the large bore for the inlet valve cage.

Fig. 5 shows the most carefully designed but also the most complicated arrangement, which is due to Pipe, of Brussels. The design of the inlet valve does not require any special precautions, consequently only the exhaust valve is shown in the drawing. This valve is cooled in the same manner as in the arrangement Fig. 4, but it is carried in a cage, together with which it can be removed from the cylinder after the loosening of four nuts. A special feature of this design consists in the use of two packings of different properties. The packing located next to the combustion chamber is metallic and of little elasticity, while the packing of the outer joint, which needs to withstand only the comparatively low pressure of the water circulation at a low temperature, is made of very elastic material, so that it will insure a tight joint under all conditions. The pattern of the cylinder is extremely simple in this case, but it seems that for boring the inclined holes for the cages special tools are necessary. This design, which gives a very desirable form of compression space, is patented.

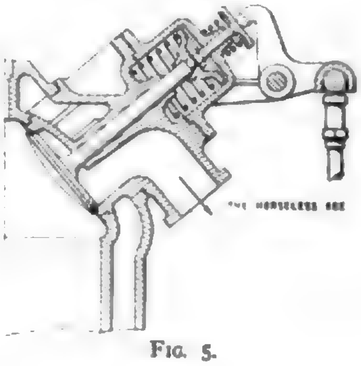


FIG. 5.

The valve operating mechanisms for the different arrangements discussed may be located in different positions, and are of consequence only in so far as they may interfere with the accessibility of the valves. With the arrangements shown in Figs. 2 and 5 the valves are operated from a cam shaft located in the crank case, while in the case of arrangements Figs. 3 and 4 the operation is effected by cam shafts above the cylinders.—*Erwin Aders, in Der Motorwagen.*

Grand Prix Finances.

Following are the different items of expense and revenue in connection with the French Grand Prix race, which netted a surplus of 140,000 francs; cost of grand stands, fences and bridges in villages, 130,000 francs; guarding of the course by soldiers, 70,000 francs; tarring the course, 60,000 francs; miscellaneous expenses for organization office, officials, etc., 50,000 francs; total cost, 310,000 francs. Entry fees for both the small and the big cars, 249,500 francs; bonus of the city of Dieppe and of the Departmental Government, 50,000 francs; revenue from the grand stands, 110,000 francs; miscellaneous revenues from advertisements, bar, garage, program, cloak room, etc., 40,000 francs; total revenue, 449,500 francs.

MINOR MENTION

Hamilton & Armington have opened a salesroom in Boylston street, Boston, for handling Havoline oils.

The August issue of the Studebaker house organ, the *Studebaker*, is almost entirely devoted to automobiles.

The Beckley-Ralston Company, 80 Michigan avenue, Chicago, have secured the Chicago agency for Panhard oil.

The first machine turned out by the Rowe Motor Company, at the shops of the Victor Tool Company, Waynesburg, Pa., was given its initial test last week.

According to the report for June of Capt. A. P. Spalding, Seattle harbor master, three automobiles were shipped to Behring Sea ports during that month.

The receipts under the Ohio automobile law for the second month it was in force amounted to $17,264, all of which went into the State Treasury for the Good Roads Fund.

The Fiat Automobile Company of New York have opened a Philadelphia branch house at 514 North Broad street under the management of Cornelius Barrows.

The Waukesha Motor Company, of Waukesha, Wis., inform us that they are completing designs for a new factory building that will triple their present capacity.

The Wilson Trading Company, who handle automobile tires and sundries, have established themselves at 46 Cortland street and 179 Greenwich street, New York city.

Adams County, Neb., claims a greater proportion of automobiles to population than either France or New York State. There are 150 automobiles in the county, one to every 240 inhabitants.

The Raymond Motor Company, successors to the Hillsdale Motor Company, Hillsdale, Mich., have rented a building on Railroad street, and will immediately install machinery to begin manufacturing a car designed by John Raymond.

A plant for the manufacture of the Russell automobile will probably be located at Connersville, Ind. For the present a sample car with the Russell engine is to be built at the plant of the Central Manufacturing Company in Connersville.

A company is being formed at Holland, Mich., to manufacture a car designed by Charles Boyden, of Grand Haven, Mich., who has invented a new type of gasoline engine. The car is to be fitted with a 30-60 horse power, four cylinder motor.

The American Taximeter Company, of Bristol, Conn., began operations on August 10 in a new factory on North Main street. For the present cars will be assembled only, but later on the parts are also to be made in the factory. F. A. Moskovics, secretary and treasurer of the company, has taken up his residence in Bristol.

The B. F. Goodrich Company, of Akron, Ohio, have purchased property at 1776-78 Broadway, New York, where they will erect a six story building for their New York branch.

It has been calculated that the value of automobile imports for the fiscal year which ended June 30 showed a decline of 37.5 per cent., as compared with the preceding year, while the exports showed a decline of only 4 per cent.

The United Teamsters of America, which recently met in convention in St. Louis, considered the inclusion of the word "chauffeur" in the name of the organization. It was proposed to amend the constitution so as to include automobile drivers.

Two men were killed and one injured as a result of a series of explosions at the Automobile Gas Company's plant, Albany, N. Y., on August 6. The Automobile Gas Company is controlled by the Avery Portable Lighting Company, of Milwaukee.

The Salt Lake City chain gang, comprising about twenty men, is at present building an automobile and carriage road between White's Hill at the Salt Lake and Davis County Line and St. Mark's Hospital, Salt Lake City, a distance of about 4 miles.

It is reported that the Buick Motor Company will vacate its drop forge and hammer shop in Jackson, Mich., about November 1, moving these departments to Flint, where new buildings are now being erected. The rest of the works in Jackson will be operated for another year.

It is reported that Toledo creditors of the Pope Motor Car Company are preparing a protest to be presented to Federal Judge Taylor, urging the necessity of reducing expenses by removing two of the three receivers, who are claimed to be receiving $500 each per month.

The Empire Manufacturing Company has been incorporated at Akron, Ohio, to manufacture automobile supplies and rubber cements. The factory of the company is located at 200 East Exchange street, while offices have been established in the Walsh Block. C. W. Wickline is in charge of the factory.

The Thomas car which won the New York-Paris race arrived in New York from Paris on Saturday, and on Monday was driven in procession through the streets of the city, escorted by some twenty Thomas cars. A stop was made at the City Hall, where the crew called on Acting Mayor McGowan.

The Milwaukee Trust Company, trustee for the bankrupt estate of the Milwaukee Rubber Company, has filed its final report. A final meeting of the creditors of the concern will be held at the Bankruptcy Court Room, 434 Post Office Building, Milwaukee, Wis., on August 22 at 10 a. m. for the purpose of passing upon the final account and payment of a final dividend upon all allowed claims.

The Maxwell-Briscoe Motor Company expect to place a low price runabout on the market in the near future. Particulars will be announced early in October.

J. Montgomery Sears, a noted man of wealth of Boston, was killed in an automobile accident at Providence, R. I., on August 12. He was driving a high powered touring car on the Appoenaugh Road at about 60 miles an hour, when a tire burst, and the car overturned. The car at once caught fire and was destroyed.

B. A. Gramm, of the bankrupt Logan Construction Company, Chillicothe, Ohio, informs us that in conjunction with Fred Bisantz, formerly superintendent of the Logan Company, he has formed the Gramm-Logan Motor Car Company, which will locate in a city in northern Ohio already decided upon.

According to some statements made at the convention of the New York State Retail Grocers' Association, in Jamestown, N. Y., thefts of grocers' horses in New York city have become so frequent recently that the insurance companies have raised their rates. It was said that on an average five to six grocery horses were stolen in New York every week.

The Government is reported to have refused to build 1 mile of model highway near Richmond, Ind., as requested at the Good Roads Congress held in that city on August 8. However, the Department of Agriculture has offered to send road experts to supervise the work, provided the county or others interested will pay for the material and labor. The offer will likely be accepted.

The Peerless Specialty Company, of New York, has been incorporated to manufacture the Peerless speedometer, an instrument fitted with a mileage and maximum hand and a season and trip odometer. The company will also maintain a repair department for all makes of speedometers. The officers are W. K. Thomas, president; E. C. Angell, vice president, and J. S. Ridley, secretary and treasurer.

Plans for additional offices have been accepted by the H. H. Franklin Manufacturing Company, and the work has already been started. The entire first and part of the second floor of the company's new building, at Geddes and West Marcellus streets, Syracuse, N. Y., will be occupied, in addition to the present offices, giving a total office floor space of 16,000 square feet. The new offices will be occupied about November 1.

The H. H. Franklin Manufacturing Company have been successful in litigation in Belgium concerning the word "Franklin" as a trademark. The application of the Franklin Company for the registration of the word "Franklin" was contested by the firm of Vander Wielen & Schwiebbe. It was decided that the Franklin Company should have the right to the word "Franklin" as a trademark for automobiles, and Vander Wielen & Schwiebbe retain the right to the word as a trademark for bicycles, bicycle parts, etc.

Coleman & Bentel have taken the San Francisco agency for Michelin tires.

The Mitchell Motor Car Company, Racine, Wis., will hold a convention of its 100 salesmen on August 27, 28 and 29.

The Indianapolis Automobile Trade Association, Indianapolis, Ind., will hold a two days' reliability run during the last week in September.

Carl Thornot, 332 Seventh avenue, New York city, is organizing a company to manufacture automobile specialties, with a capital stock of $100,000.

Officials of the defunct Earl Motor Car Company, Kenosha, Wis., have decided to offer a settlement to its creditors on the basis of 15 cents on the dollar.

We are informed that Arthur L. Banker, owner of the patents on the Banker wind shields, has entered suit against the Automobile Specialty Company, of Pittsburg, Pa., for infringing patents on his wind shields.

The Auto Vehicle Company, of Los Angeles, Cal., are conducting a ten days' tour from Los Angeles to San Francisco and back for owners of their make of cars. The party started from Los Angeles on August 12.

The Fisk Rubber Company branch at San Francisco will soon occupy a permanent building at 408 Golden Gate avenue, the building being 33x137 feet, with a wing 57x70 feet. A well equipped repair shop will be installed.

E. K. Taylor, Mayor of Alameda, Cal., has presented a runabout which he formerly used himself to the police department of that city. One of the officers of the Alameda police force, who is an expert machinist, will have charge of the car.

The Northern Motor Car Company, of Detroit, announce that notwithstanding the recent reports of consolidation they will continue to manufacture their regular models, a 24 horse power, two cylinder model, and a high powered four cylinder car.

The automobile dealers of San Francisco have decided not to exhibit at the carnival to be held at Idora Park, a large amusement resort of Oakland, in a month or two. They hold that people go to these carnivals for pleasure, and not for business purposes.

An illustrated lecture on the Siberian portion of the New York-Paris race will be given by Orrel A. Parker at the clubhouse of the A. C. A. on Thursday, August 20. Two of the crew of the Thomas car will also give some of their personal experience on this occasion.

The Long Island Railroad Company have given to the newspapers a list of thirteen automobiles which crossed the Merrick Road crossing of the railroad in Springfield on Thursday and Friday of last week at over 30 miles per hour, which is not only illegal but extremely dangerous.

The motion for a new trial for W. D. Tilton, president, and Chauncey L. Graham, secretary, of the Steel Ball Company, of Chicago, was overruled by Judge A. H. Chetlain on August 14. A motion for arrest of judgment was entered, and arguments were continued to September 19.

Garage Notes.

E. S. Doty has opened the Ellis Garage in Kewanee, Ill.

The Autocar Co., of Ardmore, Pa., will soon establish a local branch in Philadelphia.

The Manitowoc (Wis.) County Fair Association will erect a garage at the fair grounds.

George Reif and S. F. Webb have opened a garage at 10 West Sixth street, Chattanooga, Tenn.

H. C. Shultz, of Lansing, Mich., has opened a garage in the old Wultz blacksmith shop, Marshalltown, Ia.

Floyd Rollins and F. W. Jones have formed a partnership to engage in the garage business in Lincoln, Neb.

Gould Dietz plans to build a garage on the north side of Harney street at Twenty-third street, Omaha, Neb.

Alice M. Paul, 57 Dover street, Lowell, Mass., has obtained a permit to build an auto house at an estimated cost of $800.

Arthur W. Horine has disposed of his interests in the Colonial Motor Car Co., Springfield, Mo., to Holland Keets and L. Wight.

L. J. Kinnel has opened a garage and repair shop at 208 Jefferson street, Joliet, Ill. He has the local agency for the Mitchell car.

Another automobile garage is to be opened in Wilson, N. C., on Goldsboro street, this month. There are said to be thirty automobiles in the town.

E. H. Meinders, Piqua, Ohio, will erect a cement block garage on Water street, to be ready for occupancy September 1. The building will be one story high, 38x110 feet.

Capt. Jack Peterson and John Maurer have purchased a lot in Salem, Ore., corner Commercial and Centre streets, on which they plan to build a two story brick garage.

A taxicab garage is being erected at 1339-1347 Wood street, Philadelphia, for Louis J. Bergdoll. The plans call for a three story brick concrete and steel structure, 78x71 feet, to cost $30,000.

The General Motor Car Co., of Philadelphia, will move on September 3 from their present location to 227 and 229 North Broad street. The company will handle the Lozier car for the coming year.

The Chalmers-Detroit Co. of Philadelphia will open headquarters at the southwest corner of Broad and Vine streets in a new building now nearing completion. H. S. Lane will be in charge of the office.

The garage of the Automobile Import Co., Montreal, Canada, was destroyed by fire on August 11. The blaze was started by a machinist with a soldering outfit accidentally igniting a pool of gasoline and oil on the floor.

A fire which started in a restaurant at 515 Golden Gate avenue, San Francisco, on August 9, burned out two automobile concerns, viz., the Standard Motor Car Co., whose damage is estimated at $20,000, and the Merry Bicycle and Motor Co., who were damaged $10,000.

The Willis-Haywood-Holcomb Company has been organized in Indianapolis, and after September 1 will represent the Packard in Indiana. The company has taken possession of the three story garage building at 330 North Illinois street, just vacated by the Fisher Automobile Co., and extensive alterations are being made. Members of the company are Frank B. Willis and Miner E. Haywood, formerly with the Fisher Company, and Raymond A. and J. Irving Holcomb. A full line of accessories will be carried, and the company will also conduct a large repair shop.

The Schuler-Morris-Jones Motor Car and Electric Co. has been formed at Pontiac, Mich., to conduct a garage and later to build low priced four cylinder touring cars. The organizers are Albert Schuler, formerly sales manager of the Streator Motor Car Co., Streator, Ill.; Edward Morris, who has been conducting a machine and blacksmith shop in Pontiac, and Berthro M. Jones, a local garage man.

The garage of C. A. Coey & Co., 1710-1718 Indiana avenue, Chicago, was destroyed by fire on August 12. A gasoline explosion is thought to have caused the fire. Fifty-eight automobiles, including some taxicabs, were ruined by the flames, and the damage is estimated at between $400,000 and $500,000. The work of the firemen was hindered by frequent explosions of gasoline, probably in the vehicle tanks.

New Incorporations.

Auto Carriage Co., Independence, Kan.—Capital, $15,000.

Grabowsky Power Wagon Co., Detroit, Mich.—Capital, $300,000.

Clinton Auto and Garage Co., West Hoboken, N. J.—Capital, $2,500. Incorporators, F. Vollner, Jr.; Ida C. Simerson and John Singer, Jr.

Enterprise Automobile Co., Hasbrouck Heights, N. J.—Capital, $100,000. Incorporators, J. F. Coleman, J. L. Lotsch and E. S. H. B. Schultz.

Ideal Auto Manufacturing Co., Jacksonville, Fla.—Incorporators, Hugh Partridge, T. A. Stewart and C. E. Clark. To carry on a general automobile business.

Empire Manufacturing Co., Akron, Ohio.—Capital, $10,000. Incorporators, C. W. Wickline, M. G. Snyder, William J. Yeager, Forest Firestone and Fred J. Gostlin.

Wisconsin Automobile Exchange, Milwaukee, Wis.—Capital, $10,000. The officers are: President, L. Deetjen; vice president, A. F. Eckstein; T. Deetjen, secretary and treasurer.

Lowell-American Automobile Co., Lowell, Mass.—Capital, $100,000. Directors, John F. Spaulding, president; Moses M. Labue, treasurer, and Jesse G. Hanson. To deal in automobiles.

Bristol Engineering Corporation, Bristol, Conn.—Capital, $500,000. Incorporators, Albert F. Rockwell, DeWitt Page and Charles T. Treadway. To manufacture taxicabs and automobiles.

Moon Motor Car Co., New York.—Capital, $5,000. Directors, Charles A. Duerr, 325 West Ninety-third street; Edward W. Elverson, 2186 Broadway; Harry Eckhard, 111 Broadway, N. Y.

Saratoga Auto Top and Body Company, New York.—Capital, $15,000. Incorporators, Adolph J. Shary and Anna D. Shary, 336 West Seventieth street; Henry A. Blumenthal, 135 Broadway, New York.

Crescent Auto Company, New York.—Capital, $1,000. Incorporators, James C. Stoopes, 207 West Twenty-second street; William V. Stoopes and Triphena E. Stoopes, 345 West Thirty-fifth street, New York.

Standard Automobile Supply Co., Chicago, Ill.—Capital, $10,000. Incorporators, W. F. McCarthy, George B. Levy, A. S. Henley. To manufacture and deal in automobiles, also general merchandise business.

Ogden Canyon Auto Co., Salt Lake City, Utah.—Capital, $25,000. The officers are: President, J. S. Corlew; vice president, Albert Scowcroft; secretary and treasurer, Joe Decker; directors, M. S. Browning and D. A. Smith.

Trade Personals.

H. Oscar Brown, formerly Philadelphia representative for the American Locomotive Motor Car Co., has joined the sales force of the Bergdoll Motor Car Co., of Philadelphia.

Chas. T. Huntington, until about a year ago in charge of the Electric Vehicle Company's advertising department, died at Hartford, Conn., on August 8. He had been in ill health for some years.

The Horseless Age

First Automobile Journal in the English Language

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Frame Side Members.

By Asher Golden.

The subject of frame design has apparently not received the attention which it deserves. This is evident from the great variety of forms which may be seen in current automobile practice. One fact, however, seems to stand out prominently, and that is that on the chasses of the more prominent European makers the frames are made of sufficiently great section, so that breakages are less frequent than on less prominent or lower priced cars. From this the inference is drawn that it is better and cheaper in the end to make the frames somewhat heavier and consequently stronger. Take, for example, the frames of the Panhard, Renault, Mercedes, Fiat and Isotta-Fraschini. These are unquestionably among the best European cars. We find the Panhard with a web about 6½ inches deep; the thickness of the stock of the Renault is one-quarter of an inch; the Mercedes has a flange about 2½ inches wide, web 4.33 (110 mm.) deep, and thickness of stock of seven-thirty-seconds of an inch; the Fiat and Isotta have very wide flanges; the flange of the Fiat is about 5½ inches wide. There is no question whatever that these frames stand up in practice; the accompanying photograph shows one of these frames after a very serious accident; the frame came through the fray without any damage.

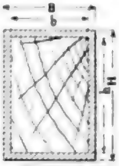

Fig. 1.

CLASSIFICATION.

For convenience of treatment frame side members may be divided into five general classes, as follows:

1. Straight channel of uniform section throughout.
2. Straight channel of varying section throughout.
3. Channel of uniform or varying section, but bent at two or more points. In this class are included frame members bent inward near the front to give a sufficient steering lock.
4. Tubular frames, plain or armored, of circular or rectangular section.
5. Wooden frames, rectangular section.

One important advantage of the straight channel frame of uniform section is its low cost of manufacture. Its application up to the present time has been to the motor truck and the omnibus. Its strength, which is the same at all points, is measured by $Z = I/y$, where I is the moment of inertia of the section about the neutral axis and y is the distance from the neutral axis to the outermost skin of the material.

Classes 2 and 3 are of most interest, since nearly all frames fall under these heads. Before taking up the discussion of these, however, it will be of interest to determine the strengths of the frames under Classes 4 and 5, for purposes of comparison. The rectangular tubular armored wood frame is used by the firm of Charron, Girardot & Voigt, of France, and the rectangular all wood frame by the H. H. Franklin Manufacturing Company, of this country.

ARMORED WOOD FRAMES.

In order to determine the strength of the steel armored wood frame two moments of inertia and two fibre stresses must be taken into consideration. The moments of inertia are those of the hollow rectangular section of the casing and the solid rectangular section of the core. The two fibre stresses are those of the material of the casing and the material of the core. The moment of inertia of the section of the casing is (see Fig. 1) $(BH^3 - bh^3)/12$ and that of the section of the core is $bh^3/12$.

The strength of the casing is given by

$$Z_1 = (B\,H^3 - b\,h^3)/6\,H = M/f_1$$

and the strength of the core by

$$Z_2 = b\,h^3/6 = M/f_2,$$

where M is the maximum bending moment of the frame and f_1 and f_2 are the maximum fibre stresses in the casing and the core, respectively. Evidently the total strength of the frame is the combined strengths of both sections, that is, $Z = Z_1 + Z_2 = M(f_1 + f_2)/f_1f_2$.

WOOD FRAMES.

In regard to the design of frames made entirely of wood, the discussion between the editor of The Horseless Age and the engineer of the H. H. Franklin Manufacturing Company, which began in the issue of December 4, 1907, will prove very interesting. In this connection the stress strain curves shown in Fig. 2 are of interest. These were plotted from experiments conducted in the laboratory of the Franklin Company, and show beyond question that a side member of ash, as used by the Franklin Company, is stronger and has a greater elastic limit per unit weight than a side member of steel.

With frames of varying section, the cost of manufacture increases with the extent of variation of section and bending. The bending moments in the case of the straight frame and the bent frame are easily found, being due solely to the extent and distribution of the loads. In the case of the frame of varying section the strength is different at all points and is a maximum where y is greatest, everything else being equal.

Although the frames under Classes 2 and 3 satisfy the same general conditions as to form of section, those under Class 3 are admittedly weaker owing to the physical change which takes place in the material at the bend during the process of bending. Therefore, wherever possible, the straight frame should be given preference over the offset frame, even if it be found necessary to make the straight one narrower than the offset frame in order to get the required steering lock. Where there is a determination to adhere to the offset frame it is necessary, in order to have a high enough factor of safety, to broaden the flanges at the points of offset. This is done on a large

Wrecked Car with Unbroken Frame.

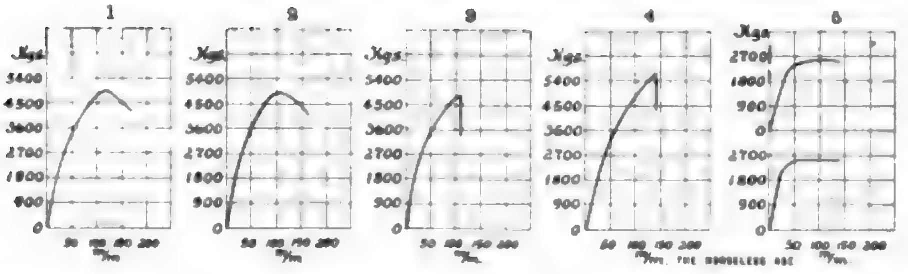

FIG. 2.—COMPARATIVE TESTS OF THE RESISTANCE AND FLEXURE OF FRAME SIDE MEMBERS.

1. Side member of chrome nickel steel, 3.5 mm. thick.
2. Side member of chrome nickel steel, 4 mm. thick.
3. Side member of ash.
4. Side member of ash.
5. Side member of ordinary Martin steel.

(From *La Technique Automobile*, April, 1907.)

number of frames. Noteworthy examples are the frames of the Fiat, Minerva and Isotta-Fraschini (see Fig. 3).

VARIABLE SECTION FRAMES.

The calculation of the strength at every point of a frame, the section of which varies from point to point, is not difficult, although of sufficient length to make the use of a table of logarithms a great convenience. The section may vary in three ways: (1) The web may be of constant depth while the flanges vary in width; (2) the flanges may be of constant width while the depth of web varies from point to point; (3) the width of the flanges and the depth of the web may vary together. In order to show graphically the comparative strengths of a frame at all points of its length we can plot a curve of moments of resistance, taking distances along the frame as abscissas and moments of resistance as ordinates. To lay out a curve for a frame, the section of which varies from point to point, it is necessary to take a number of points sufficiently close together, so that all variations may be readily shown. The peaked curve of Fig. 4 was laid out in this way. Dimensions of the channel were taken at every inch of the frame length, and the ordinates were found by substituting in the equation

$$Z = \frac{B\,H^3 - b\,h^3}{6\,H}.$$

The frame for which the curve was plotted is shown in Fig. 5. In Fig. 4 the curve A B D E shows the strength of a frame the same as the above, except that the flanges are of constant width throughout the length of the frame. Between the points A and B the frame is of uniform section, so that the strength is constant between these points, and is represented by the straight horizontal line B D. It will be observed that at the point C, distant 70 inches from the front end, the strength of the frame illustrated is twice as great as at the corresponding point of the other. For an increase in weight of about 5 per cent. the strength is increased about 100 per cent. The cost of manufacture is slightly greater, but the extra cost pays many times over for the advantage gained.

It must be borne in mind that bending moments, which are functions of the loads and their distribution, and moments of resistance, which depend only on the form of the section and the position of the axis about which the moments of inertia are taken, are independent of the natural strength of the material. The curves show, therefore, the strength of the two frames, assuming that the material of both is the same.

In laying out a frame it is important to bear in mind that the lower flange is always in tension, and the upper flange in compression. Since materials of which automobile frames are usually constructed are about one to one and a half times as strong in compression as in tension, it seems reasonable to make the lower flange wider than the upper, owing to the fact that these frames always fail in tension. For the purpose of determining the moment of resistance of this section, Fig. 6, we observe that the neutral axis does not pass through the middle of the section, so that we have two moments of resistance: one due to the portion of the section below the neutral axis, and the other due to the portion above the neutral axis. The neutral axis is nearer the wider flange, and its distances from the outermost tension and compression skins will be respectively:

$$T = \frac{H^2 + t\,c + b\,(2H - t)}{2\,(B + C + h)}$$

$$K = H - T$$

Now, calling I_1 and I_2 the moments of inertia of the upper and lower sections, respectively, and Z_1 and Z_2 the corresponding moments of resistance, we have:

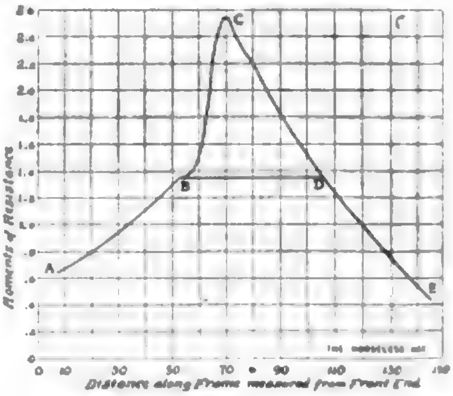

FIG. 4.

$$I_1 = \frac{B\,K^3 - b\,(K - t)^3}{3}$$

$$I_2 = \frac{C\,T^3 - c\,(T - t)^3}{3}$$

$$Z_1 = \frac{I_1}{K} = \frac{B\,K^3 - b\,(K - t)^3}{3\,K}$$

$$Z_2 = \frac{I_2}{T} = \frac{C\,T^3 - c\,(T - t)^3}{3\,T}$$

The moment of inertia of the entire section is $I = I_1 + I_2$. This relation is general, as we may see by applying it to the particular case in which both flanges are of equal width. Here $K = T$ and $B = C$; if these be substituted in the equation $I = I_1 + I_2$, bearing in mind that $K = T = H/2$ and $t = (H - h)/2$, we have the familiar expression for the moment of inertia of a channel section having equal flanges, $I = (B\,H^3 - b\,h^3)/12$. The moment of resistance of the entire section, which must be found in order to determine the total strength of

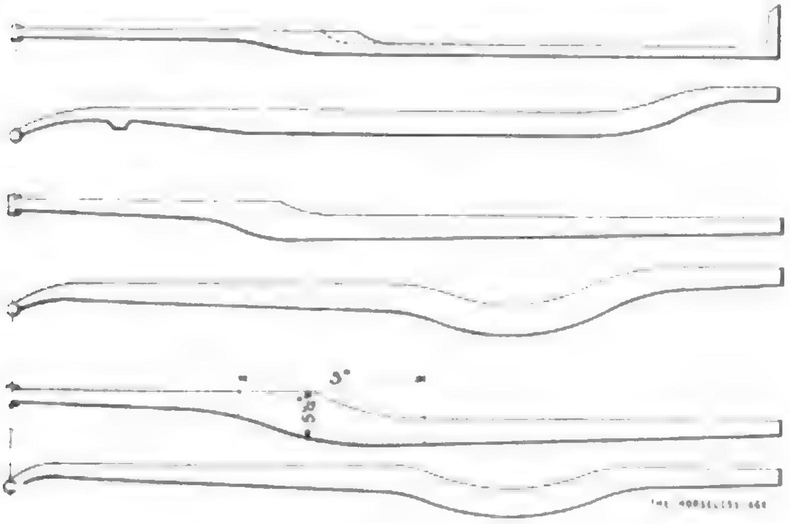

FIG. 3.

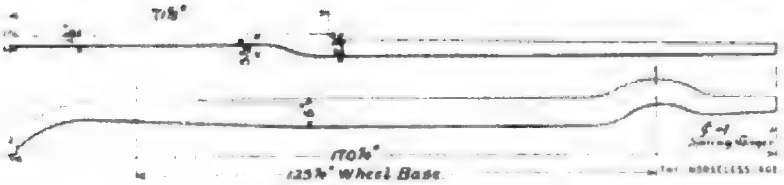

Fig. 5.

the section, may be obtained by massing up the section and laying out the modulus figure. In the following table all the values of Z except the first were obtained in this way. The table shows the comparative strengths of five channel sections in every one of which the upper flange is the same, but the lower varies in width up to twice that of the upper:

	B.	b.	C.	c.	H.	h.	K.	T.	t.	Z.
1	2	1.8125	2.0	1.8125	5	4.625	2.5	2.5	.1875	2.356
2	2	1.8125	2.5	2.3125	5	4.625	2.632	2.368	.1875	2.7145
3	2	1.8125	3.0	2.8125	5	4.625	2.762	2.238	.1875	2.775
4	2	1.8125	3.5	3.3125	5	4.625	2.857	2.143	.1875	2.8184
5	2	1.8125	4.0	3.8125	5	4.625	2.953	2.047	.1875	2.8633

Two frames with widened lower flanges are shown in Fig. 7. The upper frame is supplied as a stock article by a well known American manufacturer, and is intended for vehicles weighing up to 4,200 pounds.

The abilities of the above channels to resist tension and compression are as follows:

Tension.	Compression.
1.170	1.170
1.208	1.265
1.307	1.353
1.506	1.410
1.596	1.487

It will be found that for equal strength the channel with unequal flanges is heavier than the one with equal flanges. Take, for example, the last channel in the above table. The flanges are 2 inches and 4 inches, and the channel has the same weight per unit length as a channel with equal flanges 3 inches in width. The moment of resistance of the first is 2.8633, and that of the second is 3.225.

It is of little advantage to widen the flanges at points where the fibre stress is low. The point of maximum bending moment, and the point of maximum deflection fall, as a rule, about the middle of the frame, though these two points do not coincide. It is therefore advisable to increase the strength of the frame at the bend, which is very near the middle. It is evident from some remarks made above that a straight frame will not require as wide flanges as the bent frame.

Another method of strengthening the frame at the bend is to place a truss under this part of the frame with the post between the two bends. This, however, bears the earmarks of a makeshift, and gives one the impression that the frame was improperly designed in the first place. A truss at the bend is employed on the frame of a certain taximeter cab operating in New York city.

BENDING MOMENTS

For the purpose of finding the bending moments at all points of a frame side member it may be considered as a non-uniformly loaded beam supported at its extremities. The bending moment in pounds-inches at any point of the frame is found by plotting a bending moment diagram, of which a typical example is given below. The bending moment at any point is given by

$$M = m\,n\,d\,D,$$

where m is the load scale in pounds per inch.

n is the length scale in inches per inch of frame length.

d is the depth of the bending moment diagram in inches at the point considered.

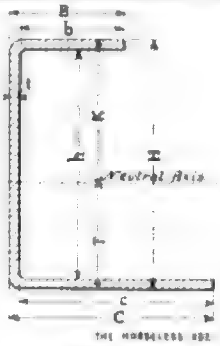

Fig. 6.

D is the polar distance of the vector polygon in inches.

This formula holds for a beam supported at two points with or without overhanging ends, and is applicable where a full or three-quarter elliptic spring is used, since in this case the suspension is from two points. Where a semi-elliptic spring is used the determination of the bending moments should take account of the points of suspension, namely, the spring brackets. Here the beam is strictly divided into three parts: the first between the front spring hanger and the front suspension bracket; the second between the front and the rear suspension brackets, and the third between the rear suspension bracket and the rear hanger; this is a continuous beam. However, since the points of support are the middle points of the springs no serious error is introduced by considering the frame side members as being supported at points passing through the centres of the axles without overhanging ends, owing to the fact that the ends are stiffened for strength. Breaking of the frame occurs between the inner suspension brackets or shackles, and usually at the bend. It does occur at other points, but these instances are rare.

The bending moments for a typical case are given in the following table. The values were found from the diagram of Fig. 8. The distance between axle centres (wheel base) is 98 inches:

Name of Part.	Distance from Front Axle Centre in Inches.	Distance from Rear Axle Centre in Inches.	Weight in Pounds.	Bending Moments Pounds-Inches.
Radiator, filled	2.5	95.5	35	1,344
Engine and engine reaction	24.	74.	370	10,752
Flywheel, clutch and steering gear	43.	55.	60	11,088
Gear case	57.5	40.5	60	10,584
Service brake and torque rod reaction	67.	31.	125	9,660
Side levers and bracket	71.	17.	10	8,652
Body and passengers	85.	13.	200	5,376

The weights given above are those carried by one side member; the full weight of the side levers and their bracket is taken, since their entire weight is carried by the right side member, for which the diagram was plotted. The weight of the radiator need not be taken into consideration unless it be situated back of the axle. In taking the bending moment due to the weight of the body and passengers care should be taken to consider the unbalanced weight, since a large part of the body and one or two passengers may be situated back of the rear axle. In other words, a large part of the body may be taken so that its centre of gravity is vertically above the rear axle centre, in which case the moment due to this part is zero. The loads imposed by the torque rod reaction (in a shaft driven car) and the engine reaction are of importance; the latter reaction may be con-

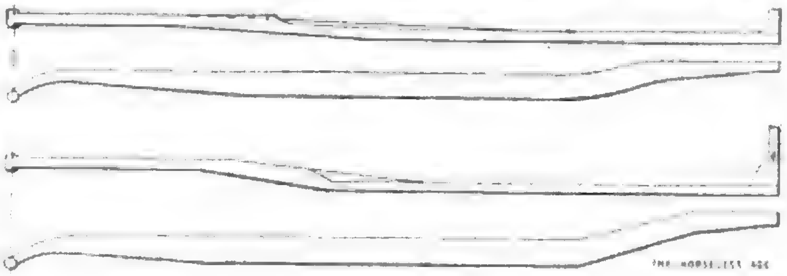

Fig. 7.

siderable, particularly where the speed of the engine can be quickly accelerated, and may be then regarded as a shock load, so that a much higher factor of safety would be required than for the condition in which the motor is running steadily at maximum speed. If it were necessary to be rigorous in treating of the bending moments, the twist of the frame when one wheel of the car passes over an obstacle would have to be taken into account. It would then be required to find an equivalent bending moment and to apply the proper factor of safety. The determination of the twist is a difficult matter, and of no value to the practical engineer. The factor of safety chosen should be high enough to cover all indeterminate stresses.

The dimensions and characteristics of the frame for which the bending moments and diagram are given are as follows:

Width of flange, both equal	1.25 inches.
Greatest depth of web	4.00 inches.
Thickness of stock	.125 inch.
Material, A-7-J Krupp, not treated.	
Elastic limit (specified by makers)	44,237 pounds per square inch.
Moment of inertia	1.722
Section modulus	.861
Maximum bending moment	11,088 pounds-inches.
Maximum fibre stress	12,880 pounds per square inch.
Flexibility	.0003125 inch per pound.
Factor of safety (at elastic limit)	3.435
Centre of gravity of concentrated load, distance from front axle	46.5 inches.
Point of maximum deflection, distance from front axle	53.00 inches.
Maximum shearing load (at front axle)	445 pounds.

For an automobile frame the factor of safety should be twice that for a purely static load and should be at least between 6 and 8. The frame discussed above has a factor of safety of 3.435, a value far too low for an automobile frame. These frames were invariably found to fail after short service, and the remedy of a truss had to be applied to correct the defect. In order to insure the proper factor of safety, say 8, it would be necessary to increase any or all of the dimensions to the extent shown below. Any two of these being given, the third can be found by substituting in the equation

$$(B H^3 - b h^3)\ 6 H = \frac{8 \times 11088}{44237}$$

In this way the following dimensions were found, and are given to show how much too small the frame was designed. B is the width of the flange, H is the depth of the web, and t is the thickness of the stock:

B and H same as in table, $t =$ [illegible] inch.

B and t same as in table, H = 6 inches (about).

H and t same as in table, B = 3.677 inches.

FORMULA FOR STRENGTH.

We may safely say that the selection of a frame that will stand up under all conditions of service is a comparatively simple matter. It is not so simple, however, to select one that will meet this requirement and yet be as light as is consistent with safety. The question of weight in a frame is of some importance, since frames usually weigh anywhere between 115 and 225 pounds. The following formula enables the engineer or designer to select a frame which will meet the requirements stated above as to lightness and proper strength:

$$Z = 39\ W/E.\ L.$$

where Z is the section modulus of the greatest section of the required frame; W is the loaded weight of the car, including the full passenger capacity; E. L. is the elastic limit of the material selected.

Values of Z are given in the following table; opposite these are given the dimensions of the required frame; the dimensions are those of standard automobile frames. As an example, let it be required to find the dimensions at the greatest section of a frame to satisfy the following conditions:

Let W = 3,000 pounds.

E. L. = 50,000 pounds per square inch; then

$$Z = \frac{39 \times 3000}{50000} = 2.33.$$

Under Z in the table we look for the nearest number and find it to be 2.35. Opposite 2.35 we find the following dimensions:

Width of flange	2 inches.	2 inches.
Thickness of stock	.218 inch.	.187 inch.
Depth of web	4.5 inches.	5 inches.

Knowing the dimensions of the section and the specific gravity of the material, it is a simple matter to select the lightest frame which will have the required strength.

In the following table all dimensions are in inches; in many instances several dimensions are given, since these satisfy the same conditions as to strength:

Z.	Depth of Web.	Thickness of Stock.	Width of Flange.	Weight in Pounds Per Inch.
.90	3.5	.125	1.75	.236
	3.3125	.156	1.5	.265
	4.125	.125	1.25	.226
.95	3.00	.187	1.5	.297
	3.3125	.165	1.5	.279
	3.3125	.187	1.25	.314
1.00	3.5	.156	1.5	.273
	4.125	.125	1.5	.243
	4.5	.125	1.25	.239
1.05	3.5	.165	1.5	.288
	4.33	.125	1.5	2.44
	4.5	.125	1.25	.239
1.10	3.5	.156	1.75	.296
	4.125	.156	1.25	.279
	4.25	.125	1.5	....
1.15	4.125	.165	1.25	.294
	4.33	.125	1.75	.262
	3.5	.187	1.5	.324
	4.5	.125	1.5	.257

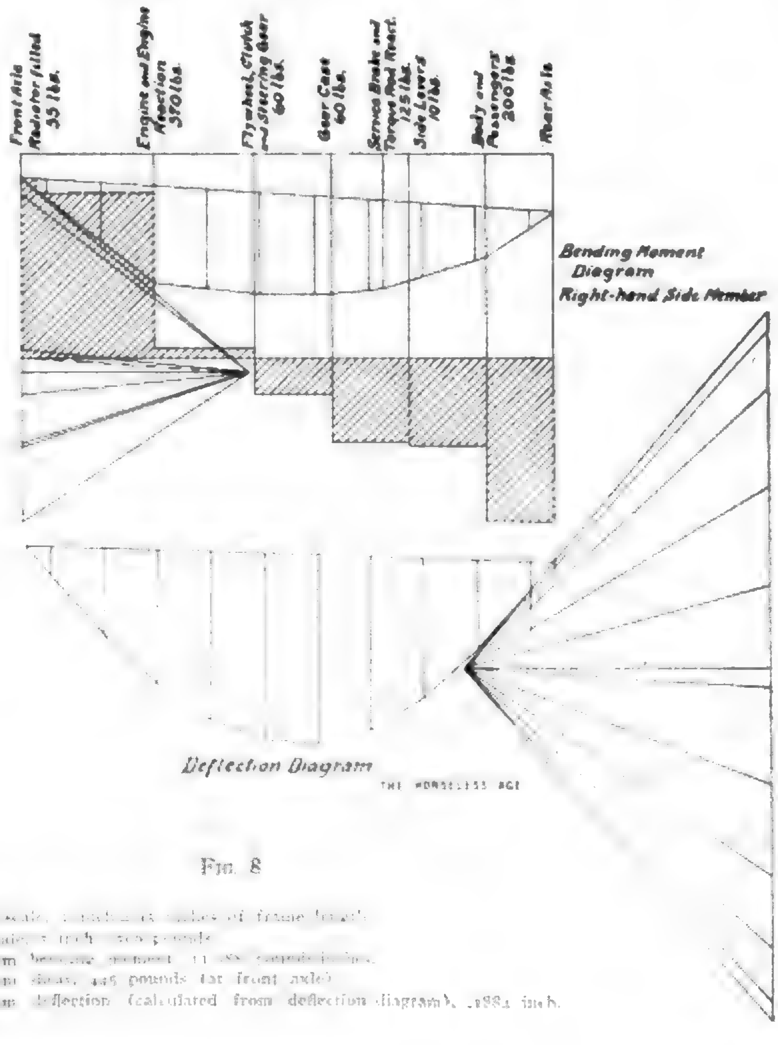
Front Axle Radiator filled 35 lbs.
Engine and Engine Reaction 370 lbs.
Flywheel, Clutch and Steering Gear 60 lbs.
Gear Case 60 lbs.
Service Brake and Torque Rod React. 125 lbs.
Side Levers 10 lbs.
Body and Passengers 200 lbs.
Rear Axle
Bending Moment Diagram Right-hand Side Member
Deflection Diagram
THE HORSELESS AGE

FIG. 8

Length scale, [illegible] inches of frame length.
Load scale, 1 inch = [illegible] pounds.
Maximum bending moment, 11,088 pounds-inches.
Maximum shear, 445 pounds (at front axle).
Maximum deflection (calculated from deflection diagram), .1882 inch.

Z.	Depth of Web.	Thickness of Stock.	Width of Flange.	Weight in Pounds Per Inch.
1.20	4.33	.165	1.25	.298
	4.	.156	1.5	....
	4.5	.125	1.8125	....
1.25	4.125	.156	1.5	.301
	4.5	.156	1.25	.296
	4.125	.125	2.	.279
1.30	3.5	.187	1.75	.350
	4.125	.165	1.5	.317
	4.5	.165	1.25	.311
	4.5	.125	1.75	.275
1.35	4.33	.187	1.25	.339
	4.33	.165	1.50	.322
	5.	.125	1.50	.275
1.40	4.5	.125	2.	.292
	4.125	.156	1.75	.323
1.45	4.125	.218	1.25	.382
	4.125	.187	1.50	.357
	4.125	.165	1.75	.341
	3.5	.218	1.75	.405
1.50	4.33	.165	1.75	.346
	4.5	.165	1.50	.335
	5.	.125	1.75	.292
1.55	4.125	.156	2.	.345
	4.33	.218	1.25	.394
	4.5	.156	1.75	.340
	5.5	.125	1.50	.292
1.60	4.33	.165	2.	.364
	5.	.156	1.50	.340
1.65	4.125	.218	1.50	.413
	4.33	.165	2.	.369
	4.5	.218	1.25	.408
	4.5	.187	1.50	.377
	4.5	.165	1.75	.358
1.70	4.5	.156	2.	.362
	5.5	.125	1.75	.310
1.75	4.33	.187	1.75	.399
	5.	.165	1.50	.358
1.80	4.125	.187	2.	.411
	4.33	.218	1.50	.425
	5.	.125	2.25	....
1.85	4.125	.218	1.75	.443
	4.5	.187	1.75	.403
	4.5	.165	2.	.381
	4.5	.218	1.50	.437
1.90	5.	.187	1.50	.404
	5.	.165	1.75	.382
	5.5	.156	1.50	.362
	5.5	.125	2.	.327
1.95	4.33	.187	2.	.418
	5.	.156	2.	.384
	5.5	.165	1.50	.381
	5.	.125	2.50	....
2.00	4.33	.218	1.75	.456
	5.	.125	2.625	....
2.05	4.125	.218	2.	.475
	4.5	.187	2.	.430
	5.5	.156	1.75	.384
2.10	4.5	.218	1.75	.467
	5.	.125	2.75	....
2.15	5.	.165	2.	.405
	5.	.125	2.875	....
2.20	4.33	.218	2.	.487
	5.	.218	1.50	.467
	5.5	.187	1.50	.430
	5.5	.165	1.75	.404
2.25	5.5	.156	2.	.406
2.30	4.33	.218	2.125	....
2.35	4.50	.218	2.	.50
	5.	.187	2.	.457
	4.33	.218	2.25	....
2.40	5.5	.165	2.	.428
2.45	5.5	.187	1.75	.457
	5.	.218	1.75	.50
2.50	5.5	.218	1.50	.50

Experience has shown that when the constant 39 in the equation for the section modulus is reduced a lighter frame may be obtained, but by so doing frame breakage is most certain to occur. In a particular case which came under the observation of the writer, where the constant was 16.6, the frames invariably broke after short service. The constant 39 is an empirical one and was derived by taking into consideration the section moduli, elastic limits, and factors of safety of the frames of several American and foreign cars which have been found to stand up well in service. The formula given applies to touring cars and runabouts; for commercial trucks the constant may be as high as 45. For these vehicles the factor of safety is taken somewhat higher, as weight is not so great a consideration, and durability is of prime importance. From a number of observations during the past two years the writer has been convinced that the tendency is to increase the strength of frames either by employing better material or by increasing the dimensions of the frame section. In many instances, where the price of new dies or the cost of better material has been found to be prohibitive, designers have resorted to the truss to get a required increase in strength. This applies particularly to European cars.

Brazing Cast Iron and Other Metals.

By Frank N. Blake.

Brazing is an art which is often very useful in automobile work, perhaps more to the repair man and experimenter than to either the manufacturer or the ordinary owner. Manufacturers, at least in some instances, take pride in avoiding the necessity for brazing, and advertise their vehicles to have no brazed parts, evidently preferring to employ integral work to anything which is built up, and no doubt this is best. In a factory which is fitted with the necessary appliances, entire "parts" can be more cheaply produced, and will be better when made, than parts composed of smaller pieces united by brazing. Probably the average automobile owner is not enough of a mechanic to aspire to performing even so simple an operation as doing a small job of plain brazing, yet there are many men in the automobile ranks whose abilities, inclinations and opportunities lead them to do such work; some have been attracted to motoring perhaps as much by the mechanical features the vehicles involve as by any other considerations, and they take pleasure and save expense by making repairs, replacements and improvements in their cars, and often enjoy planning and executing sundry alterations and additions, and to these the process of brazing is naturally an interesting one.

The repair man naturally is most interested in the subject, for he finds frequent use for a good way of uniting metal parts in an easy and reliable manner. The successful brazing of cast iron has become an accomplished fact, and the process is now within the reach of anyone who may wish to practice it, without the payment of royalty fees, shop rights or fancy prices for a few common chemicals of unknown identity. It is not intended to influence either the sale or the use of the excellent preparations which are sold for this purpose; it may be best for both the amateur and the professional to use some of these in preference to following a published formula, still for the man who likes to begin as near nature as possible there is a charm —if nothing more—in knowing what are the materials which he is using, and in making the compound as well as in using it more understandingly after it is made.

PRINCIPLES OF BRAZING.

Brazing consists in uniting metal parts by flowing melted brass, technically termed "spelter," between them. It is practically identical with soldering, except that spelter is substituted for solder, and that much greater heat is necessary than is needed for melting the alloy of lead and tin composing ordinary tinner's solder. In the greater degree of heat required to melt spelter lies one of the advantages which brazed work possesses over that which is soldered, the finished work enduring more heat without breaking or weakening, but the chief advantage lies in its superior strength at all temperatures, reliability and applicability to a large variety of uses. Cast iron is a common material which is prone to break, and which can now be brazed; if there is a good way to solder cast iron it is not commonly known, and the possessor of the method would confer a general favor by making it public.

Cast iron is not so commonly met with in automobile construction as it was formerly, though it is still used to some extent, and the vehicle into which its use entered much more largely than would now be the case is by no means an extinct species, as the repair man is occasionally reminded, and as it is naturally the older machines which are most liable to need repairs, and also for which it is sometimes impossible to obtain parts, the utility of reliable brazing is apparent. The water jackets of automobile engine cylinders are not infrequently broken by freezing, and it is often preferable to repair this, the most costly part of the car, by brazing, rather than to replace it by a new cylinder.

THE FIRE.

The production of the necessary heat is an important part of the process of brazing, and constitutes the chief difficulty and almost the only source of expense. For small work a plumber's hand gasoline torch can be used in what may be termed an amateur sort of way, but for common use a forge, a gasoline brazer, or a jet of gas supplemented by a blast of air can be satisfactorily used. The last named constitutes the cleanest, most convenient and effectual brazing fire; it is always available for immediate use, and is quickly disposed of when the job is completed. Difficulties involved in the production of the air blast are the most serious drawbacks to this method; it can be produced with a foot blower if no better way is available, but the long continued use of such a blower on a hot day and near a fierce heat is rather strenuous exercise, and does not leave the operator free to perform his manipulations. To avoid this labor as well as to get better results one ingenious repair man connected his foot blower by means of a light wooden rod with a crank on the end of an overhead shaft, and now has at his disposal a vigorous air blast without labor on his part. Foot blowers are provided with a sheet of rubber, the office of which is to equalize the pressure of the air which issues from the blower. This rubber is liable to break, the rubber deteriorating with age and sometimes from other causes, and by using a large air chamber the rubber may be dispensed with, the elasticity of the air being sufficient to equalize the pressure of the air blast. If portability is not required, this latter arrangement is the preferable one, as it saves the trouble and expense of making occasional repairs to the blower. The inner tube of an automobile tire when past a condition for satisfactory use in the ordinary way can be used to equalize the air pressure, the light pressure of, say, 2 pounds per square inch being safely carried by the tube and furnishing an excellent substitute for either the rubber sheet on the blower or the air chamber. A rotary pressure blower is an excellent device for producing the air blast, though it is more expensive to install than the ordinary foot blower, and requires power to operate it.

A bed of coke or charcoal on a forge hearth is an excellent resting place for the work during the process of brazing; a backing of firebrick or of asbestos is of considerable assistance in confining and reflecting the heat, though, of course, these do not contribute to the heating process in the way that inflammable backings do. There is considerable opportunity for the display of judgment and discretion in the arrangement of the backing; aside from the saving of time and fuel there is, on large and difficult work, all the difference between success and failure in the way the heat is applied and utilized.

PREPARING THE WORK.

Before work is assembled for brazing it should be well cleaned by file, scraper, scratch brush or other means; rust and scale do not favor the ready flowing of the fused spelter, though it will sometimes take hold of even such unfavorable surfaces. Cast iron may be cleaned by first heating to a bright red, and after cooling brushing the fracture and adjacent parts with a scratch brush.

After thoroughly cleaning the work and securing good bright surfaces, the parts must be fastened together in the exact position they are to occupy when the job is completed. Usually the pieces are secured by pinning, but sometimes screws, bolts, wire, clamps of various sorts, and even fireclay can be used to hold the parts in place. Whenever practicable the parts should be secured in such a manner that the job can be turned over during the process of brazing without disturbing the relation of the parts to each other, thus affording a better chance to apply the flux and spelter.

Alcohol used in a common gasoline torch has been said to give a greater heat than gasoline, the reason given being that it requires less air, and consequently the flame is cooled less by it. As alcohol contains fewer heat units than gasoline, it would seem a less suitable fuel to use for this purpose, but perhaps the need of less air may explain the difference claimed for it. If there is a marked difference the advent of denatured alcohol will make it practicable to substitute it for gasoline for this purpose.

FLUX FORMULA.

A simple and good formula for cast iron brazing is that communicated to the *American Machinist* by Ethan Viall; it has stood the test of over four years' use and is highly recommended. It is as follows:

	Ounces.
Boric acid	16
Chlorate of potash, pulverized	4
Carbonate of iron	3

Mix and keep dry, as moisture or long exposure to air renders it less efficient. When used mix with grain spelter. Heat pieces to a nice brazing heat and apply flux and spelter with an iron rod, flattened and spoon shaped at the end.

The above flux formula has the merit of simplicity. Other advantages are that it is not made with a liquid, does not alter by evaporation and cannot be damaged by freezing. The flux is composed of fairly stable ingredients, is not greedy to absorb moisture from the air, and its components are neither expensive nor rare.

There are a number of other processes for brazing cast iron, but it does not seem as though anyone except an inveterate experimentalist would care for anything further than the process given, considering the recommendation it has and the excellent results obtained by its use; but if such there be they may paint the cleaned fracture with a saturated solution of permanganate of potash in water, heat and proceed with common flux as in ordinary work. Or the following may be used: Make a paste of equal parts of black oxide of copper and fused borax with water, apply this first and then use common flux and spelter.

THE BRAZING OPERATION.

Borax is used for flux in brazing wrought iron and steel, for which prepared fluxes of unknown composition can also be bought; it is not expensive, and one can be sure of getting a good article by buying of a reputable dealer. In any brazing the work is first brought to a bright red heat, flux is applied, and then mixed flux and spelter. Sometimes considerable "coaxing" is required in order to make the melted metal flow into the joints; but with the flux applied first and allowed to find its way into the cracks and openings, the spelter will follow if carefully led and rubbed with the hot iron rod. After one side of the work has been brazed it is turned over and the other side is treated in the same manner. One successful worker prefers to apply powdered yellow prussiate of potash first, then other flux and then the spelter, but that this is not essential is attested by the excellent work done without it.

In preparing work for brazing too close a fit may be made, for the melted brass will not find its way into the most minute recesses. One one-thousandth of an inch is about as small a space as spelter will readily flow into.

After brazing cast iron it is a good plan to let it cool slowly, sudden chilling being regarded as injurious in some cases. Whatever process is employed it is a good rule (1) to have the work bright and clean, and (2) to use plenty of heat; these, together with good flux and spelter, constitute the essentials. Experience is always valuable, but that comes only with practice.

Schaap Auto-Oxy Welding Process.

On August 21 A. K. Schaap gave a very interesting demonstration at his shop at 344 Cumberland street, Brooklyn, N. Y., of his high temperature torch, with which he claims to obtain higher temperatures than have heretofore been possible. With his apparatus he claims to obtain with ordinary city illuminating gas a temperature near 4,500° Fahr., and corresponding temperatures with other gases. The ordinary blowpipe or blow-torch apparatus mixes the air under pressure directly with the gas, the resulting temperature ranging from 1,800 to 2,700° Fahr. Mr. Schaap's process consists in first mixing the gas with air at low pressure and then injecting into this mixture a second current of air under comparatively high pressure. With his demonstrating apparatus he used illuminating gas at city pressure, mixing it first with air at about 1 pound pressure. The torch was made of tubing, with the low pressure gas and air inlet at one end and the nozzle with the high pressure air inlet at the other end. The torch is about 18 inches long, constructed of 1 inch tubing. The second current of air, at about 30 pounds pressure, is directed through the centre of the mixture, giving the resulting mixture, which burns at a temperature estimated at 4,500° Fahr. Mr. Schaap has been working on this process for many years, and says that he expects to see it take the place of the ordinary forge fire and blow-torch apparatus with their dirt and low temperature. He has been using it for welding of all kinds of material that comes to his shop for repair, such as iron, copper, brass and aluminum. It will also readily weld silver, gold and platinum. One advantage of this process is said to be that oxidization of the work is remarkably small, the work being very clean and free from dross. He showed a rear axle housing of aluminum that had been broken and very neatly welded together again with his apparatus. Mr. Schaap is now making arrangements for placing the process on the market.

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Another A. A. A. Secession.

The dismemberment of the American Automobile Association is evidently continuing, for the Missouri State A. A. has virtually given up its membership, having, in fact, ceased to exist as a State body. The Kansas City Club formally resigned from the State association, while the St. Louis Club withdrew by failing to pay its dues. The clubs in New York, Boston and St. Louis are now out of the national association, and it hardly needs any prophetic powers to foresee that with the weakened position of the A. A. A. with regard to race control there will be still further secessions. The association is constantly recruiting new clubs and State associations in Western States where automobile enthusiasm has only just struck the population, but, of course, this growth is limited, and if the older and larger clubs continue to withdraw it is plain that the prestige of the national association must suffer seriously.

The power of the American Association rests in its control of automobile racing, in so far as national and local events are concerned. Until a short time ago the association's control of racing was not disputed. Even the secession of the Automobile Club of America did not affect it. But now the leading manufacturers and agents going in for racing have joined hands and decided to conduct their own races without asking permission from the A. A. A. This move threatens to be most disastrous to the A. A. A. The trump argument of the latter body in inducing local clubs to form affiliated State associations has been that it holds the power to issue sanctions for races, for which most clubs in newly developed automobile territory are very anxious. But if unsanctioned races are once held successfully the clubs will be loath to pay sanction money, and a state of anarchy will ensue.

We do not believe that the average automobile owner cares sufficiently for automobile racing to induce him to pay for the provilege of having a voice in its control. The several other matters to which the American Automobile Association devotes itself, like legislation and good roads, are properly State matters, and if they are to be influenced by motorists must be attended to by State bodies or local clubs. The chances for the continued success of a national automobile organization are therefore not particularly bright. The result of the present chaos in regard to race control will undoubtedly be that more of the manufacturers will abandon this method of advertising, and those who continue in it will make every effort to gain control over racing for themselves.

Let the Clubs Show Where They Stand.

Numerous moves to repress speeding have been made by automobile clubs during the present summer, but most of these attempts to check a serious evil have been of a very mild mannered nature and wholly ineffective. A general warning sent out to members will not serve the purpose. It may have the effect of rendering the cautious even more careful, but it will not reform the habitual scorcher, who is the sole cause of the public's grievance against motorists. It is absolutely necessary that examples be made of a few of the notorious speeders.

The most flagrant case of speed law violation that has been reported for some time is that of E. R. Thomas, the New York banker and turfman, who figured in a collision in New Jersey last week. He was driving a 130 horse power racing car at the time at a speed of about 70 miles per hour, according to eye witnesses. Thomas, moreover, is an old offender against speed laws and has many serious accidents to his record. We must commend the prompt action of the Motor Vehicle Commissioner of New Jersey in bringing suit against Thomas for speeding and for driving without a license, and it is safe to assume that if he had been licensed in New Jersey his license would have been immediately revoked.

Thomas is a member of the New Jersey Automobile and Motor Club, and a movement has been started within the club with the object of expelling him. It seems, however, that some of the officials of the club either are friendly toward him personally or are not in favor of expelling a member for notorious speeding, for the movement is meeting with opposition. Upon the action taken by the club in this matter will depend its future influence wtih the Legislature with regard to automobile legislation. The club is now confronted with the choice of either acquiescing in reckless speeding on public roads or coming out squarely in favor of the sane use of the highways. No middle course is possible. We shall know in a few days where the New Jersey Automobile and Motor Club stands.

Stopping the Smoke Nuisance by Law.

That the emission of offensive smoke from automobiles, especially in cities and inhabited districts, is a nuisance cannot be disputed. The accompanying odor is not pleasant and may possibly be injurious, if it is constantly present, either to health or vegetation in the parks or country. The detrimental effect upon persons and plant life has not as yet been authoritatively determined, although in France it has been claimed that the fumes coming from the exhausts of automobiles injured the growth of vegetation along the boulevards. Whether this be true or not, the fact that the smoke is offensively unpleasant warrants legislative regulation of the matter. Nuisances have from time to time immemorial been subject to legal control, and the mere fact that conduct is unpleasant, irrespective of injury to either health or property, has constituted cause for controlling it either by legislation or action of the courts. Thus noise may be controlled and unwholesome stenches may be enjoined. It is a matter of record that the courts have issued as many injunctions against the emission of gases from manufacturing establishments which injured vegetation as against any other kind of nuisance. The smoke nuisance resulting from the improper handling of automobiles is on a par with gas nuisances generally, and legislative action is not only proper but legally warranted.

In England the law prohibits the emission of offensive smoke or odors from automobiles, and several automobile drivers have been prosecuted and fined for violating the law. In America we have practically no legislation on the subject, except the recently passed ordinance of the Park Board of New York city, which is now to be tested in the courts. There is little doubt that the present objections will be overruled and the ordinance sustained, but it is open to the objection that it merely prohibits the emission of offensive smoke, and does not provide for punishment of offenders. Of course, offending machines can be ejected, but the drivers cannot be prosecuted and fined under the ordinance.

Offset Cylinders of Two Cycle Engines.

The adoption of an offset crank shaft in the two cycle engines of a well known manufacturer of cars calls attention to the special bearing of the practice of offsetting upon this type of motor. Offsetting of the crank shaft out of the axis of the cylinder bore is resorted to mainly for the purpose of reducing the angularity of the connecting rod during the power stroke, when high pressures act on the piston. Reducing the angularity, and hence the value of the average component of the reaction between piston and cylinder wall, reduces the friction between them, and hence the rate of wear on these two moving parts.

There is one important respect in which looseness due to wear in a two cycle piston is more serious than that of the piston of a four cycle engine, namely, that upon the fit of the upper edge of the piston of a two cycle engine depends the cyclical positions of the opening and closing of the exhaust and inlet ports. In the four cycle motor, so long as the piston rings conform to the contour of the cylinder wall, even though the piston is somewhat loose in its cylinder, no very serious consequences result, as compression will still be fairly maintained and valve action is not interfered with. With the two cycle motor it is otherwise. If the piston is a good fit at first the coincidence of its upper edge with the upper edges of the two ports will determine the instant of exhaust and of the recharging operation, and also the instant of the commencement of compression. If, however, the piston is a loose fit the coincidence of the lower edge of the upper piston ring with the port edges will be the factor which will control the timing of these operations, and as the ring must be below the upper edge of the piston, there will be a slight hastening of the exhaust and transfer openings and a retardation of the commencement of compression. These actions are readily discernible on manograph records taken upon a badly worn two cycle motor. How serious this effect may be in practice is not apparent, but it is evident that in so far as offsetting reduces the rate of piston wear, in just so far this interference with the valve timing will be reduced.

It should not be forgotten that the ideal sought for in the perfection of the two cycle engine is to secure from a cylinder of given dimensions double the output obtainable from a four cycle cylinder of the same size. This presupposes that each explosion of each motor shall have the same effective pressure and that there shall be twice the number of power strokes in the two cycle as in the four cycle motor, per unit of time. At full load, therefore, the rate of cylinder wear in the two cycle engine might be expected to be double that in the four cycle, and thus whatever advantages offsetting offers would be doubly important.

Since in the common form of two cycle engine all valve actions are determined by piston position, and as offsetting changes the relation between piston position and the corresponding angular location of the crank, it is evident that the offsetting of a two cycle crank shaft has a certain bearing upon the cyclical position of the various port openings and closures. With an offset shaft the tendency is toward a slightly slower opening and a slower closing of both ports, which are uncovered at the lower dead centre, as well as a very slight reduction in the total time during which these ports are uncovered. On the other hand, the time during which the suction port is held uncovered is very slightly increased when an offset is employed. These effects upon port timing are worthy of detailed study.

Trussed Supporting Members.

For the stiffening of structural members against bending stresses the common form of truss, consisting of a tension rod attached to its ends, and running over a short strut at the centre of the member, is in almost universal use in engineering constructions where rigidity is to be attained with the expenditure of a minimum amount of metal. Such an underrunning truss is very generally found upon the live rear axles of cars, but it is a curious fact that many automobile constructors have entertained a curious prejudice against its adoption, despite the fact that it is obviously the best method of giving the axle tube the requisite resistance against deflection. The mistaken idea still seems to be occasionally expressed that the use of a truss creates in the public mind an impression that the axle was inherently defective in design, and that a truss had to be added to give it the necessary stability.

The side members of the main vehicle frame are structural elements to which the underrunning truss is eminently adapted, as they are subject principally to downwardly directed bending stresses, but it is a curious fact that so few trussed frames have been used. It hardly seems possible that the above mentioned whimsical prejudice can have been responsible for this failure to embrace an obviously desirable construction, but no other plausible explanation suggests itself. It cannot be doubted that for a given weight of metal involved the trussed construction secures greater resistance against flexure than does the untrussed member. Furthermore the truss furnishes a ready means of correcting any sag or permanent set which may develop.

There are a few designers who hold the belief that a certain measure of flexibility in the frame members is desirable, and these engineers arrange their side members and the mechanism carried thereon with this idea in view. A trussed construction is of no value in such cases.

A high degree of frame rigidity and a dependence upon the vehicle springs for all resiliency is the condition generally sought after, and it is hardly to be understood why the trussed construction has not been more generally adopted. A few cars make use of it, but they are rare exceptions. It would be interesting to know the causes which have prevented the adoption of the trussed construction, whether it is merely prejudice or whether there are some real objections.

An Investigation of Fuel Flow Through Carburetor Nozzles.

By P. S. Tice.

(Concluded.)

Fig. 4 shows the delivery of nozzle A, Fig. 2. For this curve, as for the others following, two reference curves are shown, giving discharges proportional to $\sqrt{h}$, for $h = 1.5$ and 15 inches of water, respectively. This is thought to be the best way of graphically indicating the relationship between the actual discharges found and those which would exactly maintain a given weight ratio in the mixture. Inspection of the curve for nozzle A indicates that the weight of gasoline delivered per minute is almost exactly proportional to the pressure drop h, causing the flow. The weights delivered with 3, 6 and 12 inches of water are found to bear to each other the relation $W_3 : W_6 :: W_6 : W_{12} :: 1 : 1.8465$. That is, if a weight W is delivered with a pressure drop of h, 1.8465 W will be delivered with 2 h, and 1.8465^2 W with 4 h. We may thus write:

$$1.8465\ W = 2\ C\ a\ n\ h,$$

or

$$W = 1.0835\ C\ a\ n\ h \quad (6).$$

in which

W = pounds per minute.

C = a constant (indeterminate in this case, since a is not known).

a = area of each passage in square inches.

n = number of passages.

h = pressure drop in inches of water.

By (6) the discharge is proportional to $1.0835\ h$. Equation (6) will hold only when the fuel passages have a length exceeding 12 to 15 diameters, as will be seen later.

Since the $\sqrt{h}$ curve coincides with the air discharge curve (Fig. 1) a comparison of the actual delivery of nozzle A with the $\sqrt{h}$ curve drawn through the weight discharged in 1.5 inch h shows that the ratio of fuel to air in the mixture would be much increased with each increment in the value of h. Hence, the law of flow for nozzles of type A does not agree with the law of air flow, but differs from it in such a manner that the popular assumption as to the cause of enriching at high engine demands is entirely justified. Carburetors employing nozzles of the form shown in A require extreme auxiliary air port areas, and also exceptionally accurate proportioning of parts, together with close adjustment.

Nozzle B, whose discharge curve is shown in Fig. 5, provided a single straight passage of .055 inches diameter with a length of between four and five diameters. Its solid stream discharge was designed to be broken up by impingement upon either a cone or a flat surface placed at some distance above the opening. The presence or absence of this impingement surface leaves the character of the discharge curve unaltered. The discharge curve for B is of a much different form from that of A. This may be attributed to the great increase in the ratio of diameter to length in B, compared with A. The passage in B, while still a tubular passage, much more nearly approaches orifice form than do the passages in A. The reference curve ($\sqrt{h}$) drawn through the 1.5 inch h discharge for B shows that, if the mixture ratio be correct for that value of h, the proportion of fuel to air in the mixture will increase with h, but at a much lesser rate than the increase with nozzle A. The reference curve drawn through the 15 inch h discharge with B serves to show more clearly the true characteristics of the actual delivery. With h between 9 and 15 inches, the two curves practically coincide; with pressure drops of less than 9 inches a divergence, increasing as h approaches zero, is apparent. The actual discharge of nozzle B may evidently be written as a function of $\sqrt{h}$, thus:

$$W = 4.2764\ C\ c\ a\ \sqrt{h} \quad (7),$$

in which C is the coefficient of efflux which would normally be introduced into equation (5), and c is a coefficient of variable value, increasing with h until it becomes unity when h equals 9 inches of water, due to the higher ratio of the friction head (the percentage of h used in overcoming frictional resistance in the passage) to the total h at the lower deliveries.

The improvement in the character of the curve for B with h above 9 inches of water seems to indicate that a carburetor with such a nozzle would give a more automatic proportioning of the mixture with less auxiliary air port area if the passages were so proportioned that the pressure drop would be not less than 7.5 inches of water with minimum engine demand. Of course, while securing the above advantage some of the volumetric efficiency of the engine pumping strokes would be sacrificed at the higher engine demands.

The second set of curves in Fig. 5 are for nozzle C, which is similar to B in form. With C, however, a needle adjustment is provided outside the nozzle, as shown in Fig. 2. The needle is so formed that the liquid stream is spread out into a thin conical sheet as it leaves the nozzle. While the ratio of diameter to length is somewhat greater than for B, the character of the discharge curve does not much differ from that for B. The delivery with C is expressed by equation (7), only the coefficient c does not increase in value with the same rapidity as is the case for nozzle B. However, it should be noted that the tendency of the needle action is toward a straightening of the curve, and is therefore in the wrong direction.

In Fig. 6 are shown the curves for nozzles D and E. So far as the writer knows neither of these forms is employed in carburetors. They are presented here because they gave discharge curves superior to those obtained from any of the other forms tried. The close adherence of the

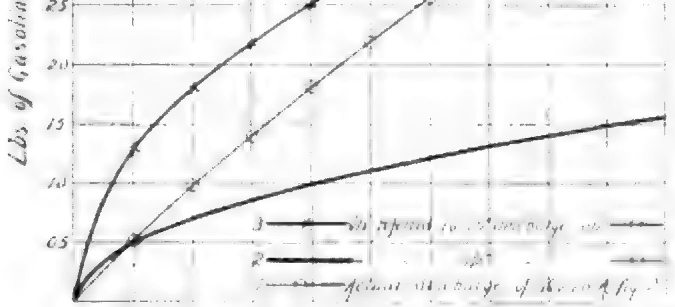


Fig. 4.

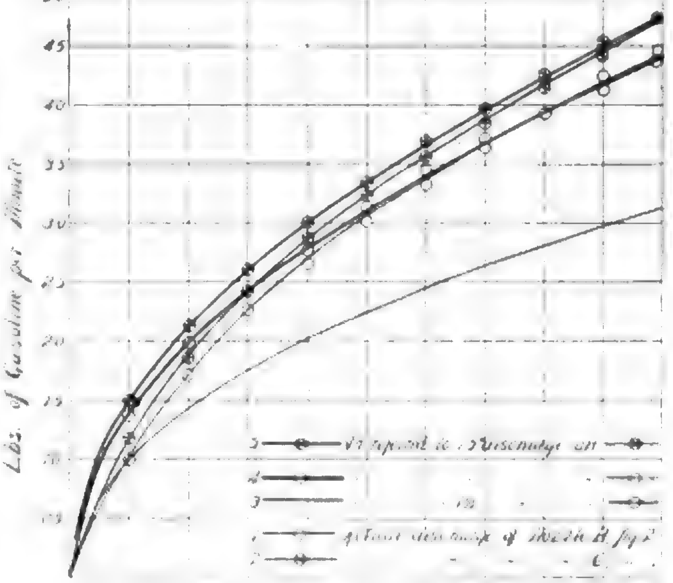


Fig. 5.

curve for D to the $\sqrt{h}$ curve for all pressure differences above 3 inches of water is very marked. In fact the curve of actual discharge as here shown is a very little superior to the $\sqrt{h}$ curve in that it tends to flatten out more rapidly than the latter. This is a distinct advantage, as will be pointed out later.

The curve for E again shows the above mentioned effect of the needle. Equation (5) may be used without modification to express the delivery of nozzle D for values of *h* above 3 inches, without introducing any appreciable error. Nozzles B and D, one a tube and the other a true orifice, being of the same diameter, afford an interesting comparison. The same is true of C and E, as well be seen from Fig. 2.

In view of the foregoing, it appears that the difference between the laws of flow of the two fluids is insufficient to account for the excessive enriching of the mixture experienced with carburetors without auxiliary air valves. Take the case of nozzle B and assume that the mixture proportion of 1 pound of fuel to 16 pounds of air is had with a value of *h* equal to 3 inches, below which pressure drop fuel will not be projected clear of the nozzle. The $\sqrt{h}$ curve air port, with ordinates expressed in pounds per minute. Taking the actual discharge through the delivery at that value of *h* may be taken as the air curve of the initial curve for B, the weight ratio of fuel to air for any other value of *h* is then found by the equation

$$R = 16\frac{A}{F},$$

in which R is the ratio desired and A and F are the values of the ordinates of the air and fuel curves respectively for any one value of *h*. From this we have, for nozzle B, the pounds of air per pound of fuel in the mixture, referred to *h*, as follows:

h	3 in.	4.5 in.	6 in.	7.5 in.	9 in.	10.5 in.	12 in.	13.5 in.	15 in.
R	16.00	14.66	14.04	13.90	13.75	13.64	13.57	13.57	13.59

The enriching effect indicated by the above would be enough to considerably impair the fuel efficiency of the engine, but would not be sufficient to cause the emission of black, sooty smoke from the exhaust pipe; in fact, the presence of superfluous fuel in a mixture of 1 : 13.5 can barely be detected by the sense of smell. Nevertheless, as everyone knows, enriching to sootiness does take place with any carburetor unless the auxiliary air port or valve is adjusted to open progressively with the engine demand. Since, with the majority of nozzle forms in use, the enriching of the mixture cannot be caused, except in small measure, by the difference between the laws of flow, it must be attributed to some other influence. That other influence is the regular fluctuation of the pressure drop through the carburetor passages due to the recurrence of motor suctions.

To illustrate this, assume that the mixture proportioning is correct at low engine demand with air supplied by the main air port alone. This will be the case with most engines at speeds of about 300 r. p. m., the auxiliary port being required to open only under the action of higher demands. At this engine speed, with the engine loaded to its fullest capacity, the main air port of the carburetor will be of sufficient area to supply all the air necessary without the aid of the auxiliary. The fuel supply can also be adjusted so that the ratio of fuel to air is correct. Under these conditions the throttle will be opened considerably and the pressure drop *h* will fluctuate through quite a range of values. At the same time the number of fluctuations will be comparatively few, 600 per minute in the case of a four cylinder, four cycle engine at a speed of 300 r. p. m., as above. That is, the fluctuations in the value of *h* will be of considerable intensity, but of comparatively low frequency.

In examining the effect of the above pressure drop characteristics on the flows of air and fuel, it is necessary to take into consideration that property of all matter which plays so important a part under conditions of alternate motion and rest, or acceleration and deceleration, i. e., inertia.

Inertia is defined as that property of a body by which it tends to persist in its state of rest or motion until acted upon by some force. Since the inertia to be overcome is equal to the product of the mass by the change in velocity, the comparative inertias of two substances are to each other for equal velocity changes, as the masses of the substances for unit volume. Thus, since 1 cubic foot of air at 60° Fahr. has a weight of .0759 pound, and a corresponding volume of gasoline, .71 sp. gr. at 60° Fahr., has a weight of 44.28 pounds, it follows that the weight of unit volume of air is to that of unit volume of gasoline as 1 : 583.4.

Now, since the pressure drop (*h*) causing the flows of both the fuel and the air is the same, it follows that the mean velocities must be the same. Taking the entire passage section as composed of area units equal to the area of the fuel passage from the above velocity relationfi neglecting friction losses, it appears that equal volumes of air and fuel will pass a unit of area in a given time. Since this is the case, considering each unit of air passage area individually, the total weight of liquid discharged bears the above relationship of 583.4 : 1 to the weight of air discharged per unit of area.

The ratio of the inertias of air and gasoline being a function of the above ratio of weights, it appears that the inertia of gasoline is many times that of air.

Taking the above outlined conditions of engine operation, the respective actions of air and fuel will be approximately as follows: The air, by virtue of its very slight inertia, will almost exactly follow in velocity of flow the fluctuations in the value of *h*, with neither loss nor gain in quantity discharged at the accelerations and decelerations respectively. The liquid, because of its very much greater inertia and internal friction, will lag and flow slower for rising value of *h*, and likewise lag and flow faster with decreasing *h*.

Evidently the intensity of the increases in *h* will have no effect upon the quantity of fuel delivered as affecting the proportioning of the mixture, provided the fluctuations occur regularly, and sufficient time

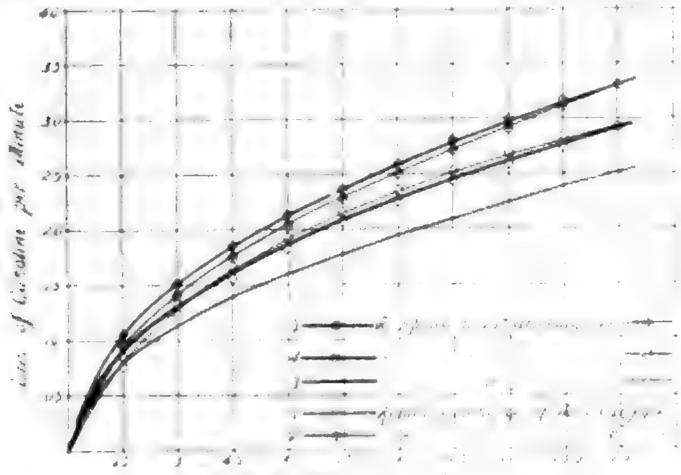


FIG. 6.

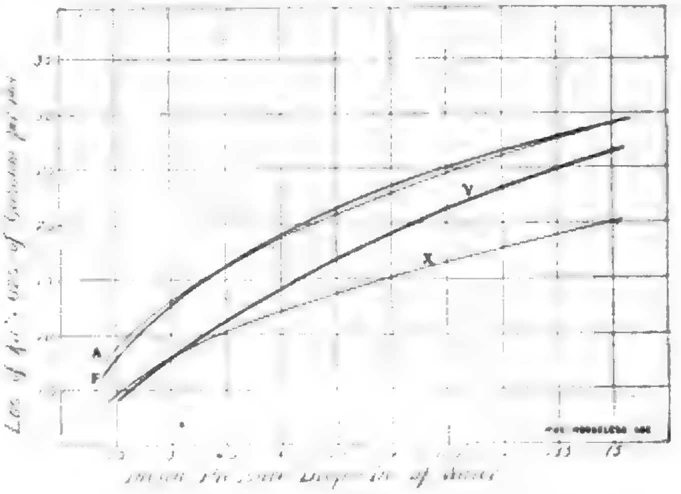


FIG. 7

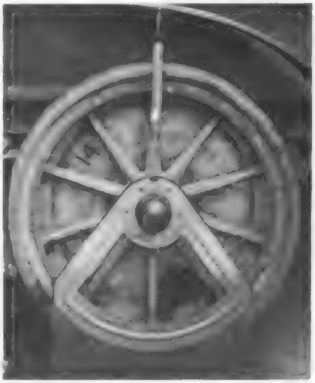
elapses between the recurring maximum values of *h* to allow of the fuel mass coming to rest. Even if the time elapsing between the accelerations of the fuel flow is insufficient to allow of the fuel mass coming to rest, the area of the nozzle opening can be made such that the total amount of fuel supplied will bear the proper relation to the total amount of air aspirated. This is the state of adjustment which must be assumed to hold when a carburetor supplies an engine with a properly proportioned mixture at the lower demands without air passing the auxiliary port. For the purposes of this illustration an engine speed of 300 r. p. m., the engine carrying its maximum load for that speed, has been assumed for the above condition.

Now let the engine speed be increased to 600 r. p. m., the load being also increased until it is nearly the maximum that can be carried at that speed. The frequency of the *h* fluctuations will now be doubled, and thus, if sufficient time lapsed to allow of the fuel coming to rest between maximum values of *h* with the engine speed at 300 r. p. m., there will be insufficient time for the same condition to obtain at 600 r. p. m. That is, while the flow of air will continue to follow the *h* fluctuations, as above, the inertia of motion in the liquid mass at the times of *h* maximum will be too great to permit of much loss in the velocity of liquid efflux before the recurrence of *h* maximum. Because of this there will be an oversupply of fuel, relative to the weight of air aspirated (the auxiliary port remaining or being held closed). This action under increasing engine demand is clearly illustrated by the curves in Fig. 7, in which curves A and F are the discharges for air and fuel respectively, according to the laws of flow for the two fluids as shown by the curves for nozzle D in Fig. 6. These two curves indicate the relative discharges where *h* does not periodically fluctuate in value, as it must in engine operation.

The curves X and Y (air and fuel respectively) in Fig. 7 show the characteristics of the discharges through the same orifices with a fluctuating value for *h*, such as is found in engine operation. It will be seen that the weights discharged are reduced in both cases, but with a considerable difference in the degree of the reduction, the reduction in the discharge of air being greatest, because of its relatively very small inertia, while, on the other hand, the inertia of the liquid is so great relatively that heavy flow persists between maximum values of *h* to such an extent that the discharge closely approaches the curve of discharge with steady pressure drop.

Curves X and Y, Fig. 7, make it appear that either the quantity of air admitted must be increased or the quantity of fuel decreased if proportions are to be maintained as the demand increases. Both these things are accomplished by the auxiliary air valve. The opening of this valve provides a greater total passage area for the entrance of air, while at the same time reducing the value of *h* maximum within the carburetor, and thus lessening the weight of fuel discharged from the nozzle. In effect, the auxiliary air valve is a means for reducing the values of *h* maximum, and thus the inertia of motion of the fuel so that an excess of fuel may not be aspirated under conditions of extreme frequency of *h* fluctuation.

It seems, therefore, necessary that some means be employed for minimizing the inertia of the incoming liquid under the heavier engine demands. For this purpose the auxiliary air valve at present holds the field, but there are other devices which strike at the root of the matter directly, cost less to manufacture, and are much simpler. Two of these devices may be here cited: The so called "equalizers" and "fuel economizers," in which the value of *h* maximum, referred to its influence on the fuel delivery, is reduced and controlled by the provision of an adjustable opening communicating the upper part of the float chamber with the mixing chamber, and the expedient of placing a jagged piece of metal in the fuel passage in such a way that it presents a great frictional resistance to the flow of liquid at high velocity, thus reducing the nozzle efflux.



Splash Guard to Rear Wheel of Omnibus.

Novel Splash Guard.

The large solid tires on motor omnibuses are the cause of considerable trouble in wet weather by splashing mud over pedestrians on the sidewalks, particularly in narrow thoroughfares. An ingenious device has recently been tried with considerable success which, it is claimed, quite obviates the trouble, and as it possesses the merit of being readily adaptable to any kind of vehicle, without alteration of the wheels, it is likely to be in considerable demand. The appended illustrations show the device fitted to a rear wheel of a motor omnibus running regularly in the town of Brighton, England. The splash guard consists of a partly triangular light steel frame having near its apex a bearing of simple form which serves to carry it on the wheel hub and permits it to make about half a revolution in a plane parallel to the wheel. The lower end of the guard conforms to the circumference of the wheel, and nearly at the extreme edge carries the splash guard proper, consisting of a flexible metallic screen, made by meshing together a large number of hardened steel links, much in the style of the ancient chain mail used by warriors in the Middle Ages. The screen is so flexible that it can be adjusted quite close to the road surface, and because of this, and the floating method of attachment to the wheel hubs, can come into contact with large stones or other impediments without suffering any damage. The steel plate is fixed on an extension plate which has a vertical adjustment of about 3 inches in relation to the main plate, giving allowance for readjustment as wear takes place at the solid rubber tire. The apex of the plate is always returned to the vertical position, if struck by any obstacle, by an encased spiral spring that is anchored to a bracket fixed at the top of the mud guard. The steering of the front wheel is not affected.

Wood Alcohol Cheaper.

The Bureau of the Census, with the assistance of the Forest Service of the Department of Agriculture, has for some years collected statistics concerning the annual production of various forest products, and the preliminary figures on wood distillation for the year ending December 31, 1907, have just been made public.

In the distillation of hardwoods, charcoal, gray acetate and alcohol constitute the leading products. During 1907 the industry passed through its first year's experience under the working of the so called free or denatured alcohol law. While this law exerted no disturbing influence on the market value of such products as charcoal, acetate of lime, pyroligneous acid, etc., its effect on wood alcohol was immediate and striking, resulting in a decline of more than 55 per cent. in the market value of this commodity—from an average value per gallon of 34 cents in 1906 to 15 cents in 1907. Otherwise, however, little or no evidence of the law's operation is discernible in the statistics of the industry for the country as a whole. In fact the demand for charcoal has been sufficient to cause a slight advance in the average value of this commodity, along with a substantial increase in production, and this in a measure compensated for the fall in the price of alcohol.

There does not appear to be much enthusiasm over the Vanderbilt Cup race among the manufacturers. The entries close on September 1, and at the time of this writing the entries number just four, an Acme, a Chadwick, a Mora and a Mercedes.

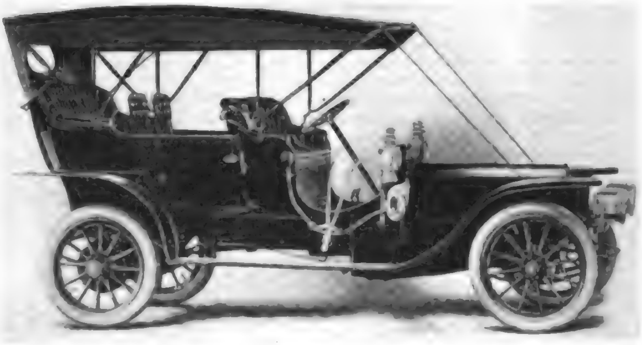
NEW VEHICLES AND PARTS

Franklin 1909 Models.

The H. H. Franklin Manufacturing Company, of Syracuse, will manufacture three distinct types of chasses during the coming season, which in general follow the design of last season.

Model G touring car, the smallest car made by the company, is this year equipped with an 18 horse power, 3⅜x4 inch four cylinder motor. The engine is slower running, and is fitted with an air fan, giving added power, while the weight of the car is slightly reduced. There has been an increase of 1½ inches in the wheel base of this model, and the wheels have been increased from 30 to 32 inches in diameter. This permits an increase in the length of the body, making it more comfortable. In design and appointments the body is somewhat similar to that of last season. Ignition is by Bosch high tension magneto only, with set spark advance. Quick detachable tires, 32x3½ inches, are used. This model is also built with a brougham body for doctors, etc. It is also furnished with a landaulet body similar in design to but smaller than that furnished on the 28 horse power car. The finish of the touring car, landaulet and brougham is royal blue, while the runabouts are finished with red body and black running gear and guards.

Type D is the largest four cylinder car made by the Franklin Company, and is equipped with a 4¼x4 inch, 28 horse power motor with high tension Bosch magneto. The design of the touring car and runabout bodies is along the lines of the six cylinder models. The wheels of touring cars and runabouts of this model have also been increased 2 inches in diameter, being now 36 inches. The Model D is also built with a landaulet body, in which case it is equipped with 32 inch wheels, to make entrance easy.

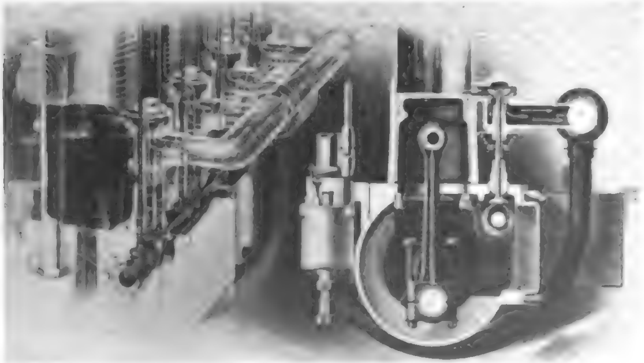


Franklin 1909 Model H Touring Car.

Type H, the 42 horse power, six cylinder model, is built in three different styles, viz., as a seven passenger touring car, a single or double rumble seat runabout and a seven passenger limousine. The auxiliary seats in the Model H touring car are of the folding or Pullman reversible type, being so designed as to be readily removed or closed up against the side of the tonneau. This model is fitted with a worm steering gear made by the Franklin Company. The wheel base is 127 inches. This car is thought to be the most powerful in proportion to weight now on the market, its catalogue weight being 2,500 pounds. The tonneau of the Model H touring car has a false bottom, which covers up all bolts and attachment irons. On top of this is placed the regular linoleum cover, in addition to which there is a heavy cork linoleum mat, leather bound and held in place by snap catches. The running boards of the Model H are also covered with the same material, held in place by a brass binding.

MOTORS.

Three different sizes of motors are used in the 1909 Franklin cars, they being a 3⅜x4 inch, four cylinder, 18 horse power; a 4¼x4 inch, four cylinder, 28 horse power, and a 4¼x4 inch, six cylinder, 42 horse power. In design and construction the motors are similar to those of 1908, except in certain details. No governor is used on any of this year's models, it having been rendered unnecessary by improvements in carburetor design. The crank shaft on the Model H is made stiffer and larger.



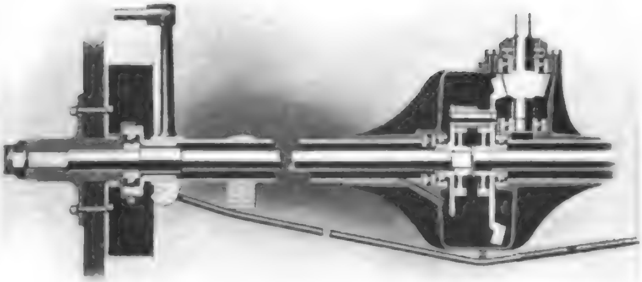
X Ray and Sectional View of Auxiliary Exhaust

Through extensive hill climbing tests carried on by the Franklin Company it has been demonstrated that the results obtained are more or less affected by the position of the carburetor, relative to the centre of the motor. The position of the carburetor has, therefore, been reversed. As regards ignition equipment, the double or battery and magneto ignition system has been replaced with a single high tension Bosch magneto. On the Model H the magneto's action is controlled by an automatic governor with expanding arms pressing outward against the magneto's balance wheel, thus obviating the possibility of a back kick. The ignition wires are passed through a conduit to prevent chafing and short circuiting.

The discarding of the timer has made possible several changes and a slight reduction in engine weight. With the new engine construction the front cheek piece can be removed without disturbing the cam shaft, or the cam shaft may be taken out without interfering with the cheek piece. The starting crank in its attachment to the crank shaft has been made waterproof, and is held in place by a leather stirrup. The concentric valve and dome head cylinders, two exclusive Franklin features, are retained. The method of suspending the type H engine is somewhat different from that used during the past season, the cross rails being made of angle steel and also support the magneto and oiler.

CARBURETOR IMPROVEMENT.

A double heat accumulator for securing warm air for the carburetor is a new feature on the six cylinder motor. The auxiliary exhaust pipe is surrounded with a copper jacket, and the heat so accu-



Rear Axle.

mulated is passed through the air intake pipe underneath the engine base to the carburetor. The copper case used on this motor is in addition to the regular steel warm air collector used on all other Franklin engines.

A new style of oiler is used, and is so located as to make filling much more convenient than in former methods. The Hancock positive gear driven oiler is used on all models, with a number of feeds depending on the size of the engine. It is placed directly against the engine base, where the oil is always kept fluid by warmth from the engine.

As has been their policy in the past the Franklin Company use the strongest materials procurable, which by laboratory tests and actual practice have been found to be best adapted to air cooled motor construction. The valve springs on all models are this year made of vanadium steel, which is claimed to eliminate almost entirely the possibility of trouble from this source.

The change in the position of the carburetor has resulted in making the connectionless intake pipe run more directly into the cylinder. The pipe is of spun brass. The auxiliary exhaust of these motors is said to remove 71 per cent. of the burnt gases from the cylinder immediately on the completion of the power stroke, the remaining 29 per cent. passing out through the main exhaust, which, not being connected with the muffler, makes back pressure impossible. These valves are mechanically operated by the cam shaft in a similar manner to the regular exhaust valve.

The clutch is of the Franklin steel to bronze multiple disc type. To deaden engine noises rawhide gears are used, and the cams are given an "hyperbolic" form. All the 1909 models are equipped with a transversely slotted oil baffle plate, used in connection with the splash system of oiling.

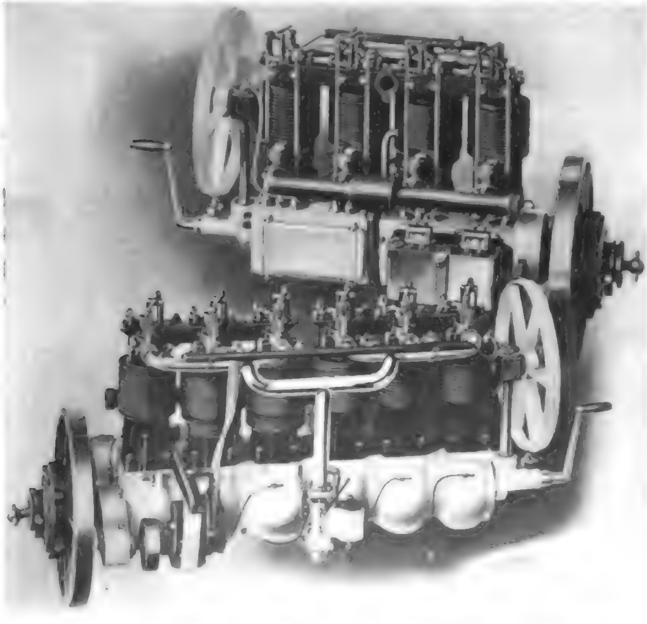
The front air fan, which is used on all motors this year, is of true helix form. This fan is driven by bevel gear and shaft from the front end of the crank shaft. The fan is made of aluminum and is held in place by a coiled spring and friction disc.

The carburetor is of the automatic float feed type, of Franklin design, the supply of gasoline being controlled by a T handle connected with the valve and passing through the dash within easy reach of the operator. There is also a small starting primer.

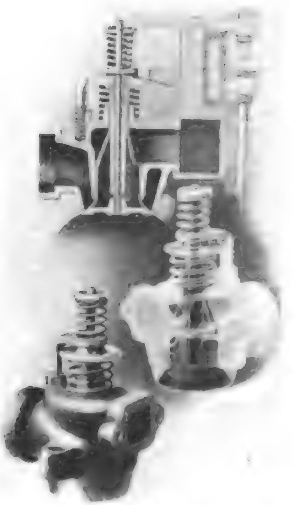
Selective change gears are used on the two larger models and a progressive change gear on Model C. The selective type is entirely free from lost motion and positive in its action. The lever is automatically held in the central position by spring tension. No H slot guide is used. For low gear the lever is pressed outward and back; for intermediate inward and forward, and for high gear inward and backward. The connections from the change gear lever to the transmission are very direct.

Another Franklin feature is the laminated wood frame through which road shocks and vibration are reduced to a minimum. The frames are made of second growth white ash, put up in three laminations securely set in glue and fastened together with numerous screws. A protecting strip along the top, laid in white lead, completely excludes dampness. In selecting the sections for each frame care is taken that the grain of the different laminations or strips run in a somewhat different direction from each other, which adds both to the strength and resilience of the frame.

There is no coil box on the dash of the 1909 Franklin, and the oiler being placed underneath the hood next to the engine base, the dash is entirely left free. On the Models D and G the dash is painted the same color as the other body parts; on the Model H the dash is made of mahogany, brass trimmed. On Model G with set spark ignition there is no spark lever, but on the D and H models a spark controlling lever is used. The ratchet retaining arrangement as used on last season's cars has been done away with the throttle and spark levers being retained by a secondary operating shaft arrangement. All lever shafts pass through the centre of the steering post and are operated from above the steering wheel. The steering wheel on the Model D has been increased from 15



Model D Engine, Exhaust Side (Top Figure). Model H Engine, Intake Side.



Concentric Valves and Dome Head Cylinder.

to 17 inches. All steering parts are mounted on plain instead of ball bearings.

Auxiliary gasoline tanks of 1 or 2 gallons capacity are another new feature of the 1909 models. They are so arranged as to be automatically filled at the time of filling the main tank. This supply, however, is shut off and cannot be used except through the opening of the three way gasoline cut-off, which when open for the regular tank is closed to the auxiliary tank, and vice versa. This gasoline cut off, which is located on the outside of the frame underneath the driver's seat and within easy reach, has been changed from the two way to a three way cut-off, one position shutting off entirely the gasoline supply, another opening the regular tank and a third closing the main tank and allowing the gasoline to be taken from the auxiliary tank.

The transmission boot has been removed and the engine boot lengthened out. The guards on all models have been strengthened by adding reinforcements which reduce vibration. The front guards are made with flanges so formed as to prevent the mud and water thrown by the front wheels being splashed from underneath the guard. The Models D and H have a mud apron placed directly underneath the front end of the hood to prevent the splashing of mud and water through the hood grill onto the engine.

A slight change in the method of casing the differential gear has been made, the pins of the casing having been changed from bolts and nuts to rivets, making a more positive and stronger construction. An anti-rattling device which holds the brakes rigidly in position when not set is used.

BODIES.

Reinforced steel angle frame sheet metal bodies are used on all the Franklin cars this year, making a light and strong construction. The doors and pillar posts are made of cast aluminum. All models are upholstered in hand buffed, straight grain leather, blue leather being used on the royal blue cars and red on the runabouts finished in this color. The upholstering is somewhat thicker and more luxuriant than heretofore. The upholstering on the D and H runabouts is tufted similar to that on the touring cars, while on the G runabout it is plain, with a roll along the edge of the back and across the front of the seat cushion. The toeboards are made in three pieces of cast aluminum, reinforced by webbing on the under side.

The tops for 1909, all of which are made in the Franklin factory, are somewhat lighter than those of the past season. Double face Pantasote is used, doing away with padding and lining. In addition to the outside top joints retaining straps are used which prevent the top from swaying and also exert a tension, keeping them in good form at all times. On the runabouts four bow Cape tops, extremely light and strong, are used, and are held in place by front retaining straps. All of the 1909 models are regularly equipped with storm front, side curtains and dust covers.

The tonneaus of the D and H models are fitted with an adjustable foot rest which can be pushed back out of the way when desired. On the Model G certain of the heretofore bright parts are finished in black. The Model H equipment box on the running board has been enlarged, to hold the tire pump, repair outfit, tubes, etc. Another new feature this season is a collapsible angle steel luggage carrier.

The Model D runabout and touring body are interchangeable on the same chassis. The body of the Model H runabout extends back beyond the rear seat, making an additional compartment for luggage. Entrance to the space underneath Models D and H runabout rear seat is through a door placed in the back of the under body, making it unnecessary to disturb the rumble seat passengers. Under the front seat of all models are two tool drawers.

The rear seats and lower body of the Models D and H runabouts can be detached midway between the front and rear seats, and a hamper substituted. The front seat of these models is ironed for a three bow Cape top in case it is desired to so equip the car when a hamper is used. Slip covers for all models are furnished as extras. These are made of a waterproof material and designed to perfectly protect the upholstering; they are attached by push buttons which engage in an overflap around the outside edge of the seats, the cushions being slipped into pockets. At points where wear is most likely to occur the covers have leather inserted which matches the other trimmings of the car.

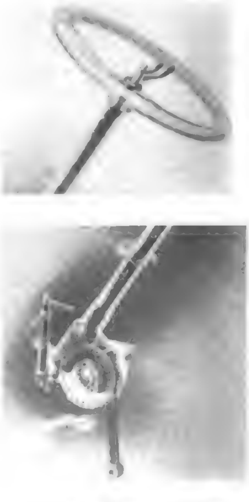
The upper edge of the tonneau doors is protected with oval wood caps so formed and placed as to leave no opening for water or dust to settle. The lower interior of the tonneau is completely lined with waterproof duck and all wood parts of the seat frames underneath the cushions are also lined with this material. The interior of the compartment underneath the rear seat, used for storage of wraps, etc., is also lined. In the tonneau of the Model D touring car and tipping back from underneath the front seat is an auxiliary tool box.

The gasoline tank opening has been changed to a 2 inch solid brass screw plug, permitting of ready cleaning.

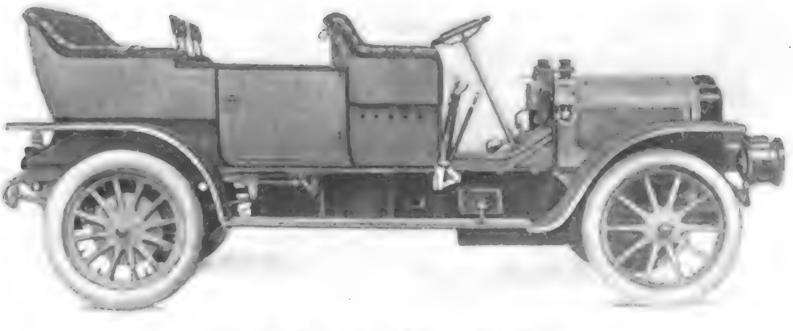
The 1909 White Steam Cars.

The White steam car for 1909 will be built in two distinct models which, while differing in power, size and price, resemble each other in their general lines of construction. The horse power rating of the two models are based on the actual power delivered at the rear wheels.

The larger car, known as Model M, is the successor of Model K of the present season; it is rated at 40 horse power, has a wheel base of 122 inches, and is fitted with 36x4 inch and 36x5 inch front and rear tires, respectively. The car is regularly fitted with a straight line seven passenger body. The engine is compound, of new design. The high pressure cylinder is of 3½ inch



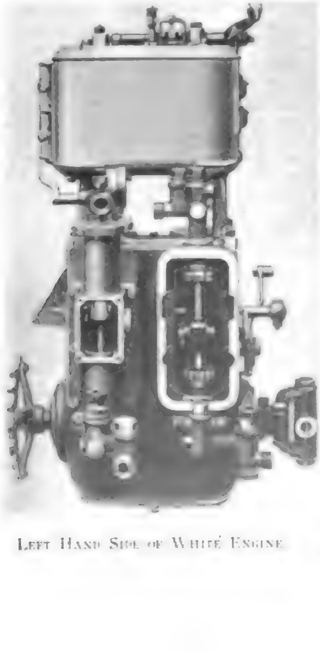
Franklin Steering Gear.



Model "M," Forty Horse Power, White Steamer

bore, the low pressure cylinder of 6 inch bore, and the stroke is 4½ inches. The frame is of armored wood, the reinforcing plates of nickel steel being fastened on both sides of the wooden sills. The front axle is tubular. The front springs are 44 inches long and 2½ inches wide; the rear springs 55 inches long and 2½ inches wide. Both the foot brake and hand brake act on drums on the rear wheels, the former being of the expanding and the latter of the contracting type.

The smaller car will be known as the Model O, and is essentially a smaller edition of the new Model M, rather than a successor of any previous model. It is rated at 20 horse power, has a wheel base of 104 inches and 32x3½ inch tires all around. The car is regularly fitted with a straight line five passenger body. The engine, except as regards size, is identical with that in the Model M. The high pressure cylinder is of 2½ inch bore, the low pressure cylinder is 4¾ inch bore, and the stroke is 3 inches. The frame is of pressed steel. The front axle is a one-piece forging of I-beam cross section. The front springs are 37 inches long and 1¾ inches wide; the rear springs are 45 inches long and 1¾ inches wide. Both the foot brake and the hand brake act on drums on the rear wheels, the former being of the expanding type and the latter of the contracting type. As in the Model M, the water tank is placed under the footboards and the fuel tank is in the rear.



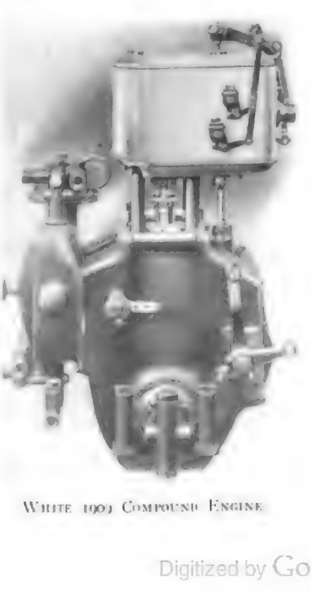
Left Hand Side of White Engine

The principal mechanical change in the new cars is in the engine, and the following description applies to both models. In former years the engines used in the White cars were fitted with the Stephenson valve motion, which was actuated by eccentrics on the crank shaft, as were also the pumps. The new White engines are fitted with the Joy valve motion, which is actuated directly from the connecting rods, and the pumps, all of which are located on the left-hand side of the engine, are driven by the levers of the valve mechanism.

The advantages of the new engine construction are that the number of parts is reduced almost by one-half, considerable weight is saved, all eccentrics are done away with, and the cylinders are brought close together, permitting the use of a short one piece crank shaft. The new crank shaft is a one piece forging of tool steel, and there are only two main bearings to the crank shaft. This is a most advantageous construction, because when three or more bearings are used in any shaft there is always a possibility that they may get out of alignment. The main bearings are of the annular type and may be removed from the crank shaft by taking off lock nuts and lock washers. The two main bearings and the two connecting rod bearings are fitted with ball separators, with balls of extra large size. The connecting rods are one piece forgings.

Both the high pressure and the low pressure valve are piston valves. Steam is admitted through the centre of the valve and exhausts at the ends. The pressure on the valve stuffing boxes is thus reduced to that of the exhaust from the respective cylinders. Referring to the cut of the working parts, the small arm A on the end of the pump rocker shaft is connected by a rod to a ratchet device which drives the oiler placed on the dashboard. The sprocket on the forward end of the crank shaft is connected by chain to the fan shaft, which runs faster than the engine. The fan itself is not rigidly fastened to the fan shaft, but is connected by a ratchet device, which permits the fan to run ahead of the shaft. Therefore, when the engine is stopped or slowed down the fan continues to run as long as its momentum persists, thus preventing any backlash in the chain. The fan shaft housing is held in place by eccentrics, and the tension of the chain may be readily altered by turning these eccentrics.

The crank case of the engine is made in one piece, but ready access may be had to all the parts within by the removal of the side and bottom plates, and the crank shaft



White 1909 Compound Engine

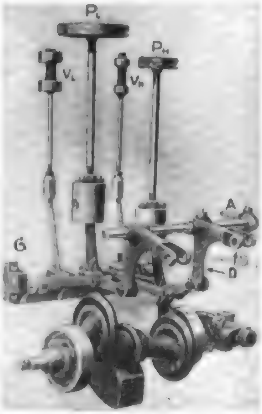
may be taken out through either end. Stuffing boxes are fitted to the upper end of the slides in which the cross heads travel, so that no oil may be splattered out of the crank case. The cylinders are provided with relief valves, opened momentarily by a little lever on the dash before admitting steam to the engine.

The engine is so adjusted that it runs normally on "cut off"—that is, the admission of the steam to each cylinder is stopped before the end of the stroke, and the steam then works expansively for the balance of the stroke. In starting the engine the pushing of the simpling pedal allows the engine to take steam during the full stroke. There is also a "cut off" pedal which, when pressed, produces the same results. This "cut off" pedal is used only when slow, hard pulling is required, as in climbing particularly steep grades or running over very heavy roads. An interesting feature of the Joy valve mechanism is that, when the "cut off" is changed, the "lead" of the valve is unchanged, and the engine thus runs more smoothly on "cut off" than was possible with the Stephenson valves. The engine is reversed and the "cut off" is changed by simply changing the tilt of the guide G.

The engine is supported on two cross members of the frame, which are so placed that the entire weight of the engine is behind the front axle, with the driving shaft perfectly horizontal.

Within the exhaust pipe from the engine to the condenser, on the right-hand side, is a coil of piping, through which the water from the pumps circulates on its way to the generator, this arrangement thus heating the feed water and aiding the process of condensation.

The generator is of the same construction as in former years. The system of temperature and pressure regulation is also the same as formerly.



Working Parts of White Engine.

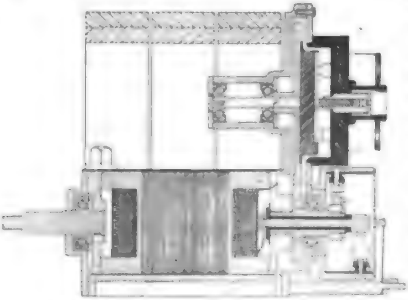
P H—High pressure piston.
P L.—Low pressure piston.
V H—High pressure valve.
V L.—Low pressure valve.
G—Valve guide, by tilting which the engine is reversed.
A—Rocker arm which drives the oiler.
D—Rocker arms which drive the pumps.

The Splitdorf Model B Magneto.

C. F. Splitdorf, of Walton avenue, New York city, is bringing out his Model B magneto for four and six cylinder motors. The apparatus is of the separate coil type—that is, the magneto itself is of the low tension type, and is furnished with a distributor for the secondary current, but the transformation of current takes place in a coil separate from the magneto itself.

The armature is of the built-up type, and is provided with a primary winding, one end of which is grounded and the other connected to a spindle, which rotates with the armature, and is insulated by means of a fibre brush. The make-and-break device is operated from the end of this shaft, and in enclosed in a cylindrical brass casing. Upon the armature spindle is mounted a brass pinion. This pinion is in mesh with a brass gear having a recessed web, in which is bolted a thick disc of gray fibre. Imbedded in this fibre is a brass segment fitted with a radial arm extending to the centre. The gear is enclosed in a casing, the lid or cover of which is of vulcanite, and is provided with four carbon brushes, which are kept in contact with the fibre disc by spiral springs. Upon the exterior of this casing are four cup-shaped terminals, each electrically connected to one of the carbon brushes, leads from these terminals being taken to the spark plugs. A centre carbon brush presses upon the radial arm of the brass segment, and a lead from a similar terminal is taken to the secondary of the coil. The pinion and gear are in the ratio of 1:2, and both the armature and gear spindles are mounted on ball bearings. The magnetos are of the U type, and are screwed to the armature casing in pairs, there being three of these pairs on the Model B instrument. The circular casing of the make-and-break is fitted with three binding posts. One of these leads to "ground" and takes off internally upon the end of the armature spindle. Another is connected to the anvil of the make-and-break and leads to one end of the primary winding of the coil. The third is for an auxiliary ignition by battery and coil, and is so connected that the make-and-break of the magneto may be used for the auxiliary circuit make-and-break, except that the current will flow in the opposite direction from that of the magneto current, and thus prevent wear upon the platinum points of the make-and-break.

The special coil furnished with this magneto is fitted with a two point switch used to put the magneto or battery into circuit, as desired, or to cut off either and thus stop the motor. The magnetos are well magnetized and are guaranteed to remain in good condition for one year. Each instrument is tested for leakage, timing, etc., upon a special stand, as well as being "run in" for fitting and adjustment. The weight in complete running order is 14¼ pounds.



Splitdorf Magneto, Sectional View.

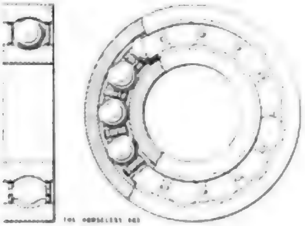
The Imperial Magneto.

The Gibson Automobile Company, 238 Massachusetts avenue, Indianapolis, Ind., have brought out a low priced magneto specially designed to be fitted to multi-cylinder cars sold with battery equipment only. The magneto is similar in most respects to the standard low tension magnetos now on the market, but it is not driven in synchronism with the motor by means of positive gearing. The driving means consist of a friction disc or wheel engaging with the flywheel of the motor, and the drive is controlled by a friction governor. The magneto takes the place of the battery regularly fitted on the car, and operates on the same coils and with the same timer. Its weight complete is 23 to 25 pounds. The armature shaft runs in annular ball bearings. The company supplies fittings for mounting the magneto on either one of a number of popular four cylinder machines, such as the Ford Models N, R and S, Maxwell cars and Premier cars.

Goodyear Air Bottles.

The Goodyear Tire and Rubber Company, Akron, Ohio, has added to its line a tire in-

Imperial Magneto Applied to a Ford Car.



Schafer Ball Bearing.

flating device known as the Goodyear air bottle, which is made in two sizes. This device is a small steel tank filled with compressed air. The small bottle holds sufficient air to inflate fully twelve 3 inch tires, and the large bottle sufficient to inflate twenty 3 inch tires, and other sizes in proportion. The bottles will partially inflate a great many more tires. The Goodyear Company has arranged to sell these air bottles through its agencies, and will refill the bottles for two years free of charge. The device was thoroughly tried out in the recent Glidden Tour.

Following are some records of tests, furnished us by the company, as to the effect of temperature changes on the pressure in these air bottles, which tests are held to prove that there is absolutely no danger in exposing to the rays of the sun a bottle containing nothing but compressed air.

Goodyear Air Bottles.

Difference in pressure at the different temperatures:

	Pounds.
Charged at	2,000
On ice three hours at 32 degrees	1,800
In boiling water one hour, 212 degrees	2,750
Gain over charging	750
Gain over cooling	950
Charged at	2,600
On ice two hours, 32 degrees	2,400
In boiling water one hour, 212 degrees	3,500
Gain over charging	900
Gain over cooling	1,100

In sun for two hours, 80 degrees, 2,700 pounds, pressure raised 100 pounds.

Schafer Ball Bearings.

These bearings are imported from Germany by Barthel & Daly, 42 Broadway, New York. They differ from other annular bearings chiefly in the manner of separating the balls in the silent type. The spacers used for the purpose are small pieces drop forged to fit the curve of the balls, with their ends riveted into side rings which nearly fill the space between the inner and outer races. By this construction adjacent balls are very close to each other, and it is claimed that from 25 to 50 per cent. more balls are used with a given bearing diameter than in other bearings of the silent type. For this reason greater loads can be carried.

Another peculiarity of these bearings is that the races are grooved more deeply than in other makes of the same size, so they will stand more end thrust.

Besides the usual assortment of sizes in annular end thrust bearings a special Schafer bearing is made for magnetos. It has flat ball races and a pressed brass ball separator. This bearing is sold at a lower price than is usually asked for bearings for this purpose. It is claimed that the material and workmanship in these bearings are equal to those in the more generally used makes.

A New Low Priced Mitchell Car.

It is announced that the Mitchell Motor Car Company, of Racine, Wis., are working on the design of a new touring car to sell at $1,500. It will be equipped with a four cylinder engine of 4¼ inch bore by 4½ inch stroke, rated at 28 to 30 horse power, a selective type transmission and magneto ignition. The wheel base will be 104 inches. The car will be fitted with a detachable tonneau, and may be used also as a three passenger roadster, and a two passenger runabout with a flat deck in the rear for a trunk or supplies. The car will be fitted with unusually big tires, viz., 32x4 inches in the rear, and 32x3½ in front.

The Holsman Light Delivery Wagon.

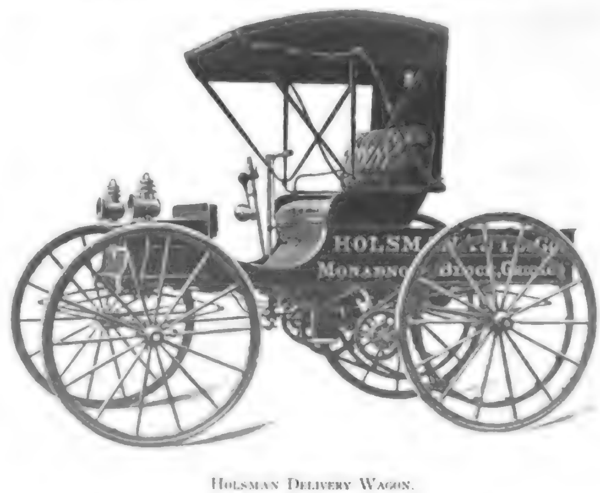
The Holsman Automobile Company, Monadnock Block, Chicago, are now marketing a light delivery wagon as here illustrated. The construction is practically the same as that of their Model 11, except that the body is built longer and deeper in the rear and has a drop end board. The size of the loading space back of the seat is 31x42 inches.

The Seabury Water Gauge Glass.

Seabury Water Gauge Glass.

The Steam Automobile Appliance Company, of Denver, Col., are marketing the Seabury water gauge glass for steam automobile and locomotive service. The gauge consists of a series of gun metal cylinders cast integral with one another, these cylinders being fitted with glass bullseyes to show the level of the water. These bullseyes are of Scotch gauge glass and are retained in place by means of brass rings, and packed so that an allowance of three-eighths of an inch is made for expansion. The water seen through these bullseyes has a black appearance, the empty compartment above the level showing white, thus giving a strong contrast and enabling the water level to be seen at a glance. The usual top and bottom connections are provided, being cast integral with the gauge frame itself. The makers guarantee the bullseyes to withstand 1,500 pounds pressure. The instrument measures 8x1¾x2 inches, and the distance between connections is 6¾ inches. A purging cock is fitted as in standard practice.

The London Road Car Company has made an agreement with the City Council of Westminster according to which the former will pay one-half of any damage done by its motor omnibuses to lamp posts and other municipal property.



Holsman Delivery Wagon.

Maintenance and Repairs

Dry Battery Trouble.

By "Merove."

Some time ago I was tramping along a country road when I discovered an automobile stalled some distance ahead. Finding the owner to be a very pleasant chap, I stopped and asked as to the nature of his trouble. The symptoms recited by him seemed to indicate weak batteries, and consequently this was suggested. His answer was that he hardly thought that possible, as he had not run more than 50 miles since putting in new dry batteries.

Not being satisfied, however, I looked over the cells and found that half of them had been improperly sealed and that there was a large crack between the zinc shell and the pitch with which the cells were sealed.

Inquiry revealed the fact that he hadn't used the car for several weeks until that morning, when he had seen signs of trouble soon after starting.

As he had no spare cells, I suggested that the ones he already had might be revived, as the active fluid had evidently been evaporated. Accordingly we took the defective cells to a farm house near by, broke out a portion of the seal on each cell and then gradually added water until they would absorb no more. The farmer supplied a hot stove poker, with which we then resealed the cells and went back to the car.

After connecting them up again the engine started easily, and my newly acquired friend was soon on his way again.

Several days ago I received a souvenir postal from him saying that he believed his batteries were better now than when he bought them.

This suggests that much annoyance may often be saved by examining new cells to see that they are properly sealed when purchased.

Care of the Planetary.

It is generally the unexpected that happens, and to guard against this as much as possible the car should be carefully inspected at regular intervals. Very few people have ever heard of the shearing of the screws that hold the two halves of some planetary gear cases together, yet this thing actually has occurred, and could have been prevented if the case had been even casually inspected. It is an easy matter even with the engine under the body to test these screws with a screwdriver to see if they are all tight, for unless they are there will be play between the two halves, and the extra stress will be sufficient to shear the screws and temporarily lay up the car, and, besides, unless the case is tight the oil will be thrown out very quickly.

The Automobile in Alberta, Canada.

By L. V. Kelly.

Alberta as yet has not developed into a great motoring province, but to judge by the steps which the industry has taken during the past three or four years it will not be long before it has proportionately as large a number of motor vehicles as any of the other provinces. Four years ago there were three or four lone motor cars in the entire province, and the people did not feel that they would be a success, but since then this method of locomotion has been tried, and tried hard, and the result has been more than satisfactory.

When the demand first began the smaller run of vehicles were the favorites, many believing that the big touring cars would not stand up on the prairie trails as well as the lighter cars, but this has proven to be a mistake, and the call now is for the large and high powered machines. There is little use for commercial vehicles as yet, although many merchants are seriously considering purchasing them, and the automobile dealers are expecting that the sale of these will take a boom next winter or spring. Pleasure cars are the best sellers, and since four years ago, when there were but four in the province, the number has increased until at the present date there are 113 licensed automobiles in the province, the high powered cars being about equal in number to the smaller runabouts. The demand now is nearly entirely for the big vehicles, although there is a certain call for the light ones for city and suburban runs.

The roads are splendid, particularly the natural trails across the prairies. Hundreds of miles of these level, hard and springy roads run from point to point, and the machines can stand the service over the trails better than over made roads. When the demand for automobiles first started the people felt that they were good only for city trips or short jaunts out in the country; but since the big cars have been used and have demonstrated that better time can be made over the prairie trails than can be made by the railroad, the high powered vehicles have become the favorites. The long runs from Calgary to Lethbridge or Macleod; from Edmonton to Calgary, and from Calgary to Medicine Hat have been made again and again without the slightest trouble. Cars are also now used for trips to the mountains, and into the foothills, while in the south, from Nanton to Carmen Gay daily service, over a course of about 30 miles each day, is about to be established.

Some record runs have been made in the long jaunts between the principal cities. Gasoline can be obtained in every small town or village, although the dealers have not yet commenced to cater particularly to the automobile trade. Every 10 or 20 miles there is a village of more or less size, and the necessary fluid can be obtained at these places.

The automobile industry is yet in its infancy, but the trade is flourishing, particularly in the four main cities. More and more cars are being brought into the country, and it is expected that the number will be doubled before another year has passed.

There are no clubs in the province, but organizing is going on in both Edmonton and Calgary, and the expectation is that a number of flourishing associations will spring from this agitation. Legislation is not very strict, and there are many miles of ideal speeding trails on the prairies from any of the towns.

There are already four large automobile liveries in the province, one at Medicine Hat, one at Edmonton, Calgary and Lethbridge. Although as yet in an early stage, this branch promises to be a big item in the motor business in the province before long. At present the livery rates are $5 per hour straight.

If the American machines are to be considered under the caption of foreign, then the majority of automobiles in the province are foreign ones. It might be said that all of the motor vehicles now being operated in Alberta are American machines, although a couple of makes are assembled in Canada, and one make is purely Canadian. No European cars have yet been sold here and no demand seems likely to arise for them, because the motoring public is satisfied with the class of cars that is already on the market.

The favorite American machines are the Franklin, Cadillac, Pope-Toledo, Pope-Hartford, Mitchell and Reo. All of these makes are well liked. Two American machines that are assembled in Canada are the Ford and the Buick. Both of these machines are popular for certain kinds of work, and good sales have resulted. The only Canadian made vehicle that is operating in the province is the Russell, and it has not yet become very popular. At present the Ford and the Franklin have the most sales, although the Pope-Hartford is gaining rapidly in favor and is well liked for the long runs.

Indiana Endurance Run.

The Indianapolis Automobile Trade Association last week arranged to hold its two days' reliability run on October 1 and 2, and the technical committee has begun to draft rules for the event. According to the wishes of a majority of the members the run will go to French Lick and return, going through Columbus, Seymour and Mitchell, and returning through Bedford, Bloomington and Martinsville. The run the first day will be 140 miles and the run the second day about 120 miles. A technical committee, consisting of G. A. Weidley, of the Premier Motor Manufacturing Company, chairman, and W. G. Wall, of the National Motor Vehicle Company, and Howard Marmon, of the Nordyke & Marmon Company, has been appointed to draft the rules of the contest, which will be looked forward to with considerable interest.

COMMUNICATIONS

"Spring Design."

Editor Horseless Age:

I read Mr. Furmidge's criticism in your issue of July 22, in answer to my communication of May 20, and I still maintain that Mr. Furmidge does not understand my article, otherwise I cannot conceive why he should continually misquote me and make statements that I never dreamt of. He says:

"According to Mr. Favary, to get the spring suspension right all the manufacturers have to do is to keep lengthening and widening the spring."

I request Mr. Furmidge point blank to indicate where I made any such statement.

In his criticism on long springs he says: "One company in particular have been doing this (lengthened their springs?) on their semi-elliptic, and for their 1909 cars have abandoned it entirely; this shows that it is impossible to make a car ride right with the old style semi-elliptic spring."

I ask any engineer whether, because one company has "abandoned it entirely" (I think Mr. Furmidge means to imply they have shortened their springs; if he means something else, I am sorry to say I cannot understand his very scientific language), this is any proof that it is impossible to make a good semi-elliptic spring, and that the many other prominent automobile manufacturers are wrong. If he will mention through your columns the name of the party that "abandoned it" (the long spring) I am willing to mention about twenty-five manufacturers that have done the opposite. It would also be interesting to know why his party has abandoned it; was it on account of too much flexibility or because the springs broke? If the latter, did they break because he considers the principle of the semi-elliptic springs wrong (if so, please, Mr. Furmidge, explain why it is wrong), or was the steel defective, the treatment incorrect, or the design and construction wrong?

Mr. Furmidge says: "The spring of the future will be the spring which will do its work in the shortest given space." (I think he means springs will have smaller deflections.) I do not contradict his statement in the least, but will he kindly explain why he considers such a spring superior, and how such a spring can be smoother in its action or more comfortable to the occupants of a car.

Again quoting from his criticism: "Regarding what he (Favary) says about patent springs, if people were not willing to adopt new things for old ones we would still be using the old ox wagon instead of the automobile, which is a bundle of patents from one end to the other."

I wish to ask Mr. Furmidge to point out to me where or when I made any such statement, or where I meant to imply that I am adverse to new patents. I scrutinized my article of April 18, and my communication of May 20, and I cannot find where I made any such statement.

In answer to his criticism of April 1, where he compares me to a physician, etc., I said Mr. Furmidge's one advocated remedy for curing all the defects sounds like advertising a patent medicines for all the ills that springs are heir to; and further, in answer to his ridicule on spring breakages on the rebound, I said: "Mr. Furmidge makes no distinction between the top leaves and the bottom leaves; he calls them all spring breakages, and invariably advocates his patent remedy."

I still maintain that whenever the top leaf only or the two top leaves of a spring are broken, said breakage, in many cases, is due to the rebound, and the rebound only, notwithstanding Mr. Furmidge's jejune remark: "This idea belongs to the last century and has been riddled with proof so conclusive that this idea has been buried beyond the hope of resurrection, and I am surprised at Mr. Favary digging up the corpse again." It sounds as if Mr. Furmidge had been looking up lexicons or bombastic rhetorics, because this language does not seem to correspond to the rest of his technical (?) style.

To prove that springs do not break on the rebound Mr. Furmidge says: "All you would have to do is to use straps to keep the springs from opening more than, say, 3 inches beyond normal, which would entirely stop the chance of breaking on the rebound."

I think whatever is good for the goose is good for the gander, and if the straps entirely stop the chance of breaking on the rebound, then, using Mr. Furmidge's synthetic philosophy, rubber bumpers ought to entirely stop the chance of breaking on the downward deflections of the springs. Yet we know that many owners use both straps and bumpers, often also shock absorbers, and still have breakages, although, as they claim, less frequently than formerly.

The reason why straps do not prevent the springs from breaking on the rebound is the following: Take a new spring having an ultimate deflection upward of about 5 inches, and use straps so as to check said deflection at 3 inches. As long as the spring is new an upward motion of 3 inches could not break it, but if on account of an excessive overload the spring be permanently distorted or set down 1 inch (this may not even be perceptible) an upward deflection to the 3 inch limit of the strap would now amount to 4 inches, and this might now cause breakage of the top leaves, as the fibre in the metal is under greater strain. If the permanent distortion is greater, the chances of breakage (of the top leaves) on the rebound are greater.

Mr. Furmidge says he examined all the cars in the Glidden Tour that had broken springs, and they all had straps, "which shows conclusively that this (breakage on the rebound) is entirely erroneous." I presume Mr. Furmidge considers it erroneous because, no doubt, many of these springs which he examined were permanently distorted downward, and this to him might seem an additional proof that these springs broke on the downward deflections.

If a spring with its top leaves broken shows the rest of the leaves greatly bent or distorted downward, I consider it an *additional proof*, in most cases, that the top leaves *broke on the rebound*, for on the downward deflection the lower leaves are under greater strain (as explained fully in my article of March 18).

If rubber bumpers are used to prevent excessive deflections, and straps to prevent excessive rebounds, the top leaves might still break on the rebound, because, after some time, crystallization takes place in the metal, thereby reducing the ultimate deflections of the springs. The same holds good for breakages on the downward thrusts.

If Mr. Furmidge has the audacity to criticise, why on earth does he not illustrate his criticism by proofs and explanations, so as to substantiate his claims?

All his statements about "digging up the corpse," "treatise on the breeding of horses," "the old ox wagon," "rebounding and fixing the telegraph wires," etc., are very euphonious; but he does not in a single instance say or explain why the coil spring, which he advocates, is the panacea for all the ills of springs. I think every engineer is on the lookout for new improvements and is only too willing to avail himself of the benefits derived, but he must be convinced that an improvements have been made.

I do not wish to disparage the device advocated by Mr. Furmidge in the least, but, as mentioned before, I would like to have some reasons and explanations why it is so useful.

E. Favary.

Brass Plating Steel.

Editor Horseless Age:

We would like to have you give us a formula for putting brass plate on steel.

B. B Company.

[According to the Electro-Plater's Hand Book, by G. E. Bonney, the steel must be first pickled in a solution of 6 fluid ounces of sulphuric acid to each gallon of water, and then rinsed in clean water, after which it should be scoured until a clear, bright surface is obtained. Then to remove the grease dip the steel in a hot potash bath made by dissolving one-half pound of caustic potash or American potash in each gallon of water used. The steel should be again rinsed in clear water, after which it is ready for the brass. A brassing solution is made by dissolving good sheet brass in nitric acid, and using this solution instead of copper and zinc salts in making up the brassing bath. Dissolve strips of sheet brass in warm diluted nitric acid until the acid ceases to dissolve any more brass. Avoid the resulting fumes. Add the brass solution to water in the proportion of one ounce of brass to half a gallon of water; to this add strong liquid ammonia until the solution assumes a clear, deep blue color; to this add a strong solution of potassium cyanide until the blue color entirely disappears and the solution assumes the tint of old ale, then filter and make up with water so as to contain one ounce of brass in the gallon of solution. This solution will work well cold or hot, but should be left for some hours after making before using. Care must be taken to keep this solution in proper working condition. The anodes may be of good sheet brass, or they may be of best rolled sheet zinc and sheets of electrotype copper in equal numbers. The anodes must dissolve freely, otherwise the solution will become poor in metal, resulting in a poor deposit. It is best to use an excess of ammonia so that the oxide of zinc which forms on the zinc anode may readily dissolve. For an excess of zinc in the solution add more free cyanide, which will dissolve the copper. Brassing solutions require from six to nine volts, depending on their composition, and a current volume depending on the kind of brass desired in the deposit.—Ed.]

Ignition Queries.

Editor Horseless Age:

Will you kindly explain in the columns of your paper the following queries regarding the wiring of a gasoline engine?

In the system of wiring shown in Fig. 1 is not the wire A as much of a secondary wire as B? Isn't it both a primary and a secondary wire? Doesn't the voltage of the current passing through it equal the voltage of the primary and secondary currents combined? If not, why not, and if so why isn't it necessary to insulate it as heavily as wire B?

Would as good results be obtained if we should connect wire A with binding post E, and wire C with binding post D? In other words, if we require the secondary circuit to be completed through the movable part of the make-and-break mechanism does it have any bad effect or cause the engine to miss?

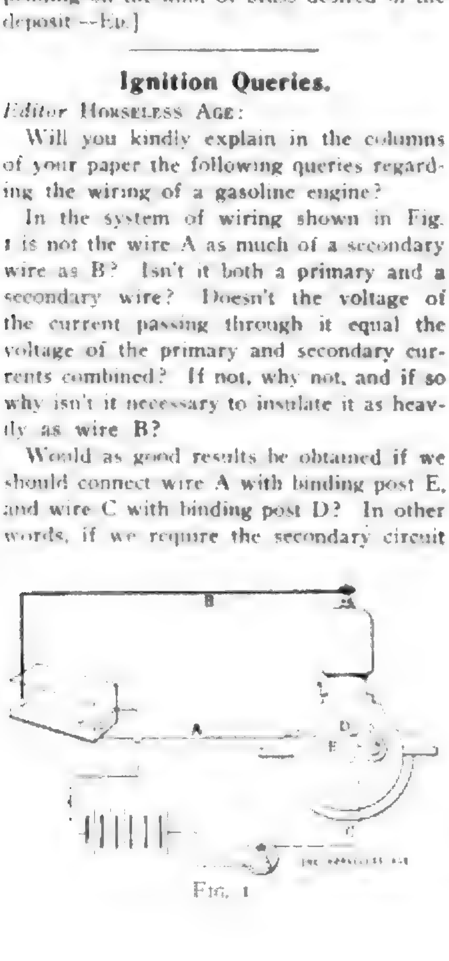


Fig. 1

Is it injurious to the batteries, or for any other reason a poor plan to wire an engine as shown in Fig. 2, completing the secondary circuit through the battery?

O. W. N.

[The wire A carries the secondary current, the same as B, but it doesn't need to be insulated as heavily as B; in fact it doesn't need to be insulated at all, as its very purpose is to carry the current into the frame of the motor, and that is where the current would go if there should be any leakage from A. On the other hand, if there was leakage from B to the frame of the motor, the secondary circuit would be short circuited, and no spark would occur at the points of the spark plug. The wire A is usually referred to as the common ground connection. It carries both the primary and the secondary currents. The voltage of the current passing through A is the same as that passing through B, as the same current flows through both of these conductors. Voltage may be regarded as pressure, and there is only one pressure tending to send a current through the secondary circuit, which is composed of the secondary winding of the coil, the wires A and B, and the spark gap of the spark plug. But it is not to oppose this pressure that insulation is needed on the wires. This insulation is needed mainly to prevent current flowing from the wires into the motor casting or the vehicle frame. The wire A being directly connected with the motor casting and vehicle frame through binding post D, the blade and the interrupter shaft, it is at the same potential (or electrical level) as the motor body and vehicle frame (technically referred to as "ground"), so there is no pressure tending to force current to leak from wire A to "ground." Wire B has no metallic connection to "ground," except through the secondary winding of the coil, in which the pressure is induced or generated. The difference of potential between wire B and ground is substantially equal to the voltage of the secondary circuit, and if leakage from B to "ground" is to be prevented, B must be covered with heavy insulation.

Although the arrangement shown in Fig. 2 would probably work, we do not consider it nearly as good as Fig. 1, for the reason that the secondary circuit would not be effectively grounded. The secondary current or spark only passes after the primary current has practically ceased, at which time the contact blade would have left the contact screw, and the secondary current would have to force its way not only across the gap between the points of the spark plug, but also across the gap between the contact blade and the contact screw. The result would be that the spark would be reduced in volume, and that there would be considerably more sparking at the interrupter, burning the contact point away more quickly.—Ed.]

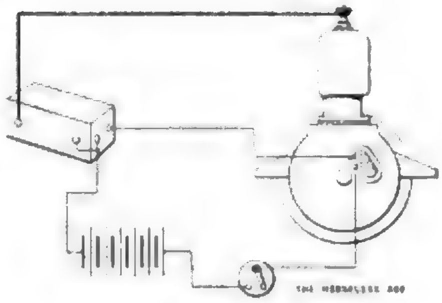


Fig. 2.

What the Glidden Tour Was Supposed to Be and What It Really Was.

Editor Horseless Age:

A number of automobile owners and manufacturers—the owners for the sport, the manufacturers for the advertisement, together with a view of perfecting any shortcomings in their make of cars—entered this tour. Each had every reason to expect at least fair play, excepting the undersigned, who from the start was positive justice could not be expected only on condition that one certain make of cars went through with a perfect score. That the Peerless team made the only perfect score from the start is, of course, the opinion of a majority of the contestants. Why? For every reason that can be described. The operation of their cars, the conduct of all the crews and the absence of racing. In fact, as before stated, everything that goes to make automobiling perfect was theirs; that there were other good cars, perfectly handled, and which individually did as well as the Peerless, there is no question. So much for the Peerless; but readers please understand the undersigned drives a Thomas, with which he is more than pleased. That the trophy kindly put up by Mr. Glidden for this kind of sport should fall under the handling of a chairman who is claimed to have an interest in a manufacturing company whose cars were entered is or looks wrong to start with; that the trophy was awarded to the Pierce team, who for reasons entirely too clear to need further comment returned same. That the attention of the chief observer need be commented on is too plain for further detail; that he satisfied his personal feeling on any and all, and for reasons best known to himself. The tour so far as receptions given by the automobile clubs, the beauty of scenery, the division of day runs, the care with which we were handled by the hotels, the weather, and if the writer could only include the final decision, would have made the run perfect.

Gus G. Buse.

For our Runabout Number, September 23, we desire practical contributions on the use of this class of vehicle in various callings. If you wish to contribute write to the editor.

LEGISLATIVE and LEGAL

Necessary Features of Proposed Automobile Legislation.

By Walter S. Schutz, Counsel Connecticut A. A.

Limitation of speed was the sole purpose of our earlier statutes, next the identification of the car was considered of importance, then the control and responsibility of the individual operator became the main object of the law. The time is not far distant, in my opinion, when revenue will be the chief, if not the sole, reason for automobile legislation. The fact that high powered cars seriously injure the roads makes it necessary to collect an ample revenue from automobilists, and apply this to the maintenance of present roads and the new ones.

There are four points which the model law must cover, viz., proper identification, control of operator, reckless driving provisions, and a clause which will prevent the establishments of traps, where the law abiding motorists are caught on technical violations, and through which the speed maniacs easily escape in their high powered machines.

My personal opinion is that the examination of drivers, either professional or amateur, avails nothing and is only a needless expense to the State. Indeed, I believe statistics will bear me out when I say that the great majority of accidents result from the reckless driving of experts rather than from the ignorance of novices. I do not think we should make any distinction between private operators and professional chauffeurs. No reasonable person is going to engage a chauffeur until he is satisfied that the applicant can operate a car, and if the chauffeur's license is annual, while the amateur's is good until revoked, the owner will pay the fee in both cases. With a proper minimum age limit, it seems to me perfectly safe to license any applicant with the proviso that his license will be revoked if he proves himself in any way unworthy of the privilege granted.

Public sentiment is opposed to all forms of highway robbery, and in nine cases out of ten a speed trap is operated for no other purpose than to catch a driver and hold him for a technical violation. Each day it is becoming more apparent that the only true test of proper operation is to determine the speed at a particular time, and to take into consideration the width of the highway, the amount of traffic, and the number of pedestrians and the houses along the highway.

The Connecticut law, which has proven very satisfactory to all classes of citizens and to visiting as well as resident motorists, provides that no person shall operate a motor vehicle on the public highway recklessly, or at a rate of speed greater than is reasonable and proper, always having a regard for other property and for life and limb. Convictions under the new law have been secured under difficulty in cases where the operation of the car was improper, and the Connecticut authorities are holding the reckless in better restraint than they are held in any other State where the automobile laws are based upon speed limitations. An abstract of each conviction is furnished the Secretary of State, and in flagrant cases the Secretary of State has the power to revoke the license of the driver. It is significant that up to this time none of the reports from the courts have recommended such action on the part of State officials.

A very important feature of the model law is the fair and liberal treatment of non-residents. In Connecticut non-residents are admitted for a period of not more than ten successive days, provided, of course, they carry a license from the States from whence they come.

As to revenue, it seems to be reasonable to suppose that the automobilists can afford to bear the burden of the reasonable check, provided he is not unjustly hampered in the use of his car, and also feels that the money which he pays is to be used in maintaining the roads. With their constant increase in number the power of automobilists to properly influence legislation is enormous. If the State automobile associations and the local clubs will work systematically to secure simple and uniform autmobile laws, the remaining barriers between States will soon fall away, and petty and needless restrictions upon the proper operations of automobiles will disappear.

Decision Regarding Agent's Discount on Repairs.

A decision of some interest to garage men was handed down by Judge Hodgson, of Buffalo, last week in a suit brought against a Buffalo dealer by a Cleveland manufacturer, for whom the dealer had acted as agent. The amount in dispute was 25 per cent. discount on an order for repairs amounting to about $200. A provision of the contract between the manufacturer and dealer, which was submitted in evidence, read as follows: "That on orders for parts for delivery in said territory by dealer, the manufacturer agrees to allow a discount of 25 per cent. from the list price." The testimony brought out the following facts: In 1907 the automobile was sent by defendant to the plaintiff and repairs were made in the plaintiff's shop in Cleveland, parts of the value of $211.08 being put on. When the repairs were completed the automobile was returned to the defendant. The amount in dispute was a discount of 25 per cent., which the defendant claimed under the contract provisions. In his opinion Judge Hodgson said:

"It seems to me that the contention of the defendant is reasonable. It is admitted that he would be entitled to the discount if the parts put on had been sent to Buffalo unattached. I am unable to see why it interferes with the defendant's rights that the parts were sent attached to the automobile. No matter how they got here, they were delivered to the defendant's order and he should have the commission."

New Jersey Motor Vehicle Commissioner Proceeds Against E. R. Thomas.

Commissioner of Motor Vehicles J. B. R. Smith, of New Jersey, has instituted proceedings against E. R. Thomas, of New York, the former banker and turfman, for having driven a 120 h. p. Hotchkiss car on the roads of that State at the rate of 70 miles per hour, and caused a serious accident. The accident occurred near Long Branch recently. While driving the car at approximately the above mentioned speed, Thomas encountered a horse vehicle, and was unable to avoid a collision. Both the horses got killed, and the occupants of the vehicle were thrown out and seriously injured. Thomas and his mechanic also were thrown from the vehicle and received bodily injuries, and Thomas is now in a hospital.

Thomas is to be proceeded against under two separate charges, viz., of driving at illegal speed and of driving without a driver's license. The car he drove is registered in New Jersey in the name of Harry Levey, of 311 West Forty-third street, New York. It is rated at 120 horse power, and it is stated that it is impossible to drive it at legal speed. Mr. Smith announces that he has notified all agents of the motor vehicle department not to register any cars of over 65 horse power, which will only be registered upon personal application to the commissioner, and then only temporarily, as the commissioner believes that the regular use of these vehicles cannot be justified.

Legal Notes.

The city council of Minot, N. Dak., has been petitioned to amend the automobile ordinance so as to abolish the $1 license.

Under the recently adopted licensing ordinance in Little Rock, Ark., forty-four automobiles have so far been licensed, which is thought to include practically all the cars in the city.

The board of trustees of Sacramento, Cal., has passed over the veto of the mayor the new law giving physicians responding to emergency calls the right of way over other vehicles on the streets.

The commissioners of the District of Columbia have adopted a regulation which provides for the immediate refund upon demand of the fare paid by any passenger whenever a sightseeing automobile fails to leave the designated starting point within at least ten minutes of the time announced for the departure.

Jos. J. Jermyn, vice president of the Scranton Automobile Association, on August 17 swore out warrants against the burgess and council of Archibald, on account of their failure to keep the roads in proper condition. Constable Mitchell served the warrant and notified the defendants of a hearing on August 20.

The city of Long Branch, N. J., has engaged two special police officers to devote their whole time to stopping automobile speeding.

Chief of Police Shippy, of Chicago, announced that owners of vehicles who failed to pay their wheel tax up to last Saturday would be liable to arrest.

The Buffalo, N. Y., police have instituted a campaign to enforce the ordinance requiring all automobiles to be provided with underpans, and are also enforcing the speed ordinance. Quite a number of arrests have already been made.

The board of trade of Santa Monica, Cal., has appointed a committee with the object of stopping "automobile baiting," as the operation of speed traps by the police is referred to. The board of trade fears that if the practice is continued Santa Monica will lose its reputation as a resort for motorists. The automobile catchers are said to receive a percentage of the fines, which makes them rather eager to arrest motorists.

It is claimed that old license numbers are being illegally used by many automobile owners in Iowa. The State law provides that every motor vehicle must be separately registered (fee, $5) and that license numbers cannot be transferred from one car to another, yet, it is claimed, old numbers issued for cars that are known to have long since been thrown on the scrap heap are being used on new cars in Des Moines. An investigation is to be made.

Judge T. A. Whallon, of the Indianapolis Police Court, has ordered several hundred warrants issued for the arrest of automobile owners who failed to pay the city license fee last year recalled. Many of the warrants had been served and the victims fined, while in numerous instances it was found owners had paid the fee after the warrants were issued but before they were served. Judge Whallon said the cases took up too much time in court, and ordered all the remaining warrants destroyed.

The Motor Vehicle Commission of New Jersey recently had to deal with a rather peculiar case. On June 28 Dr. Julius Shenkin, of Third and Lombard streets, Philadelphia, was arrested for speeding by Justice Garven at Ellwood, N. J., and fined $10 and costs, $13.90 in all. He gave the justice a check, which was forwarded to the Motor Vehicle Commission for collection, but the commission found that payment on the check had been stopped by the doctor. Dr. Sherkin's New Jersey license may be revoked in consequence.

Electric Vehicle Company's Affairs.

The Electric Vehicile Company, of Hartford, Conn., has more than 225 men at work on the 1909 model. The 1909 car will be similar to the 1908, but the wheel base will be lengthened from 100 to 115 inches, so as to be suitable for touring, runabout or limousine bodies. The horse power will be 29. The receivers wish to make several hundred of these cars. A number of the electric victoria phaetons will also be turned out. By the middle of September from 800 to 900 men will be at work in all the departments.

Many creditors of the Electric Vehicle Company failed to present claims within the time fixed, and the receivers had the time extended. Claims amounting to $21,632.52 have since been presented. The receivers say that according to the books of the company there is but $18,031.83 due on them.

Offer Made for Pope-Waverley Plant.

Vice Chancellor Howell, of New Jersey, on August 20 signed an order for a hearing September 8 on an application of the receivers of the Pope Manufacturing Company to be given permission to accept an offer of $190,000 for the Pope-Waverley plant in Indianapolis. This plant, which produces the well known Pope-Waverley electric vehicles, is owned by the Pope Motor Car Company, all of the stock of which is controlled by the Pope Manufacturing Company. If the deal goes through it is likely that a third dividend of 25 per cent. will be paid to creditors of the Pope Manufacturing Company. At the same date as above there will also be a hearing on the question of a payment of 2½ per cent. to Thomas Laylor & Co., of Chicago, who negotiated the recent sale of Columbia Steel Company stock for the Pope Manufacturing Company. The sale price was $190,000, and it is on this that the commission is to be based.

Testing Shafts for Twisting Strength.

The following method for determining the resistance to twisting strains of the driving shaft on Rambler cars has been devised by Frederick Purdy, head of the Rambler testing department. A portion of the driving shaft, together with the squared portion on which the gears are mounted, is rigidly held at one end and twisted with a rack and pinion at the other on a pitch radius of 2¾ inches, which corresponds to the length of the crank. The pressure required to twist the shaft of special steel is 12,000 pounds, the torsion increasing rapidly to 13,000 pounds when the shaft is permanently set. Fourteen thousand pounds are required to twist the squared portion of the shaft, but this is not permanently set until the application of 15,000 pounds. It will be seen from the photo that this shaft has been twisted permanently half a revolution without any sign of rupture.

Fall Meeting of the Society of Automobile Engineers.

This meeting has been set for Friday and Saturday, September 18 and 19, at Cleveland. A large part of the time will be devoted to an inspection of the various automobile factories located there. It was originally intended to make the date of this meeting somewhat later in the fall, but it could not be arranged without conflicting with events which would have prevented the attendance of a large number of members. So far as outlined at present the program will be as follows: Convene at headquarters (to be determined later) at 9 a. m. Friday, September 18, the morning being devoted to factory visits. The afternoon and evening will be given over to the business meeting, reading of papers and a dinner, followed by further sessions. Saturday morning will be devoted to further visits, while the visiting members will be in the hands of the local committee Saturday afternoon, for any form of entertainment the latter wish to provide.

Warner Gear Company Incorporated.

The Warner Gear Company, of Muncie, Ind., which was formed as a partnership in 1903, was last week incorporated with the Secretary of State of Indiana with a capital stock of $500,000. The officers of the company are: President, A. L. Johnson; vice president, Hugh L. Warner; treasurer, Ray P. Johnson; secretary and general manager, Thomas W. Warner. These, together with W. E. Hitchcock and Thomas Morgan, compose the board of directors of the company.

The company was originally formed to manufacture differential gears, and then occupied a one story frame structure 30x40 feet. Later such other automobile components as change gears, steering gears, clutches, etc., were added to the line of products, and a modern factory was built up at Clerk and Penn streets on the Big Four tracks, which the company is now occupying.

System of Rewarding Employees for Useful Suggestions.

The Chalmers-Detroit Motor Company, finding that their employees had made some excellent suggestions with regard to their own work or the work of some department, are offering prizes for the best suggestions that may be received, as well as for any others adopted by the company. Small registers, such as are used in stores for making duplicate copies of bills, are installed in various parts of the factory and the employees write their suggestions thereon, the copies being made in triplicate. The first of these copies is retained by the employee, the second is placed in a box intended for its reception, and the third remains in the register for a permanent record. The boxes are opened at intervals and the suggestions are passed upon, awards being made quarterly. The system is thought well of by the employees, and tends to create interest among the men in their work.

Commercial Applications.

Factory Use of Automobile Motors.

The Maxwell-Briscoe Motor Company, of Tarrytown, N. Y., believe that around an automobile factory the automobile and automobile engine should be used wherever there is need of work that cannot be efficiently performed by muscular effort. The writer recently had an opportunity to observe some interesting applications of this policy. A bridge on the main road that leads to the factory was in need of repairs, needing new piling, which was being hauled to the spot by one of their four cylinder cars hitched to the big piles by block and tackle. Further on a fill was being made beside a stream that flows past the factory, so a suction dredge was improvised which, by a centrifugal pump, drew the mud and water from the stream and forced it to the fill, the mud being precipitated and the water flowing off. The motor driving this pump consists of two regular 40 horse power engines coupled together. Further on they were making an addition to their forge and blacksmith departments, in which a 1,000 pound drop hammer and two punches were already installed but not connected to the main plant. The machines were needed at once, so the automobile engine was resorted to, a four cylinder 24 horse power stock engine being mounted on a suitable bed and belted to the line shafting. This little motor easily ran the big hammer and punches when all were working together.

Commercial Notes.

At Duluth, Minn., it is proposed to buy a motor patrol for the police department at a cost of about $3,000.

Chief Tyson, of the Louisville (Ky.) Fire Department, has been provided with an automobile in which to attend fires.

The police department of Fargo, N. Dak., is endeavoring to have an appropriation made for a motor patrol wagon.

The Department of Docks of the City of New York has purchased two Acme cars after having published specifications and solicited bids.

Col. I. H. Dungam of Humboldt, Tenn., is planning an automobile service between Humboldt and Dyersburg, via Gibson Wells. The plan is to operate three or four large cars.

Hexter Taximeter Cab Company, New York city, will move about October 15 to 249-251 West Sixty-fourth street, and will engage more extensively in the taxicab business.

The Twin City Motor Company has been organized by capitalists of Houghton and Hancock, Mich., with $50,000 capital, with the object of operating an automobile line between the two cities across Portage Lake bridge and to nearby towns. This is an extension of the service recently installed between Red Jacket and Laurium, 1½ miles, where four cars are now used to maintain a five minute schedule.

Saunders & Butler, Newbury street, Boston, Mass., have placed in service in that city the first of a lot of twelve White steam taxicabs. They are built on the Model O 30 horse power chassis, and seat four passengers inside, and one beside the driver. American taximeters are fitted.

The woman taxicab driver plan, which proved a failure in Paris and Berlin, is now to be given a trial in New York. The manager of the taxicab service operated from the Knickerbocker Hotel thinks the woman driver an excellent advertising feature, and has engaged Miss Frieda Klinger to try out his ideas.

The fire departmeent of Wheeling, W. Va., is corresponding with manufacturers of motor fire engines, money having been appropriated for the purchase of two such vehicles. One of them is to be a combined chemical fire engine and hose wagon and the other a runabout with four 7 gallon fire-extinguishers.

The Arnold Print Works, North Adams, Mass., are using three air cooled trucks between their various mills and the freight houses of the railways. The net result of the change from horses to motors is not known, but it is understood that one of the trucks which makes some of the longer hauls has displaced three teams.

The Mexico City Club and Omnibus Company has had a 35 horse power Panhard omnibus in service for a month between Zocalo and Colonia Roma, with satisfactory results, it is reported. Ten such omnibuses have been ordered. They carry thirty passengers each. Later on the company expects to introduce Panhard taxicabs.

Harrisburg Fuel Economy Contest.

A 1 gallon fuel economy test was held by the Motor Club of Harrisburg, Pa., on Saturday, August 15. There were twenty-two entries and eighteen cars started. The event began at 2:30 o'clock p. m., and the cars were sent from the starting point up North Second street to Reily, to Sixth, to Maclay, to Second, to Front, to Market, to Market square. The length of this course is about 4 miles, and the cars circled around it until their fuel supply became exhausted. When they finally came to a stop they were pushed to the side of the road and the driver and official observers remained on the spot until the official car came along to take down the record and supply them with sufficient fuel to run home on. J. Clyde Myton was referee.

The contest was won by a single cylinder Cadillac equipped with solid rubber tires; that is to say, this car covered the greatest mileage of all. The competing cars were divided into eight classes, according to cylinder number and price. The summaries follow:

Class 1—Single cylinder runabouts, won by Cadillac, 38½ miles; second, Reo, 23.9 miles.

Class 2—Two cylinder runabouts, won by Jackson, 31.6 miles; second, Maxwell, 31.3 miles.

Class 3—Two cylinder touring cars, won by Maxwell, 33.2 miles; second, Jackson, 30.2 miles.

Class 4—Four cylinder runabouts, under $1,000, won by Buick, 28.6 miles; second, Ford, 22.4 miles.

Class 5—Four cylinder runabouts, between $1,000 and $2,000, won by Franklin, 32.6 miles; second, Pullman, 24.2 miles.

Class 6—Four cylinder touring cars, costing under $2,000, won by Pullman, 27.8 miles; second, Franklin, 21.5 miles.

Class 7—Four cylinder touring cars, above $2,000, won by Cadillac, 27.5 miles; second, Franklin, 17.5 miles.

Class 8—Four cylinder runabouts, above $2,000, won by Cleveland, 20.2 miles; second, Pullman, 19 miles.

Road Map Reading.

One of the requirements of a motorist, whether professional driver or amateur, should be the ability to read maps. This is a part of driving training which is overlooked for some unaccountable reason, although it is very easy to learn, and certainly is most useful. A good method of practice is by the use of a street map, taking two points thereon, and tracing the course from one to the other, driving the car over the course meanwhile. This should be first done in a city where the driver is familiar with landmarks, crossings, etc. Next a short run by map in the country should be taken, keeping the north point of the map toward the north, and noting landmarks, etc., as the run is made. A few trials of this nature will suffice to give an excellent training in map reading. Not only will this create an interest in touring, especially in a section of the country strange to the driver, but sufficient information can be got from most maps to insure careful driving at bad spots, thus averting accidents. This in itself should be a strong argument in favor of training in map reading.

How Cable News Can Be Manufactured.

An automobile race is to be held in Beaumont, Tex., and the local papers are boosting the event with all their might. To stimulate local interest in automobile racing among the population the Beaumont *Journal* printed the following "special":

GREAT EUROPEAN AUTO RACE.

(Special to the *Journal*.)

PARIS, August 12.—The annual race of the Automobile Club of France over the Ardennes circuit, which stands next in importance to the Grand Prix among the annual automobile racing fixtures in Europe, started today under favorable auspices. The cars were sent off at 10:30 a. m. The circuit measures 85.714 kiloms., and is to be covered seven times. Entered in the contest are the foremost cars of French, English, German, Italian and Belgian makes.

The *Journal* probably has the distinction of being the only newspaper in the world reporting this event, which was never held, having been abandoned on account of lack of entries and interference with the date for the Bologna race meet, as reported in THE HORSELESS AGE recently.

MINOR MENTION

The Autocar Company, of Ardmore, Pa., expect to bring out a commercial vehicle shortly.

The automobile classes held at the New York city Y. M. C. A. were attended by 641 students last year.

The firm of Benz & Co., of Mannheim, Germany, has declared a dividend of 8 per cent. on its capital stock for the recently concluded business year. Last year it declared 15 per cent. dividends.

In Berks County, Pa., 443 automobile licenses have been issued this year, this including licenses to both owners and drivers. It is estimated that there are about 415 cars in the county, of which 280 are owned in the city of Reading.

The Motor Car Company, of Detroit, manufacturers of the Cartercar, who employ about seventy-five men, are considering to move away from their present location. It is understood that inducement have been offered the company by Toledo, Ohio.

A hill climbing contest will be held in Minneapolis, Minn., on Saturday next, starting at 2 p. m. The hill has not yet been definitely selected, but the climb will probably be held on Columbia Heights. There will be events for six classes.

The Indiana State Board of Agriculture will oil Thirty-eighth street, from Meridian street to the fair grounds, in Indianapolis, during fair week next month. This is for the benefit of those who desire to attend the fair in automobiles, and the work will cost about $100. Last year sprinkling with water was found impractical.

A petition in bankruptcy has been filed against the Albany Automobile Company, manufacturers of motor buggies, at Albany, Ind., by stockholders of the company. The liabilities are estimated at $4,800 and the assets at $2,500, the latter being represented by machinery, tools and unfinished parts. There is no money on hand.

The Sun Automobile Agency, Rising Sun, Ohio, have completed a new brick building, 35x75 feet, one story high, on Day street. The building has a stone coping and cement floors, and offices are located in the front portion. The firm makes a specialty of buying used cars and building them over, and also does repairing of all kinds. C. A. Ulsh is the sole member of the firm.

The Gramm-Logan Motor Car Company have been formed at Bowling Green, near Toledo, Ohio, by parties formerly connected with the defunct Logan Motor Construction Company, of Chillicothe, Ohio, to manufacture commercial vehicles. J. B. Wilson is president; B. A. Gramm, vice-president and general manager, and Fred Bisantz, superintendent. A plant comprised of one-story brick buildings just outside of the town has been secured. Side tracks lead directly to the plant, and a gas plant is located on the premises.

A Mr. Van Tuyal, of Iowa City, who was formerly connected with O. S. Kelley & Co., of that place, is endeavoring to organize a company in Wichita, Kan., to manufacture automobiles.

A. S. Lanich, Baraboo, Wis., has disposed of his experimental motor car to Dr. J. E. English, and will continue the manufacture of automobiles. The machine is of the high wheel buggy type, having an air cooled 12 horse power engine and live axle with centre sprocket.

The Wrightsville and Chanceford Turnpike Company, York, Pa., has decided to build a roadway along the lower Susquehanna from Wrightsville to Long Level, at a cost of about $10,000, using the old towpath along the abandoned Pennsylvania Canal.

It is reported that the Cleveland Auto Cab Company, which recently began operations in the former plant of the Geneva Steam Automobile Company, Geneva, Ohio, has recived an order for fifty taxicabs, to be placed in service at the Auditorium Hotel, Chicago.

The Muncie Trust Company has been appointed receiver for the Albany Automobile Company, New Albany, Ind. The receivers were instructed by the judge making the appointment to operate the plant if any orders for automobiles or parts are on hand, and to use up the raw material.

The Premier touring car which is being driven 100 miles for 100 consecutive days reached Washington, D. C., on August 18, completing its seventy-ninth century run. On the following day it started on its return to Indianapolis by way of Hagerstown, Cumberland and Columbus.

According to the report of the receivers of the Pope Motor Car Company, Toledo, Ohio, the company had a cash balance of $107,553.09 on July 1, and $102,098.60 at the end of the month, an increase of $24,545.51. The sales for July amounted to $60,099.05, and the factory payroll was $13,764.11.

The report of John F. Steel, City Treasurer of Pittsburg, shows that there are 1,198 automobiles in use in that city, in addition to which, it is thought, at least 100 are stored away in garages and not used. Since February 1, 1908, 842 licenses for large cars and 350 for small cars have been issued.

McCord & Co., manufacturers of mechanical lubricators, etc., are seeking a new location for their Chicago factory in some northern Indiana town. Mishawaka, Elkhart and South Bend are being considered, and it is proposed to erect a plant with over 60,000 feet of floor space at the point selected.

The Philadelphia automobile show during the coming winter will be held January 23 to 30, immediately following the Madison Square Garden Show in New York. It will be in charge of a committee of the Philadelphia Automobile Trade Association, consisting of J. A. Wister, of the firm of Gawthrop & Wister, president; W. F. Smith, manager of the Philadelphia Rambler branch, and E. H. Fitch, manager of the Philadelphia Diamond Tire branch.

It is reported that George M. Lowe, of Boston, a well known dealer in that city, will be at the head of a new company which will handle the Gyroscope car in New England.

The Marvel Motor Car Company, which up to last November occupied a factory building at 284 Rivard street, Detroit, is negotiating with Elkhart, Ind., business interests with a view to locating in that city.

The Oakland Motor Car Company, of Pontiac, Mich., will continue their two cylinder car practically unchanged for the 1909 season. In addition they will manufacture a 40 horse power, four cylinder machine, which will be sold at a popular price.

Toledo, Ohio, has eleven police officers mounted on motorcycles who during the month of July attended to 578 complaints and performed 199 errands, which would ordinarily have required a mounted officer or a patrol wagon. Their total mileage for the month was 5,324 miles.

The assessor of Minneapolis has located 1,215 automobiles in the city which are assessed at $724,980. This is an increase of 564 in the number of cars, and $279,175 in the aggregate value as compared with last year. It is interesting to note in comparison that the total assessed value of diamonds in the city is only $182,745.

Automobiles were used exclusively in the notification ceremonies for John W. Kern, candidate for vice president on the Democratic ticket at Indianapolis August 25. Heretofore it has been the custom to use horse drawn cabs in such events, but the committee decided automobiles would be more practical in conveying the notification committee to the State Fair Grounds.

The Kissell Kar Company, of Hartford, Wis., have increased their capital stock from $100,000 to $200,000, the additional stock having been allotted to the present stockholders. It has also been decided by the company to build a four story 50x130 feet building and equip it with special machinery for the manufacture of automobiles. An output of 1,200 cars is planned for the 1909 season.

The McCue Company, of Hartford, Conn., who have been building gears and work in the white for the wholesale carriage trade, are adding automobile parts to their line, which they will now make for the trade. They will manufacture a complete line of forgings, brake and control levers, hubs, bearings, I beam front axles and other necessary parts required for the assembly of a complete machine.

The Goodyear Tire and Rubber Company, Akron, Ohio, announce that their 1909 prices to dealers will be made public as soon after September 1 as practicable. There is every indication that these prices will be lower than those now in effect, and in order to avoid tying up business for the intervening period the company offers to rebate the difference between 1908 and 1909 prices on all stock the dealer has on hand when the new prices are announced that was purchased after August 15.

Tufts & Justin have opened a salesroom on Washington street, Providence, R. I., for the sale of Stevens-Duryea cars, and another Stevens-Duryea agency is to be opened on Bellevue avenue, Newport, R. I., in charge of P. F. Conroy.

Automobiles were used in carrying strike breaking molders into the plant of the Youngstown Furnace and Supply Company, Youngstown, Ohio, past a line of pickets stationed near the gates. The strikers had repeatedly asserted that they would use no violence, but the company would take no chances, and carried the strike breakers past them at full speed.

Club Notes.

The Liberty Club of Norwich, Conn., are building a double automobile shed, for use on their hunting trips this fall.

The recently organized Denver Motor Club, which has now a charter membership of 110, has decided to take clubrooms at the Savoy Hotel.

The Automobile Club of America has appointed Harry S. Houpt a member of its contest committee, of which Robert Lee Morrell is chairman.

The Salt Lake A. C. is urging the adoption of an ordinance in Salt Lake City requiring hired drivers of automobiles to take out municipal licenses.

The Minneapolis A. C. has temporarily suspended the initiation fee requirement and accepts new members against the payment of the $10 annual dues.

The Salt Lake A. C. has asked the city council of Salt Lake City to appoint a committee to meet the committee of the club to discuss a new proposed automobile ordinance similar to the ordinances in force in Los Angeles and Denver.

The Kansas City A. C. has definitely decided on the Kansas City-Oklahoma City and return route for its annual endurance contest. A pathfinder car was to be sent out over the route on last Saturday, and the daily stages are to be limited to 125 miles.

Joseph H. Wood, chairman of the legal committee of the New Jersey Automobile and Motor Club, announces that the board of trustees of that club will serve notice on E. R. Thomas, of New York, to show cause why he should not be expelled from the club.

The Berkshire County A. A. of Pittsfield, Mass., will hold a hill climbing contest on Snake Hill early in September. Prizes will be offered for the winners in several classes. The club has voted to continue the placing of sign boards on roads frequented by automobilists.

An automobile club has been formed at Boone, Ia., with the following officers: E. O. Montgomery, president; Dr. G. H. Stanger, first vice president; Dr. C. W. Payne, second vice president; K. C. Kastberg, secretary; J. H. Robert, treasurer, and Clarence Cramer, consulting engineer. The club started with an initial membership of eighteen.

The annual meeting of the Wisconson State A. A. will be held in Milwaukee on September 9.

The public safety committee of the Bridgeport (Conn.) A. C. on a recent Sunday placed flagmen on Connecticut avenue, handing passing automobilists cards requesting them to preserve a moderate speed.

The Automobile Club of America has decided to offer $8,000 to the drivers of the leading cars in its grand prize race, distributed as follows: To the first, $4,000; second, $2,000; third, $1,000; fourth, $750; fifth, $250.

The Massachusetts Automobile Association has recently appointed a committee, with John P. Coughlin as chairman, to look after speed traps. A list of such traps has been compiled, and is to be sent out to the member clubs of the association, prominent garages and hotels.

The Big Rapids A. C. was organized at Big Rapids, Mich., on August 12 with a membership of twenty-seven. The following officers have been elected: Dr. W. T. Dodge, president; George W. Fairman, vice president; Dr. A. W. Ball, treasurer, and H. J. Ward, secretary.

The runs and tours committee of the Kansas City A. C. has recommended the following route for the fall endurance contest: Kansas City to Oklahoma City by way of Emporia, Wichita and Winfield, and back by way of Enid, Independence, Coffeyville, Joplin and Fort Scott.

The Troy Motorcycle Club was formed recently at Troy, N. Y., with the following officers: Jesse B. Wilbur, president; E. H. Brunelle, vice president; E. H. Barrett, secretary and treasurer; William Jordan, road captain. The club will meet regularly every second Tuesday of the month.

The Kenosha A. C. of Kenosha, Wis., is planning a campaign throughout the State for the passage of a law providing a heavy penalty for obstructing the roads used by automobilists. Five Kenosha County farmers were recently convicted of the offense and fined $25 each, which is the limit under the present law.

The United Automobile Clubs of New Jersey have sent out circular letters with the object of collecting a fund to defray the expenses of the suit to test the constitutionality of the State automobile law, for which John W. Griggs, former Governor and United States Attorney General, and Chas. T. Terry have been retained.

The following clubs located in and around Philadelphia have appointed a joint committee to further objects of mutual interest to these clubs: A. C. of Philadelphia, Quaker City A. C., A. C. of Germantown, A. C. of Delaware County, A. C. of Norristown and Delaware A. A. C. H. Wheeler, of the A. C. of Germantown, is chairman of the committee.

There have been rumors for some time that the several clubs which have withdrawn from the American Automobile Association during the past year are planning an alliance. Each club would be represented in the combination in direct proportion to its numerical strength. Reciprocal clubhouse privileges would probably also be included in the plan of association.

Foreign Notes.

In connection with the International Road Congress to be held in Paris in October, attempts will be made to do away with the bothersome formalities with which automobile tourists have now to contend when passing from one country into another.

The route for the Prince Henry touring contest of 1909 is already being discussed, and it is very likely that Berlin-Breslau-Vienna-Munich will be selected. The speed trials held in connection with the contest would take place in Forstenrieder Park.

The administration of the jails in Moscow, Russia, has purchased two automobiles for the transportation of prisoners. These are so arranged that the only door to the interior can be opened only after the seats of the driver and the guard have been completely turned around.

The Austrian A. C. informs us that its annual Semmering Hill climb will this year take place on September 20, and that there will be ten events in all, viz., one for single cylinder motorcycles, eight for gasoline touring cars of various limiting cylinder dimensions, and a free for all event. The preliminary closing of entries is set for Sept. 9, and the final for Sept. 15.

According to a report of the Dutch Chamber of Commerce in Johannesburg the imports of automobiles into South Africa during the year 1907 were as follows: From England, £54,307; France, £23,048; Germany, £14,949; Belgium, £7,091; Canada, £3,829. The values of motorcycles imported were as follows: From England, £5,417; Germany, £5,417; Belgium, £789; France, £593.

In a recent legal case in Germany in which a motor omnibus company claimed to be immune from liability for damages caused by the skidding of one of their omnibuses on a slippery asphalt pavement, because the accident was due to excessive sprinkling, and to the consequent layer of mud, the court held that the municipal government was under obligations first to arrange for the suppression of dust, and could only then attempt to obviate the danger to motor vehicles arising from the sprinkling.

The town of Issoire near Clermont-Ferrand, France, recently took out over forty summonses against motorists, chiefly for exceeding the speed limit. As a result the town and its immediate neighborhood were rigidly boycotted by motorists, who passed right through and refused to purchase anything there. The town council, awakening to the situation, immediately caused announcements to be made in the press that no more summonses would be issued, and that motorists would be "welcomed with opened arms in Issoire."

GARAGE ITEMS

Fires in Garages.

By J. E. Jennings.

The destruction by fire of half a dozen garages in the month of July, one fire alone causing damage to the extent of $250,000 in the town of Greenwich, Conn., has attracted the attention of the insurance world to the inherent danger of conflagrations in garages. It is likely that rates will, as a consequence, be raised, and that more care will have to be exercised, inasmuch as the danger is ever present.

Most fires arise from preventable causes; in other words, faults of construction and equipment quite susceptible of correction. Matches, sparks and explosions constitute a high percentage of the causes of the whole number of fires, and these causes are said to figure prominently in fires in garages. Carelessness, in a hundred different ways, nearly all of which could be avoided, also plays a prominent part. There is also the great "unknown" cause, which, if the truth could be known, would upset perhaps any deductions that might be made as to the causes of fires in garages.

Is there not too much carelessness in the carrying on of the garage business? The National Fire Protection Association opines that there is, and suggests that buildings of standard fireproof construction, not over five stories in height, with all floor openings protected and without turntables on floors, and floor areas subdivided by fire walls, present the best type of structures for this class of occupancy. It is particularly pointed out that buildings of ordinary or frame construction are not suited to their occupancy. It is unfortunately true that there are buildings of the latter description used as garages, but they meet with small favor and little consideration at the hands of insurance men.

Danger is considered inherent wherever there is a chance for possible explosion or leakage of combustibles. The National Fire Protection Association has repeatedly drawn attention to these possibilities and laid emphasis on the ever present danger of an outbreak of fire. To this end it recommends that all boilers for power or heating should be in separate buildings, not communicating with the main structure. If, however, it is found necessary to have the boiler room in the building, the room should be of fireproof construction, with walls and ceiling of not less than 12 inches brick, with no openings permitted to the main garage. Access to the boiler room should be by an outside doorway. It is also recommended that no dynamo or gas engine should be permitted in or under rooms where gasoline is stored or handled, and all exposed artificial lights should be eliminated from the building.

The heating of a garage should be permitted only by steam or hot water. The repair pit should be of fireproof construction and drained or ventilated to the outside of the building. The entire garage should be so constructed that all floors are freely ventilated so as to insure a continual change of air.

These are but a few of the hints about garage construction as favored by the association. If its suggestions were carried out strictly there would, it is thought, be fewer garage fires.

The garage of corrugated iron or of reinforced concrete is likely to meet with most favor at the hands of the insurance companies. Much information of value to the insurance interests, and consequently to the public at large, is expected from the work of the Government laboratories at St. Louis in testing building materials. The work is considered of supreme importance because the tests embrace, in part, that of the fire resisting qualities of these materials. If a large saving can be effected by these Government tests in the cost of manufacturing building material and in perfecting its resistive qualities against weather and fire, the prospective work is of great importance to the country. Among the bodies called into consultation by the Government are the National Board of Fire Underwriters and the National Fire Protection Association. At present the experts are studying concrete, reinforced concrete and the constituent materials available for making it. A series of tests has already been started of the fire resisting qualities of structural materials found in the neighborhood of Chicago. Fire underwriters consider that this work should be continued indefinitely. So far as is known the great conflagrations of recent years have firmly established confidence in the fire resisting qualities of concrete. A conflagration is necessarily of relatively short duration, a fact which is one of the elements in the durability of concrete. It is of vital importance to men who seek absolute permanence in their garage construction.

After all, however, the chief danger of outbreak of fire in garages lies in carelessness. Rules intended to prevent fires are of no use whatever if disregarded. Carelessness with matches, open lamps, flooded carburetors, explosions, etc., are responsible too often for the fires which put garage men temporarily out of business. The danger of fire is so pronounced with steamers that all fire insurance men have little hesitation in stating that they are the most hazardous class of machine, and some garage men, mindful of fires and the restrictions of the insurance companies, refuse to garage them. Even when allowed to be stored the steam driven machine should not be propelled in the garage, as the flame necessary to generate steam is considered as hazardous as hazard can possibly be. The attempts to enforce the requirement that steam driven cars shall not be propelled by their own power have been determined and continuous in many cases, yet chances are taken by those in charge of the machines, with the result that the garage man who wishes to avoid fire finally comes to the conclusion that he will bar them altogether.

Is the automatic sprinkler installed in garages as much as it could be? While sand, in pails, should be on every hand where gasoline is used or stored, it is known that automatic sprinklers have been quite successful in holding fires in check and also in extinguishing them where large quantities of gasoline were exposed in open receptacles within a few feet of the flames. Sprinklers usually behave pretty well. In piping a big building, such as many garages in our large towns are, care should be taken to see that not too great a number of sprinkler heads are fed from one central feed pipe. When automatic sprinklers are being installed in a garage the system should be as simple as possible and accompanied by explicit directions. The fewer the valves the better the equipment, and they should be as nearly foolproof as possible.

A Simple Check for Garages.

Every garage owner has his own ideas as to the best method for recording the time at which every vehicle leaves or

TIME
KEEPERS
OFFICE

Simple Check for Garages.

enters, and in places where considerable business is transacted it is often difficult to keep account, paid drivers being the worst offenders in trying to rush the machine out surreptitiously. At the large Wolseley garage near the Houses of Parliament, London, there has been in use for some time quite a simple idea, which the photographic reproduction makes self explanatory. The weight of the wooden check gate just overcomes the weight attached to the other end of a wire cable passing over a small pulley inside the timekeeper's office, the man who has charge of the time book being the only person permitted to give admittance or exit to a machine. Space is left between the gate and the wall to allow a single pedestrian to pass. If any person attempts to lift the gate from outside the office the release of the weight inside closes an electric circuit and thereby causes a bell to ring continuously.

Garage Notes.

Roy Crawford has purchased the Topeka, Kan., agency for Ford cars from Mr. Cowdrey, of the Cowdrey Auto Co.

A salesroom and garage, 60x80 feet, is being erected in El Paso, Tex., for C. M. Barber, Southwestern manager for the Reo Motor Car Co.

James A. Wright, Merrill, Wis., is erecting a garage with a capacity of six cars. The building will be steam heated, and have every convenience.

Roger H. Mills, Jr., Rochester, Minn., has purchased the business of the Auto Construction Co., formerly conducted by Vernon Witherstine.

Eugene Wuesthoff, Milwaukee, Wis., is building a garage at Thirteenth street and Grand avenue. The building will be of brick construction, one story, 48x155 feet.

The Michigan Automobile Co. will open a garage on Sixth street, Red Jacket, Mich., with Paul Pawler in charge. The company will handle the Chalmers-Detroit car.

Richard J. Penney and J. J. Richards, Milwaukee, Wis., have formed a partnership, and will open a garage to be known as the North Avenue Garage at 312 West North avenue.

J. W. Butts & Son, Wichita, Kan., have bought the garage business of the Wilson Automobile Co., at 118 and 120 South Lawrence avenue. Butts & Son were formerly in the hardware business.

A garage to be known as the Ogden-Farwell garage is being erected by George F. Gerlach and Charles P. Mayhew at 82-86 Farwell avenue, Wis. The company have the agency for the Studebaker and "E. M. F."

The Penn Motor Car Co., Philadelphia agents for the Mitchell car, have made arrangements with the manufacturers for an increase in their territory, so as to include considerable portions of Pennsylvania and New Jersey.

J. P. Schneider, Detroit, Mich., has secured a long lease on property on the corner of Woodward and Bagg streets, and will begin immediately the erection of a modern garage building 130x160 feet, to be completed in about two months.

Fire in the garage of Frank P. Wonson, Raymond street, Magnolia, Mass., on August 20, resulted in the destruction of four cars and a total loss of $15,000. The fire resulted from an explosion due to the carelessness of a chauffeur in cleaning a car.

The Martin Auto and Repair Company has opened a garage and repair shop on Rodman street, near North Highland, in Pittsburg, Pa. David E. Martin, formerly with the Banker Brothers Co. and the Atlas Automobile Co., will be in charge of the repair work.

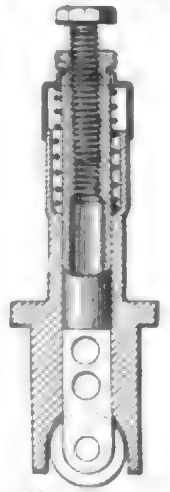
The Zell Motor Car Co. has been organized in Baltimore, Md., by A. Stanley Zell to handle the Peerless and Chalmers-Detroit cars. A temporary garage has been secured on Morton street, near Chase, and an option has been secured on an uptown lot on which a large garage is to be erected.

Herbert F. Bates, North Scituate, Mass., will build an automobile garage 30x50 feet.

Trade Personals.

C. E. Matthewson, Pacific Coast manager of the Diamond Rubber Co., has arranged for a larger branch house and increased working force at Los Angeles.

E. P. Olmstead, formerly with the Autocar Equipment Co., of Buffalo, is now vice president and general manager of the American Motor Truck Co., of Lockport, N. Y.



No. 891,340.

W. M. Gibson, formerly with the Goodrich Tire Co., but who retired from the business about eighteen months ago, is now manager of the San Francisco branch of the Fisk Rubber Co.

L. Kissell, president of the Kissell Motor Car Co. of Hartford, Wis., was fatally shot by John Gerbier, an employee at the company's store in Milwaukee on August 19. Kissell was shot in the head twice, and also in the stomach. He was seventy years old. The shooting is said to have been the result of a trivial dispute.

George H. Smith, formerly Philadelphia branch manager for the White Co., has been appointed traveling salesman by the Winton Motor Carriage Co. for the Eastern part of the country, and Charles S. Calvert, formerly a member of the firm of Calvert & Zusi, Winton agents in Newark, N. J., has been appointed to a similar position for the Western part of the country.

Trade Literature Received.

Niles-Bement-Pond Co., 111 Broadway, New York.—Catalogue of Niles boring mills.

Chalmers-Detroit Motor Co., Detroit, Mich.—Catalogue of Chalmers-Detroit 1909 models.

The Goodyear Tire and Rubber Co., Akron, Ohio.—Circular of the Goodyear air bottle.

The Goodyear Tire and Rubber Co., Akron, Ohio.—Circular on Goodyear detachable auto tires and rims.

Coming Events.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

September 11—Hill Climb of Springfield (Mass.) A. C.

September 14—Annual Economy Run, Chicago Motor Club.

October 1 and 2—Endurance Run of the Indiana Motor Trade Association.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

MOTOR VEHICLE PATENTS

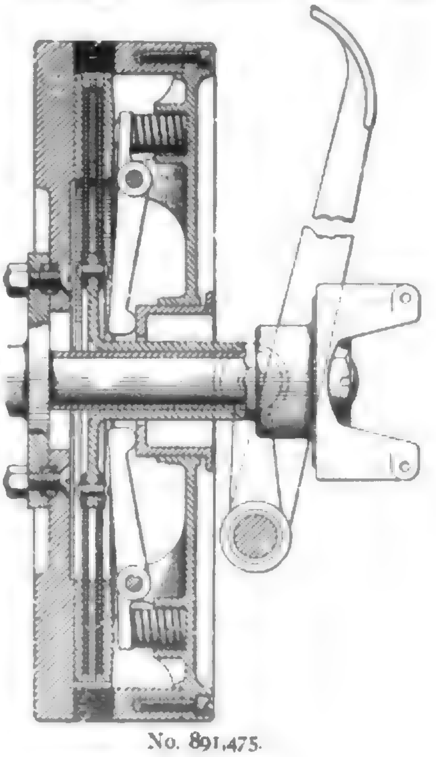
Review of Specifications.

891,340. Valve Operating Mechanism for Hydrocarbon Engines.—Russell Huff, of Detroit, Mich. June 23, 1908. Filed October 1, 1907.

This relates to a provision for protecting the moving parts of a valve mechanism from dust. The push rod guide is inserted in the crank casing and its interior acts as a bearing for the hollow push rod. This rod has two internal diameters, the lower one being the greater, while the smaller, upper one is tapped for a push plug fitted with a hexagon head. A groove near the head of the push rod serves to support a cylindrical dust guard, which at the same time takes the thrust of a spring which fits within a cup upon the upper part of the guide. This spring tends to keep the push plug in contact with the valve stem and prevent hammering. Adjustment for wear is made by operating the threaded push plug within the rod. The usual roller and yoke are attached to the end of the rod.

891,475. Clutch.—J. G. Heaslet, of Detroit, Mich. June 23, 1908. Filed July 17, 1907.

This relates to a multiple ring or plate clutch, which is fitted entirely within the flywheel. The clutching mechanism proper consists of three bronze rings or plates between which are two steel discs. The bronze rings are capable of a limited axial motion, but are prevented from moving radially by means of keys. The steel discs are fastened at their inner circumferences to the flange of a cylindrical collar, which

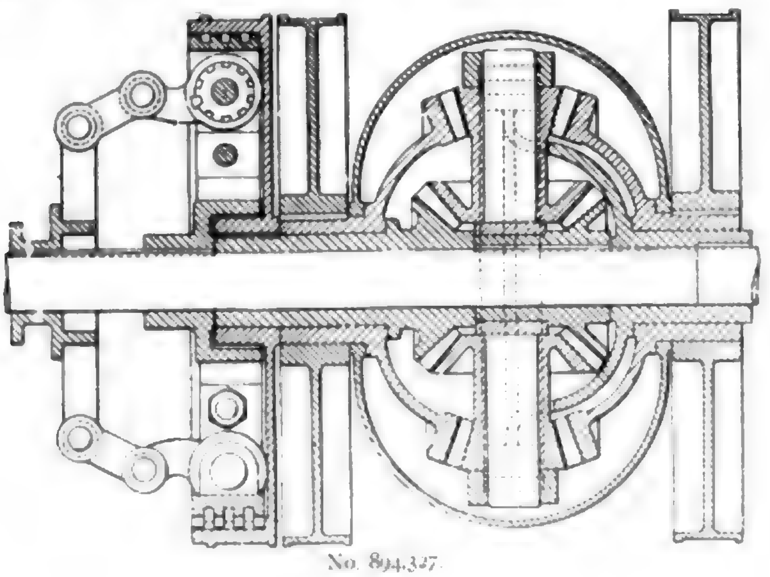


No. 891,475.

is further fitted at its other end with another flange, to which is attached the universal joint for the drive or clutch shaft. This collar bears upon a cylindrical bush upon the extension of the motor shaft. A steel cup rides upon the aforementioned collar, and is capable of axial movement within a circular opening in the clutch cover, bolted to the flywheel flange. The back of this cup acts upon the long arms of levers pivoted upon lugs on the clutch cover, and provided with powerful springs upon the short arms tending normally to force the steel discs and bronze rings together, thus coupling the motor and drive shafts. Rollers pressing upon the flange of this steel cup force the levers forward, thus allowing the discs and rings to separate axially, these rollers being actuated by the clutch pedal. The clutch casing and cup enclose the entire mechanism, rendering it oil tight and dustproof.

894,327. Change Speed Gear.—John Johnston, of Putney, England, and William Buddicom, of Nannerch, Wales. July 28, 1908. Filed May 9, 1905.

This is a change speed gear of the bevel planetary type in which all the planetary gears run in an oiltight casing. There are three speeds in a forward direction and one reverse. The line shaft from the motor extends nearly through the entire gear from left to right, abutting against the end of the drive shaft. Keyed to this line shaft is an internal expansion mechanism, operated by levers and acting within a drum. This drum is itself keyed to a long collar fitted with a broad bevel face with which meshes the larger of two pairs of bevel pinions mounted and revolvable upon radial axes. Next to this drum is a second drum, keyed to a collar fitted with a large cup provided with bevel teeth meshing with the smaller bevel pinions upon the axes before mentioned. A similar arrangement is fitted on the opposite side of the casing, another drum being keyed to this collar. The pins carrying the bevels are supported by yokes and segments with arms extending to a collar which is keyed to the drive shaft. The direct drive is obtained by operating the internal expanding device, causing the whole gear to revolve and locking the shafts together. The intermediate speed is put into action by causing the same drum to cease to revolve when a slightly reduced speed of the drive shaft is accomplished by the larger bevels in mesh with the broad bevel face, causing the yoke and segment construction to revolve, and consequently to drive the shaft. Low speed is obtained by preventing the second drum from revolving, the bevel faced cup being rigid, causing an orbital movement in the corresponding bevel pinions and the larger bevel pinions in the yoke construction and giving a still greater reduction of drive. The reverse is applied by holding the drum on the opposite side of the casing from revolving, when a similar action takes place, except in the opposite direction.



No. 894,327.

Patents Issued August 11, 1908.

895,753. Convertible Bicycle and Tandem Frame.—Carl O. Hedstrom, Springfield, Mass. Filed July 15, 1907.
Sandusky, Ohio. Filed November 15, 1906.

895,542. Transmission Gear.—James F. Duryea and William M. Remington, Springfield, Mass.
Marks, San Diego, Cal. Filed September 12, 1906.

895,661. Automobile Construction.—William Morison, Chicago, Ill. Filed October 31, 1904.

895,697. Muffler.—Benjamin W. Snow, Syracuse, N. Y. Filed March 7, 1907.

895,557. Lubricator.—Charles C. Haller, Chicago, Ill. Filed July 25, 1907.

895,618. Power Transmitting Device.—Leonard K. Clark, New York, N. Y. Filed November 20, 1906.

895,632. Collapsible Foot Rest for Vehicles.—Charles J. Harris, Bridgeport, Conn. Original application filed November 5, 1906. Divided and this application filed May 22, 1907.

895,645. Valve Timing Device for Explosive Engines.—Lester L. Kell, St. Louis, Mo. Filed December 17, 1907.

895,653. Rotating Explosion Engine.—Roy C.
895,437. Tire Protector.—Louis Crise, Upper
895,754. Internal Combustion Engine.—Carl O. Hedstrom, Springfield, Mass. Filed October 30, 1907.

895,755. Self Oiling Connecting Rod.—Carl O. Hedstrom, Springfield, Mass. Filed December 21, 1907.

895,762. Detachable Rim for Automobile Tires.—Richard E. Jeffery, Piedmont, Cal. Filed March 20, 1907.

895,766. Lubricating Oil Feeder.—Thomas J. Kehoe, Dayton, Ohio. Filed April 5, 1906.

895,855. Driving Pulley.—Otto Hartmann, Stuttgart, Germany. Filed September 16, 1907.

895,941. Vehicle Wheel.—Linda H. Barry, Durango, Mexico. Filed October 10, 1906.

895,975. Auxiliary Relief Wheel Rim for Motor Cars and Vehicles.—Thomas M. Davies and Walter Davies, Llanelly, England. Filed April 11, 1904.

895,982. Gasoline Engine with Mixing Cylinders on Crank Cases.—Frederick A. Dobbins, Newark, N. J. Filed June 21, 1907.

896,034. Transmission Gearing for Automobiles.—Grover I. Mitchell, Cornell, Ill. Filed April 4, 1908.

Patents Issued August 18, 1908.

896,104. Guard or Fender for Vehicles.—Charles W. M. Guhle, Philadelphia, Pa. Filed January 20, 1908.

896,112. Starting Device for Hydrocarbon Engines.—Russell Huff, Detroit, Mich. Filed November 30, 1907.

896,136. Recoil Compensator.—Frederick J. Mellen and Burton A. Edwards, Beloit, Wis. Filed November 14, 1907.

896,145. Compound Stud to Be Used in the Construction of Non-Skidding Bands and Tires.—Caleb Payne, Cranbrook, England. Filed January 21, 1908.

896,183. Internal Combustion Engine.—Lewis S. Waters, Scranton, Pa. Filed July 29, 1904.

896,195. Universal Joint.—Fred H. Bogart, Hartford, Conn. Filed August 12, 1907.

896,254. Valve for Explosive Engines.—Paul Schramm, Alameda, and Ira E. Wise, Wallace, Cal. Filed October 12, 1905.

896,298. Controlling Mechanism for Motor Vehicles.—Frank D. Howe, Waltham, Mass. Filed February 1, 1908.

896,305. Device for Simultaneously Controlling the Spark and Throttle of an Internal Combustion Engine.—Herman Lemp, Lynn, Mass. Filed June 30, 1906.

896,314. Motor Vehicle.—James C. McCurry, Texarkana, Tex. Filed August 26, 1907.

896,362. Resilient Wheel.—Samuel S. Childs, Bernardsville, N. J. Filed January 28, 1908.

896,375. Starter for Explosion Engines in Self Propelled Vehicles.—Delamere B. Gardner, Chicago, Ill. Filed October 5, 1907.

896,388. Carburetor.—Kirk G. Johnston, New York, N. Y. Filed August 12, 1907.

896,389. Friction Clutch.—Kirk G. Johnston, New York, N. Y. Filed August 12, 1907.

896,451. Safety Clutch for Starting Gas Engines.—Walter S. Jones, Plainville, Conn. Filed August 30, 1905.

896,455. Exhaust and Signal Control.—Jonathan D. Maxwell, Tarrytown, N. Y. Filed August 23, 1907.

896,559. Air Inlet Regulator for Carburetors.—Adele A. Longuemare, Paris, France. Filed May 27, 1904.

896,606. Automobile Horn.—Robert Wright, Cleveland, Ohio. Filed October 15, 1907.

896,624. Motor Vehicle.—Walter Christie, New York, N. Y. Filed February 12, 1908.

896,652. Gasoline Feed Chamber for Carburetors.—Godfried J. Mayer, Buffalo, N. Y. Filed May 23, 1907.

896,661. Tire.—William Porter, Los Angeles, Cal. Filed June 26, 1907.

And now the automobile is credited with putting a stop to polygamy in Utah. The explanation is simply this: Many Mormons could buy job lots of openwork "merry widows," but there are very few who are so rich that they can afford to have more than one wife and an automobile at the same time. Either the extra wives or the auto has to go. The Mormons are buying autos and economizing on household expenses.

The Horseless Age

First Automobile Journal in the English Language

VOLUME XXII NEW YORK, SEPTEMBER 2, 1908 NUMBER 10

Trusses for Frame Side Members.

By Asher Golden.

There are few, if any, engineers engaged in railway car design who question the necessity of reinforcing car frames by means of some form of truss. One may search far and wide for a railway car which has a frame without one. There seems to be no reason, therefore, why most automobile designers do not employ this means of increasing the rigidity of the frame.

The form of truss which will do its work most effectively, and the manner of supporting or fastening the truss and varying the tension of the tie rods, are questions of importance, since it is not an uncommon thing to find trusses which are either too light or too heavy, or which have slack tie rods. A slack tie rod is not doing its work, and the frame is stronger without it. The manner of disposing the posts and anchoring brackets also deserve consideration, since these may be placed where they will weaken the frame instead of strengthening it.

Errors of this kind are unpardonable, particularly in cases where other features of the design are clean cut and bear the marks of sound engineering. Let us take, for example, the case of a frame with a decided offset, as shown in Fig. 9. The posts and anchoring brackets should be designed and arranged on the frame, so that every panel of the truss is in the same vertical plane. This may be accomplished by designing the front bracket to project outward a sufficient distance to allow for the offset. A good form is that shown at *a*, Fig. 9. The rivets or bolts used to fasten the bracket are under shear; they must be so arranged as to be equally disposed about the neutral axis in order that there shall be as little tendency as possible to warp the web. This is shown at *c*, Fig. 9, *xx* being the neutral axis.

On the other hand, if both brackets are the same, and both are placed under the flange, as shown at *b*, the vertical plane of the panels is distorted. The result of the tendency of the distortion to disappear when the tie rods are under tension is the crippling or warping of the flange, as shown at *d*. The greater the tension in the tie rods the greater will be the extent of the warping. This discussion does not relate to a hypothetical case. An error of this kind was actually observed on a well known foreign car exhibited at the last Importers' Show in New York.

Another interesting case of poor truss design was observed on a well known French car. This truss consists of three panels; there is a vertical strut between the front and the centre panels, and a horizontal strut between the centre and the rear panels. The tie rods are put in tension by screwing up at the struts. The result of screwing up at the vertical strut is the movement of the panels downward in a vertical plane, while at the other the movement is outward in a horizontal plane. The distortion is greater in this case than in the last. An eye is arranged on the front panel of the tie rod to allow the steering lever to pass through. It may be remarked that this design has been changed, although many of those described may still be seen; the rear strut is now disposed vertically, and is part of the sprocket wheel hub.

Where frames have been found to fail it is far easier to reinforce them by means of a truss than to go to the expense of redesigning. In several instances where trusses have been used to overcome this difficulty the design of the truss has been as bad as, if not worse than, that of the frame which it was intended to strengthen. The writer has some of these in mind. On a certain American car the struts are made of ordinary gas pipe with the lower ends milled out to take the tie rod. The anchoring brackets are of pressed steel, too thin to keep the rods in tension. The result is that the rods are always slack, and are not doing their work. Another American car has a truss of two panels with the strut made of rectangular bar stock about 2 inches wide, three-quarters of an inch thick, and about 8 inches long. This truss does its work, but it would look better as part of a bridge.

STRESSES IN TRUSS MEMBERS.

In the case of an ordinary touring car (filled with passengers), for the purpose of trussing the load may be assumed to be uniformly distributed. The stresses in the truss members may be easily found. There are four cases to be considered: Two in connection with the two panel or king post truss, and two in connection with the three panel or queen post truss, as follows:

Two panel truss—
1. Equal panels.
2. Unequal panels.

Three panel truss:
3. End panels equal.
4. End panels unequal.

These will be considered in the above order (see diagrams, Fig. 10).

Case 1. AD = A'D. Let W be the total distributed load, and let the T*s* represent the tensions in the tie rod panels, and the C*s* the compressions in the struts. We then have:

$$C = \frac{W}{2}$$

and
$$\frac{T}{\cos a} = \frac{T'}{\cos a} = \frac{C}{\sin 2a} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

from which $T = T' = W/4 \operatorname{cosec} a$. By diminishing the length of B D the tensions in A B and A'B are increased; by increasing the length of B D the tension in each diminishes and approaches the limiting value W/4.

Case 2. If owing to the presence of step brackets or other brackets on the frame it is not possible to make AB = A'B, we then have:

$$\frac{T}{\cos a} = \frac{T'}{\cos b} = \frac{C}{\sin a + b} \quad \ldots\ldots\ldots\ldots (2)$$

from which

$$T = \frac{C \cos b}{\sin (a + b)}$$

$$T' = \frac{C \cos a}{\sin (a + b)}$$

The tension will evidently be greater in the

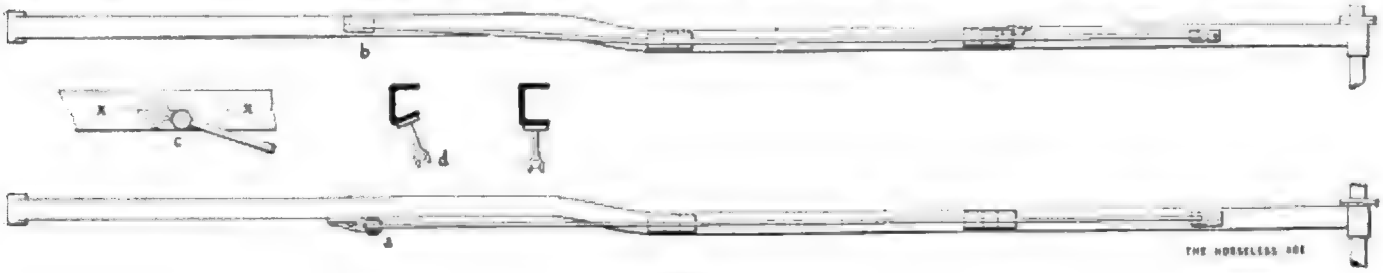


Fig. 9.

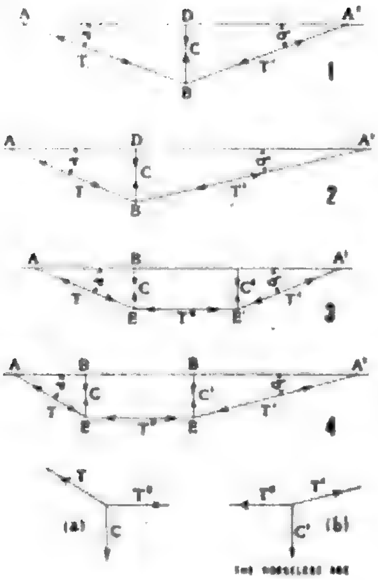


FIG. 10.

smaller branch of the tie rod. As before, $C = W/2$.

Case 3. $AB = A'B' = BB'$. If W is the total distributed load, $C = C' = W/3$, and $T = T'$. We then have

$$T = \frac{T''}{\cos a} = \frac{C}{\sin a} \dotfill (3)$$

$$\text{from which } T = c \operatorname{cosec} a = \frac{W}{3} \operatorname{cosec} a$$

$$T'' = c \cot a = \frac{W}{3} \cot a$$

The portion of the frame BB' instead of being under tension is now under compression, the value of the compression being $W/3 \cot a$.

Case 4. Referring, for the sake of clearness, to Fig. 10, we have from (a)

$T = T''/\cos a = C/\sin a$ ……………… (4),

and from (b)

$T' = T''/\cos b = C'/\sin b$ ……………… (5).

From equations (4) we have

$$\left.\begin{array}{l} T = C \operatorname{cosec} a \\ T'' = C \cot a \end{array}\right\} \dotfill (6).$$

From equations (5) we have

$$\left.\begin{array}{l} T' = C' \operatorname{cosec} b \\ T'' = C' \cot b \end{array}\right\} \dotfill (7).$$

Now, since T" is the same in equations (6) and (7), we have $C \cot a = C' \cot b$; or,

$$\frac{C}{C'} = \frac{\cot b}{\cot a} = \frac{A'B'}{AB} \dotfill (8)$$

That is, the compressions in BE and B'E' are inversely proportional to the cotangents of their opposite angles.

In either cases 3 or 4 the sum of the compressions in the posts is 2/3 W; if now we let $A'B' = m$ and $AB = n$, we have from equations (8):

$$\frac{C + C'}{C'} = \frac{m + n}{n};$$

substituting for $C + C'$ its value 2/3 W, we have

$$C' = \frac{2}{3} W \frac{n}{m + n}$$

$$C = \frac{2}{3} W \frac{m}{m + n}$$

The compression in BB' is $2/3\ W\ mn/(m+n)\ d$, where $d = BE = B'E'$.

If the frame, assumed to be of uniform section, has a symmetrical or uniformly distributed load, the point of maximum bending moment will be the same as the point of maximum deflection. If we decide to use a two panel truss we place the post or strut at this point, that is, the middle of the frame; if we are to use a three panel truss the posts are placed so as to divide the frame between the anchoring brackets into three equal panels, as nearly as possible. If we wish to assume that the frame is eccentrically or irregularly loaded, the point of maximum bending moment is not the same as the point of maximum deflection. It would seem to be the natural course to determine the latter point in order to find where to place the post or posts, but in the case of actual frames the number of conditions makes it practically impossible to find this point. In any event the posts may be shifted away from the point of maximum bending moment toward the region of lighter load.

In regard to the relative advantages of the two panel and the three panel trusses, it may be said, in general, that either type will give satisfactory results, since the stresses in the truss members in either case are well within the tensile strength of the materials usually employed. Let us take a hypothetical case, assuming a uniformly distributed load. Let W = 1,000 pounds, and let angle *a* have the values given below, we can then tabulate the stresses as follows:

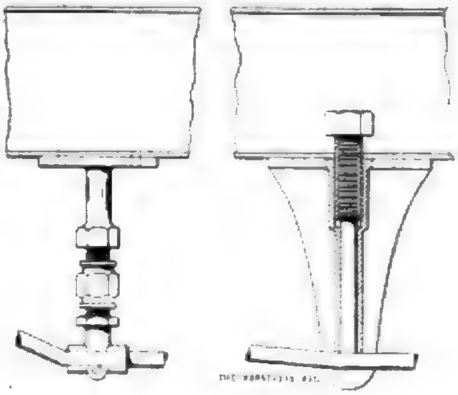
—Two Panel Truss.—			—Three Panel Truss.—		
C.	T.	*a*.	C.	T.	*a*.
500	500	30°	333	666	30°
500	435	35°	333	579	35°
500	387	40°	333	516	40°
500	352	45°	333	467	45°

From this table we see that for the same load the compressive stress in the post is smaller, but the tensile stress in the tie rods is greater for the three panel than for the two panel truss.

If we call S the unit stress in the tie rod and A the area of cross section of the rod we have for a two panel truss with equal panels

$$S = \frac{W}{4} \frac{\operatorname{cosec} a}{A}$$

If now we take, for example, a three-



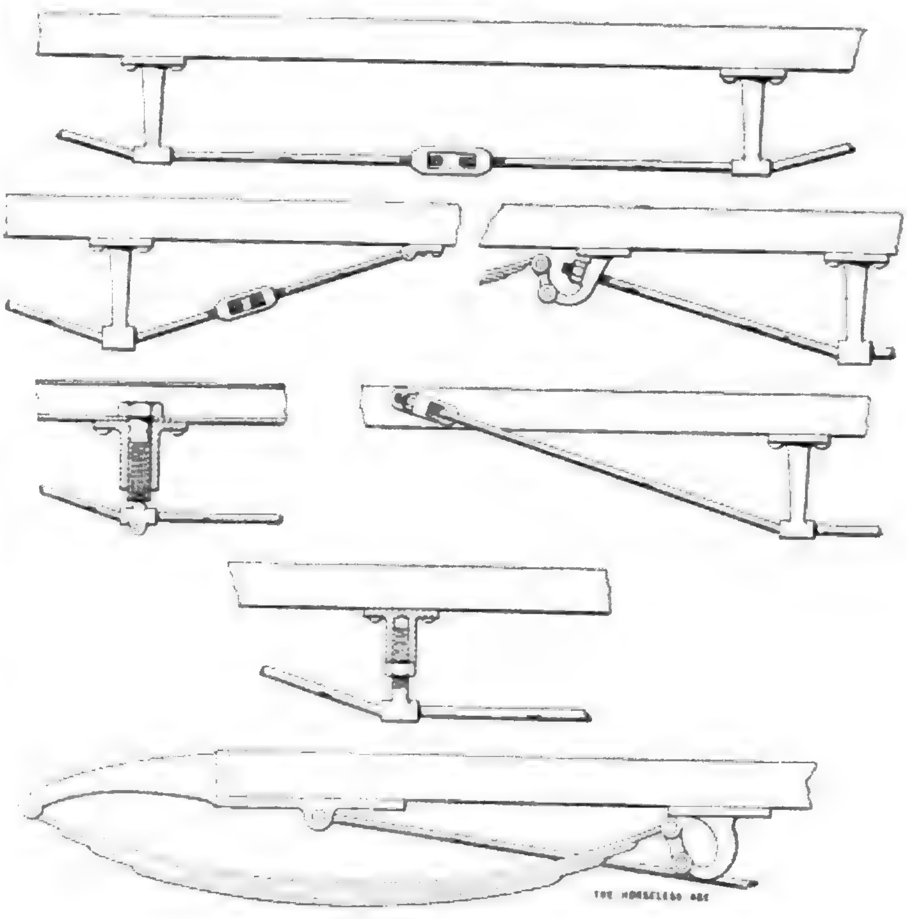


FIG. 11.

eighth inch rod and assume W to be 1,500 pounds, that is, on one side of the frame, then, if *a* be taken at 30 degrees, we have

$$S = \frac{1500}{4} \times \frac{2}{.1104} = 6790 \text{ pounds per sq. inch.}$$

If we assume the rod to be made of a steel having an elastic limit of 30,000 pounds per square inch, the factor of safety is 30,000/6,790 = 4.425. For a seven-sixteenth inch rod the factor of safety is 6, and for a one-half inch rod the factor of safety is 7.785. We see, from the above, that a three-eighth inch rod is sufficient for all practical purposes.

A post having a diameter of one-half inch and a length not exceeding 6 or 7 inches is likewise strong enough for all purposes. The area of cross section of a one-half inch rod is .1963 square inch; then for a distributed load of 1,500 pounds on one frame side member the compressive stress in the post of the above example is

$W/2 \times 1/.1963 = 750/.1963 = 3,820$ pounds per square inch.

This gives us a factor of safety of 30,000/3,820 = 7.785.

It must be remarked, in connection with the stresses in the post, that in addition to the compressive stress there is also a bending force. However, this will have little influence if the length of the post is kept down to as low as 6 or 7 inches, as pointed out above.

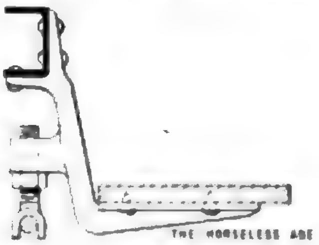


FIG. 12.

In no case should the diameter of the tie rod be less than three-eighth inch unless a steel of sufficiently high elastic limit be used. A concrete example will show the necessity of this. The example is that of a high powered racing machine. This was provided with a three panel truss of which the tie rod was one-quarter inch in diameter. Lightness is an important consideration in a racing car. The weight of this car on the axles was about 1,850 pounds, making the load on one side 925 pounds. Angle *a* is 30 degrees and the area of cross section of the rod is .049 square inch. The tension in the rod is

925/3 × cosec 30° = 620 pounds (about).

The tensile stress in the rod is

620/.049 = 12,650 pounds per square inch.

The steel used had an elastic limit of 30,000 pounds per square inch, giving a factor of safety of 30,000/12,650 = 2.37. Even if the steel used had an elastic limit of 50,000 pounds per square inch, the factor of safety would still be too low for a high powered racing machine having a considerable engine reaction. The first time the car went out to be tested the tie rod snapped!

In regard to taking up the tension in the tire rods, it is evident that in most cases the considerations of cost of manufacture and neatness are practically the only factors governing the selection of a particular design. Among the designs shown in Fig. 11, which are taken from actual trusses observed on American and foreign cars, there will be no difficulty in selecting those which are both cheap and neat.

Where it is desired to make use of the advantages of the truss without in any way affecting the outward appearance of the chassis, a combination step bracket and truss post, as shown in Fig. 12, may be used. The utility of this arrangement will be easily seen.

In all cases where a truss is used it is absolutely necessary to pin the rod into the fork so as to prevent the rod from leaving its seat in the fork as the car moves up and down, owing to inequalities of the rod. This is shown in Fig. 11.

The Fallacy of High Compression for Automobile Engines.

BY F. E. WATTS.

The subject of compression has always been a live topic of discussion among gas engine designers, and it probably always will be, for it is one of the first questions which come up in the design of an engine, and, being a complex subject, admits of a variety of opinions. Generally speaking a considerable variety of opinion is permissible, for most engine designs allow of quite a range of compression being used. There are always an upper and a lower limit to the permissible compression pressure, but these limits are often quite far apart, and the use of any intermediate pressure will result in a smooth running, successful engine. In stationary work, where an engine is usually operated the majority of the time at a fixed speed and load, there must of course be some one compression that is best. But where an engine is used under conditions of widely varying speeds and loads, as it is on an automobile, where air temperature, humidity and density vary greatly from day to day, and where, as the machine moves from place to place, the engine is furnished with a great variety of fuels, ranging from the most volatile gasolines almost to kerosene, no particular pressure can be called best.

Besides the variable conditions just mentioned, all of which are more or less external to the engine, there are many factors in the engine itself. Among these are cylinder diameter, number of cylinders, method of casting (single or multiple), method of cooling, carburation, ignition and lubrication, chances of leaks, weight of reciprocating parts, connecting rod length, conditions of surface of cylinder bore and of cylinder and piston head. There are also another set of external conditions, which are often within the control of the designer, viz., car weight, passenger and luggage capacity, the number of gear ratios and the reduction of each. To these may be added conditions of use, such as road surface, grades and the temperament of the driver regarding speed, gear changing and spark advance. This last set of conditions is largely beyond the designer's control, and calls for a considerable factor of safety.

Of course it is generally understood that the compression in an automobile motor varies widely with the speed, and by "compression" is usually meant the pressure at normal speed, say 600 to 800 feet piston speed per minute.

Any adequate theoretical discussion of the foregoing conditions is well nigh impossible, and experience is the only safe guide. Let us see what experience teaches.

It is interesting to watch an engine designer's opinions regarding compression develop. The process is usually about as follows: The youth, in shop, school or college, sees a gas engine run and begins to wonder what makes the wheel go 'round. He buys or borrows some books and begins to study. Among the things he learns is that the gas must be compressed before it is ignited. This usually attracts his attention, for it seems as though the power spent in compressing must be wasted. But he soon learns that compressing the gas causes it to exert a much greater pressure after it is fired. So much greater, in fact, that the higher the gas is compressed the more powerful is the engine. He learns, however, that if the compression is greater than a certain amount the engine will not operate, because the charge will ignite itself before the piston reaches the top of its compression stroke.

At this stage of his evolution, and for some time after, he is an advocate of high compression. His view of the subject is somewhat as follows: "With high compression, near the point of pre-ignition, the engine gives more power and is more economical than with a lower compression. So it pays to use as high compression as possible."

For stationary work these ideas are not far wrong, for there is usually an ample supply of cooling water and a more or less skilled attendant. However, even in these engines compression is often carried too near the danger point, and I have seen a slight change in the quality of the gas cause a great deal of trouble.

For automobile use, however, owing to the varying conditions of operation, a much wider factor of safety must be allowed. And it is noticeable that as the automobile designer advances in experience he generally uses lower and lower compression.

A few years ago high compression was widely advocated for automobile engines.

And the compression of many engines was raised from about 80 pounds gauge to 90, 100, 105 and even in one case to 110 pounds. This latter compression is only possible with valves located in the head, very thorough water jacketing and circulation.

These high compressions resulted in most cases in increased engine power and speed. But they caused crank shafts and other parts to break,, and after carbon accumulated in the cylinders not a few cylinder and piston heads were broken. It was also found difficult to keep some of these engines cool when used continuously for heavy work. Further, the high compression engine did not pull so well at low speeds as did its predecessor. It was also difficult to crank the motor. These facts caused a general reduction of pressures after a year or two's experience with the higher values, though a few makers still continue to use quite high compression.

Probably if the opinion of all the automobile engineers in the country regarding this subject were obtained the composite would be about as follows: The most advantageous compression for automobile engines, using gasoline fuel, lies between 70 and 85 pounds gauge, the exact amount for each particular case depending most largely upon the size of the cylinder and the relation of the motor power to the weight carried. For motors with four and six cylinders, each of them rather small, running a good deal of the time lightly loaded, the higher values are best. For heavily loaded motors and those with large diameter cylinders, 70 to 75 pounds gauge is best.

This view is sustained by a table on page 461 of Vol. 19 of THE HORSELESS AGE in an article on connecting rod design by Mr. Heldt. The compressions of nineteen American motors are given, and the average value is 70 pounds gauge. I have no later figures than these, which cover as many cars, but it is my impression that the average compression has been reduced the last two years.

Perhaps one factor which has contributed to this reduction, though I do not remember to have seen it mentioned, is the change in the grade of gasoline. Much of the gasoline we get now has a considerable content of heavy hydrocarbons, ranging almost to kerosene. While I have had no personal experience with kerosene engines, I understand that from 40 to 65 pounds compression is about the upper limit, and that higher compressions are not usually successful. It may be that changes in our fuel have made lower compression advantageous without our realizing it

Among the arguments which might be advanced against the use of high compression in automobile engines is the fact that only a slight misadjustment of the carburetor is needed to cause the loss of the extra power gained over a moderate compression. A pertinent illustration of this is found in the Government experiments comparing gasoline and alcohol fuel. The engine used was a 6½x10 inch two cylinder, vertical, hit and miss governed, with make and break ignition. Using gasoline, the results were as follows:

Compression (Lbs. Gauge).	R. P. M.	M. E. P.	Fuel Used Lbs. Per H. P.
68	282	85.3	.92
66	284	78.9	.72
86	285	74.6	.89

These are only a few out of many tests and show no decided advantage for the higher compression. With alcohol higher compressions were used, which were not possible with gasoline in this paticular engine. The general conclusions from the tests were that with either fuel it is easy through wrong adjustment to use much more than the minimum amount of fuel necessary; that high compression gives a slight improvement in fuel economy, but this improvement may very easily be more than overcome by wrong adjustment of the fuel supply. After very extended tests upon seven other types of engines the conclusion was reached that increasing the compression with alcohol fuel from 70 to 125 pounds produced only a slight improvement in the fuel efficiency. These tests also showed that good carburetor adjustment and proper ignition timing are the main factors in engine power and efficiency.

In conclusion we may safely generalize as follows: High compression for automobile engines is not advisable in most cases. While a high compression engine may be "tuned up" to give both higher speed and more power than one with lower compression, it needs more skilled attention to keep it in good condition. The back pressure of the high compression is always present, while the additional pressure which it may cause in the explosion is easily lost by a slight change in conditions or adjustment. Not until carburetors are more reliable and other conditions of operation more uniform will compressions of over 80 pounds gauge be an advantage in automobile work.

Some Factors of Safety Used in Automobile Construction.

By DAVID LANDAU.

It has been the custom among engineers for many years to increase the strength of parts several times beyond that required by the actual stresses imposed, but it is quite characteristic of automobile engineers not to increase the strengths above that required in other lines of mechanical engineering. This increase of strength or resistance of the materials is accomplished in several ways, such as increasing the cross section of the material or changing the shape of the part by the use of different grades of material, or by designing the parts so that they will be subjected to pure stresses. These changes are made for the purpose of increasing the degree of security of the part. The degree of security which expresses the number of times that the strength of the part is increased above that actually required, as determined by calculation or experiment, is known as the factor of safety. This factor is usually expressed by an integral number, such as 3, 5, 10, etc., and we may define it as follows: The factor of safety for any material is the ratio of its strength to the known stress to which it is subjected. Little amplification of this definition at this stage is necessary.

In most materials used in automobile construction experiment shows that when they are subjected to a stress we find that the stress produces a proportionate strain, and this continues until the stress reaches a certain intensity, after which the strain increases more rapidly than the stress. At the point where the strain ceases to be proportional to the stress, the material is said to have reached its elastic limit. If we continue the stress above the elastic limit we finally reach a stage where the material finally ruptures. The stress required to effect rupture is known as the ultimate strength of the material for tension, compression or shear, as the case may be. For a fuller discussion of this subject see "Physical Characteristics of Materials—Metals," HORSELESS AGE, November 7, 1906.

From what has been said above it can be readily seen that we have two principal points from which to reckon strength, and in our definition of the factor of safety, and in its application to what is to follow, we will assume the strength as measured by the elastic limit, or, as it is termed, the elastic strength. Experience shows that in spite of materials being subjected to stresses far below their elastic limits, they will nevertheless break in the course of time, and the question of longevity of any material is dependent on the factor of safety. For some years past we have been unable to assign a reasonable cause for materials breaking when subjected to low stresses, except by attributing it to a "molecular fatigue." An examination of bars that have been stressed beyond the elastic limit and broken due to fatigue, shows certain well defined surfaces where sliding has occurred. This is due to the fact that when a material is stressed beyond the elastic limit the temperature increases owing to internal molecular friction and the elastic property of the material is destroyed.

From a consideration of thermo-dynamic principles it may also be shown that temperature changes occur in substances stressed below the elastic limit, the substance getting cooler under tension, and warmer under compression (india rubber being a notable exception). In 1902 Turner made careful measurements of these changes (see Transactions of Amer. Society of Civil Engineers, Vol. 48, 1902), and he has shown that these temperature changes continue uniform up to about three-fifths of the elastic limit, at which point a sudden change occurs, the material in tension growing warmer, and that under compression increases at a more rapid rate. It is thus seen that for materials working under higher stresses than three-fifths of their elastic limit, the energy is converted into heat, and it seems likely that this holds true for lower stresses as well.

The foregoing explains in a more rational way why fatigue occurs more rapidly under an alternating stress. The consideration of these facts, together with the results of the classic experiments made by Wohler and Bauschinger, throws some light on the factors of safety adopted.

The factor of safety being a purely relative term, it may be better called the factor of security, common acceptance of the term factor of safety being the only good reason for its adoption. In the course of an experience of successful design extending over several years, in the compilation of much data from various sources, the writer has derived factors of safety for the various parts enumerated below. The method of deriving these factors will be shown, and while they may lack a strictly scientific derivation in some instances, they have this to recommend them, namely, that other factors of safety, similarly derived, will give results which produce durable parts.

SAFETY FACTORS FOR SHAFTS

Propeller shafts, rear axle shafts for floating axles, gear box shafts, lay shafts or cross shafts for chain driven cars are subjected to torsion, but in some cases we have bending as well. Taking the simplest of these cases, that of the propeller shaft, and neglecting the friction at the universal joints, and the weight of the shaft itself, we find that the propeller shaft in shaft driven cars are subject to pure torsion, and we find that the average dependable cars have these shafts designed with a factor of safety of between 6 and 8, or an average of 7, this factor of safety being computed by taking the maximum twisting moment of the shaft, that is, when transmitting power on the first speed. This also applies to the rear shafts in a shaft driven car, except that the factors of safety are usually somewhat higher, so as to provide sufficient material for securing the wheel clutches at the respective ends.

The twisting moment in pounds-inches may be readily obtained from the equation

$$M_t = \frac{63025 \times H P}{R P M} \quad \ldots\ldots (1)$$

where H P is the horse power transmitted,
R P M the number of revolutions of the shaft per minute (taken on the lowest gear reduction),
63025 is a constant, and is obtained from the following relations:

$$\frac{12 \times 33000 \times H P}{2 \times \pi \times R P M} = \frac{63025 \times H P}{R P M}$$

Having obtained the twisting moment as above, it is then only necessary to obtain the section modulus of the shaft, and dividing the above twisting moment by the modulus found the fibre stress will be obtained. The relation which expresses this is $M_t = fZ$, where f is the fibre stress and Z the polar section modulus, that is, the section modulus for torsion. From this

$$f = M_t/Z \quad \ldots\ldots (2)$$

The section modulus for torsion for a solid round shaft is given by the formula

$$Z = 3.1416\ D^3/16 = .196\ D^3 \quad \ldots\ldots (3)$$

and for hollow shafting subjected to torsion

$$Z = .196 \frac{(D^4 - d^4)}{D} \quad \ldots\ldots (4)$$

where D is the external diameter, and d the internal diameter. For a square shaft subjected to torsion,

$$Z = .208 S^3 \quad \ldots\ldots (5)$$

where S is the side of the square. Table I contains expressions for the section moduli for sections of shafts as found in automobile practice.

We will now consider a specific case and show the application of these formulas thereto. In a certain car having three speeds forward and a reverse the following data were given:

Horse power of engine at 1,300 R P M, 42

Gear box reductions were as follows:

	Primary Shaft. No. of Teeth on Gear.	Secondary Shaft. No. of Teeth on Gear.
First speed	17	31
Countershaft	19	29

Propeller shaft—diameter, 1 inch, solid circular section.

Material—Elastic limit, 200,000 pounds per square inch.

The speed of the propeller shaft when the engine is delivering 42 horse power will be

$$\frac{1300 \times 17 \times 19}{31 \times 29} = 467 \text{ R P M.}$$

$$M_t = \frac{63025 \times 42}{467} = 5068 \text{ pounds-inches.}$$

The polar section modulus for a solid 1 inch shaft is found to be .196 by substituting in equation (3), and the fibre stress is obtained by substituting in equation (2); in this case the fibre stress being 28,850 pounds per square inch. Since the elastic limit of the material is 200,000 pounds per square inch the factor of safety is

$$200{,}000/28850 = 6.94.$$

CALCULATION OF STRESS IN REAR AXLE SHAFTS.

In the case cited above the rear axle was of the full floating type; the rear driving shafts were therefore subjected to pure torsion, and considerations of weight were important in this car. The material was heat treated, and had the same elastic strength as the propeller shaft. These shafts were $1\frac{1}{32}$ inch in diameter, the reduction in the rear axle being 23:48; hence at an engine speed of 1,300 r. p. m. the rear shafts revolve at

$$\frac{1300 \times 17 \times 19 \times 23}{31 \times 29 \times 48} = 223.5 \text{ R P M}$$

and the twisting moment is

$$M_t = \frac{63025 \times 42}{223.5} = 11900 \text{ pounds-inches.}$$

The twisting moment for each shaft will therefore be one-half of this, or 5,950 pounds-inches. The section modulus for a $1\frac{1}{32}$ inch shaft is .21536; hence the fibre stress $f = 27{,}610$ pounds per square inch and the factor of safety is 7.23, or somewhat higher than that for the propeller shaft. This is usually the case, since the ends entering the wheel clutches were made square and the circular section was made sufficiently large to enable the end being upset for the square mentioned. Prior to heat treating these shafts the factor of safety of 3.25 was used and breakages were quite frequent, but by increasing the diameter of the shaft and heat treating broken shafts were not heard of.

CALCULATION FOR STRESS OF SEMI-FLOATING REAR AXLE SHAFTS.

When this construction is used the writer finds that designers use a somewhat higher factor of safety than that for propeller shafts, and this may be readily explained in that the higher factors of safety are to allow for shocks, as when traveling on a rim or deflated tire. The following is a specific case of a foreign car of 30 horse power at 1,600 r. p. m.: Diameter of rear shafts, $1\frac{17}{32}$ inches; material of rear shafts not treated; elastic limit, 100,000 pounds per square inch; first speed reduction, .0831; load on each wheel, 1,033 pounds; distance from point of overhang to centre of wheel tread, 3.73 inches.

When a shaft is subjected to bending and twisting we can find the bending and twisting moments and take both in one expression, which shall be the equivalent twisting moment. This is given in equation (6).

$$M_{et} = M_b + \sqrt{M_b^2 + M_t^2} \quad \ldots\ldots (6)$$

where M_b is the bending moment and M_t is the twisting moment. Applying this to our case we have

$$M_t = \frac{63025 \times 30}{1600 \times .083} = 14006 \text{ pounds-inches}$$

for both wheels, half of it being taken for one wheel. The bending moment

$$M_b = Wl \quad \ldots\ldots (7)$$

Substituting, we have

$$M_b = 1033 \times 3.75 = 3859 \text{ pounds-inches,}$$

and from equation (6)

$$M_{et} = 3859 + \sqrt{3859^2 + 7003^2} = 7992 \text{ pounds-inches.}$$

The section modulus of a $1\frac{17}{32}$ inch shaft is .705, hence the fibre stress is 11,400 pounds per square inch and the factor of safety is 8.325. This car has earned the reputation of standing up to its work, and most careful inquiry has shown that breaking of these

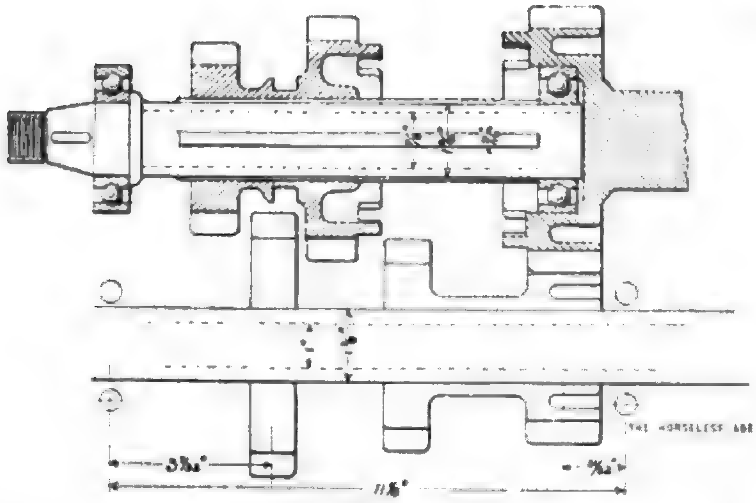


FIG. 1.

shafts is unknown, but at long intervals we have seen cases of these axles bending. Where bending does occur, it is doubtless caused by excessive strains, as in striking a curbstone, etc. The writer has measured up one of these axles before making a test run on a rim, but has found no permanent set after this abuse. From nine other cars for which the writer has compiled data he finds that the maximum factor of safety is 9.62 and the minimum 7.9. This gives a good basis for design of any other axle of the semi-floating type. The full live type of axle has now practically ceased to exist, and factors of safety for this type are of little importance.

CHAIN DRIVEN CARS.

The shafts driving the small sprockets on chain driven cars are subjected to bending and torsion, but the bending moments are very small in a car of modern design, owing to the use of ball bearings, these bearings being placed close to the sprockets. From a number of cars measured the factors of safety were found to 9, when calculated for bending and torsion.

In treating of the stresses and factors of safety in gear box shafts we will deal only with those cars having three or four speeds forward and one reverse. Gear boxes of this description contain, as a rule, two sets of shafts, these being parallel to each other, and a set or train of gears fixed permanently in place on one of these shafts termed the countershaft, the other train being mounted on the primary shaft and slidable axially. The primary shaft is usually of square section, but oftener a feathered shaft, having from four to six feathers or splines milled out on the shaft. It has been shown by F. E. Watts, in THE HORSELESS AGE, July 8, 1908, that owing to the angle of the tooth the torque pressures on the gears can be resolved into a radial and a tangential component acting at the pitch point of the gears in mesh. The two forms of teeth used exclusively in automobile construction for change gears are the standard Brown & Sharpe 14½ degree involute tooth and the stub tooth of the Fellows Gear Company, having an angle of 20 degrees.

Section No	AREA	I	Z
1	h^2	$\frac{h^4}{12}$	$\frac{h^3}{6}$
2	$H^2 - h^2$	$\frac{H^4 - h^4}{12}$	$\frac{H^4 - h^4}{6H}$
3	$h^2 - \frac{\pi d^2}{4}$	$\frac{1}{12}\left(h^4 - \frac{3\pi d^4}{16}\right)$	$\frac{1}{6h}\left(h^4 - \frac{3\pi}{16} d^4\right)$
4	$h^2 - a^2$	$\frac{1}{12}\left[l h^3 + \frac{3}{2}(h^4 - l^4)\right]$	$\frac{1}{6h}\left[l h^3 + \frac{3}{2}(h^4 - l^4)\right]$
5	$\frac{\pi d^2}{4}$	$\frac{\pi d^4}{64}$	$\frac{\pi d^3}{32}$

Section No.	AREA	I	Z
6	$\frac{\pi}{4}\left(D^2 - d^2\right)$	$\frac{\pi}{64}\left(D^4 - d^4\right)$	$\frac{\pi}{32}\left(\frac{D^4 - d^4}{D}\right)$
7	$2b(h - d) + \frac{\pi d^2}{4}$	$\frac{1}{12}\left[\frac{3\pi}{16} d^4 + b(h^3 - d^3) + b^3(h - d)\right]$	$\frac{1}{6h}\left[\frac{3\pi}{16} d^4 + b(h^3 - d^3) + b^3(h - d)\right]$
8	$2b(h - d) + \frac{\pi}{4}\left(d^2 - \delta^2\right)$	$\frac{1}{12}\left[\frac{3\pi}{16}\left(d^4 + \delta^4\right) + b(h^3 - d^3) + b^3(h - d)\right]$	$\frac{1}{6h}\left[\frac{3\pi}{16}\left(d^4 - \delta^4\right) + b(h^3 - d^3) + b^3(h - d)\right]$
9	$\frac{1}{4}\left[10b(2H - d) + \pi d^2\right]$	$\frac{1}{48}\left[7b(8H^3 - d^3) + 3b^3(2H - d) + \frac{3\pi d^4}{4}\right]$	$\frac{1}{48H}\left[7b(8H^3 - d^3) + 3b^3(2H - d) + \frac{3\pi d^4}{4}\right]$
10	$\frac{1}{4}\left[10b(2H - d) + \pi(d^2 - \delta^2)\right]$	$\frac{1}{48}\left[7b(8H^3 - d^3) + 3b^3(2H - d) + \frac{3\pi}{4}\left(d^4 - \delta^4\right)\right]$	$\frac{1}{48H}\left[7b(8H^3 - d^3) + 3b^3(2H - d) + \frac{3\pi}{4}\left(d^4 - \delta^4\right)\right]$

Now, since the radial component varies as the tangent of the tooth angle, and the tangents of these angles are, respectively, .25862 and .36937, the ratio of the radial pressures of these two gears is .36937 to .25862, or 1.405. It is thus seen that the pressures producing bending of the shafts are greater for the larger angle. In calculating the loads which produce bending in a gear box shaft the gear pressure angle must also be known.

From what has been said it is evident that the shafts in gear boxes are subjected to bending and torsion; the factors of safety of these may be calculated from their known dimensions and from the power that they have to transmit. For example, we will take the gear box having three speeds; the general dimensions are shown in Fig. 1. The gears are all 14½ degree involute, six pitch. The shafts are made of a material having an elastic limit of 90,000 pounds per square inch. The pressures on the various gear combinations are as follows:

	Total Pressure on Gear Teeth, in Pounds.
First speed	1,437
Second speed	978
Constant drivers	2,340

	Pitch Line Velocities in Feet Per Minute.
First speed	965
Second speed	1,418
Constant drivers	592

Calculating the twisting moments of the secondary shafts we have on the first speed

$$M_t = \frac{63025 \times 42 \times 31}{1300 \times 17} = 3707 \text{ pounds-inches.}$$

The secondary shaft is hollow, and its dimensions are as follows:

Outside diameter	1.375 inches.
Inside diameter	1 inch.

The section modulus for a hollow shaft of these dimensions, from (4), is .37. The bending moment of this shaft can be determined graphically or by calculation: Tan 14.5° = .25862; hence the radial load which produces bending is 1,437 × .25862 = 372 pounds, and the load on the countershaft gear will be 2,340 × .25862 = 605 pounds. The gear shaft is 11.125 inches long from centre to centre of bearing supports (centre of bearings), and when in mesh the gears take the position shown in Fig. 1 on the secondary shaft. From the bending moment diagram, Fig. 2, it will be seen that this shaft may be considered as a beam supported at two points with loads concentrated at various points. The maximum bending moment occurs at one of the loads where the vertical shear is zero. By measuring the diagram we find the maximum bending moment to be 1,080 pounds-inches, which we will call M^b. The twisting moment is 3,707 pounds-inches; the equivalent twisting moment can then be determined, which is found to be 4,942 pounds-inches. The fibre stress is

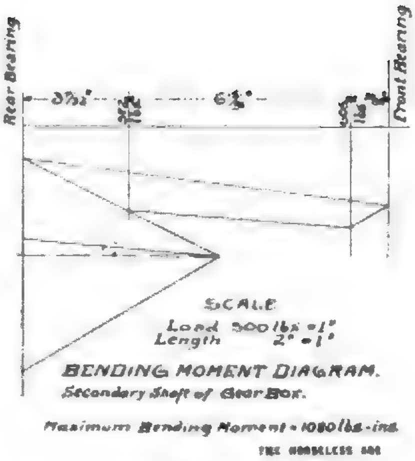


FIG. 2.

Section No.	AREA	I	Z
11	$3b(2H-d)+\frac{\pi d^2}{4}$	$\frac{1}{24}\left[5b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi d^4}{8}\right]$	$\frac{1}{24H}\left[5b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi d^4}{8}\right]$
12	$3b(2H-d)+\frac{\pi}{4}\left(d^2-\delta^2\right)$	$\frac{1}{24}\left[5b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi}{8}\left(d^4-\delta^4\right)\right]$	$\frac{1}{24H}\left[5b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi}{8}\left(d^4-\delta^4\right)\right]$
13	$4b(2H-d)+\frac{\pi d^2}{4}$	$\frac{1}{6}\left[b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi d^4}{32}\right]$	$\frac{1}{6H}\left[b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi d^4}{32}\right]$
14	$4b(2H-d)+\frac{\pi}{4}\left(d^2-\delta^2\right)$	$\frac{1}{6}\left[b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi}{32}\left(d^4-\delta^4\right)\right]$	$\frac{1}{6H}\left[b(8H^3-d^3)+b^3(2H-d)+\frac{3\pi}{32}\left(d^4-\delta^4\right)\right]$
15	$b\,h$	$\frac{b\,h^3}{12}$	$\frac{b\,h^2}{6}$

Section No.	AREA	I	Z
16	$2(B+h)t$	$\frac{BH^3-h^3(B-t)}{12}$	$\frac{BH^3-h^3(B-t)}{6H}$
17	$2(B+h)t$	$\frac{2B^3t+ht^3}{12}$	$\frac{2B^3t+ht^3}{6B}$
18	$\frac{b(S-H+4t+h-l)+t(h-t)}{2}$	$\frac{b(H^3+S^3)+3(l^4-h^4)}{24}$	$\frac{b(H^3+S^3)+3(l^4-h^4)}{12S}$
19	$\frac{\pi a b}{4}$	$\frac{\pi a b^3}{64}$	$\frac{\pi a b^2}{32}$

13,300 pounds per square inch. The material of this shaft had an elastic limit of 90,000 pounds per square inch; hence the factor of safety is $90000/13300 = 6.82$.

The primary or feathered shaft is made of the same material as the above, and always runs at engine speed; the section modulus was found to be .6374; hence its strength is far above that of the secondary shaft. It is also necessary to determine (in some transmissions) the strength of the feathers to resist shear, and in the case just mentioned we find the following conditions obtain: Pressure on first speed gear, 1,437 pounds; area of the feathers subjected to shear, 5.23 square inches. The pressure at the shearing plane is inversely proportional to the diameter of the gear and to the diameter of the shaft at the base of the feathers, and is found to be $1.437 \times 2.833/1.375 = 2{,}960$ pounds. The shear per square inch is 565 pounds. It is customary to consider the strength of the material subjected to shear to be four-fifths of the strength of the material in tension. For the material in this case the shear at the elastic limit would be $90{,}000 \times .8 = 72{,}000$ pounds per square inch; hence the factor of safety for shear at the feathers is 12.75.

The number of cases cited is sufficient to show the best practice and the factors of safety adopted; also the method of applying the formulæ. From experience the writer suggests that engineers should in all cases provide themselves with a table of the physical properties of the materials they use, and carefully investigate the stresses imposed and determine the factors of safety of the components of their design. In this connection the table of moments of inertia and section moduli given herewith will be found useful.

Particular stress should be laid on the fact that strength is not indicated by the weight of a part, but is a function of the section modulus to resist the stresses imposed. Once the nature of the stresses is determined, it should be an easy matter to obtain the weight and proper form of the part. From calculations and observations on many designs the writer is convinced that the section modulus has not been considered as much as it should in calculating the strength of parts.

Tire Pointers.

By A. D. Hard, M. D.

Sometimes the man who is using Fisk tires cannot get that make of tire readily, or for some other reason wishes to use an ordinary clincher tire on his Fisk rim. I found that my 3½x30 Fisk rim was just eleven-sixteenths of one inch less in diameter than the inside diameter of a common clincher rim. This gives just the right space to allow for eight five-sixteenths inch carriage bolts 3¾ inches long to hold the clincher rim on to the Fisk rim very much as the Fisk tire is held on to the Fisk rim. A large washer should be used on the head end of the bolt, and a three-eighths inch nut filed to act as a sort of wedge between the two rims used as a washer on the nut end of the bolt. The tire and rim may be carried thus as an extra tire, inflated ready to use. Of course tire lugs cannot be used, but some of the best clincher tires do not have lugs. If lugs are required they may be used by applying a common nut on the under side of the clincher rim, cutting the surplus stem off. Swinehart or Motz tires may be fitted to Fisk rims in the same manner.

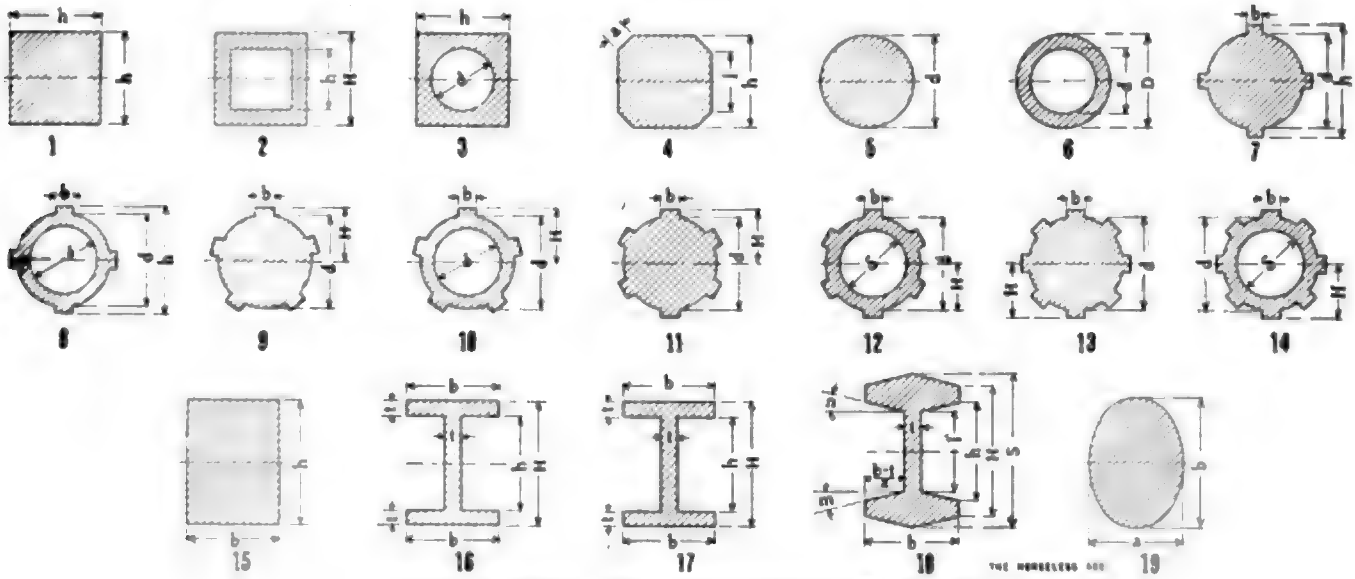
A single tube tire of proper size used as an inner tube for a clincher or Fisk casing will give freedom from punctures and blowouts, and will enable you to use the casing fully twice as long as when the strain of a tightly pumped tire is held by the casing alone. A little ingenuity is required to get a good fit, and a good tire tool is required to seat the clincher casing in the rim, but when properly done the tire has a dependability equal to a solid tire. If the single tube does not quite fill the casing an old inner tube, split so as to form a sleeve, will increase its diameter one-fourth of an inch. A clincher casing thus fitted will wear better than a rigidly pumped casing, because the rubber on the tread yields somewhat to every tearing force that strikes it on the road. The casing will wear until there is almost nothing left of it, as blowouts are impossible.

When sharp sand gets between a leather tread and the casing the slip of the leather tread in travel will grind the tread off the casing, and the casing will not wear as long as when a leather tread is not used. To avoid this I placed six straps across the inside of the felloe, from one crimped wire ring to the other, so as to prevent the leather tread from slipping around on the casing. This also holds the tread closer to the wheel on the sides, and prevents mud from getting in behind the buckles.

There is an impression that solid tires cannot be used practically on automobiles. The exact fact is, the ordinary type of automobile is fitted with springs calculated to be used with pneumatic tires, and is therefore not suitable for best results with solid tires. If the usual springs are rendered softer in action by supplementary spiral springs, or any device which will secure such results, solid tires may be used with great advantage, but speeds of from 30 to 100 miles per hour should never be attempted on solid tires.

Rubber Tires in Caucasian Cities.

Consul W. W. Masterson states that the rubber tire sales in the Batoum district of Russia amount to about $200,000 annually. The streets of the cities are paved with cobblestones, which necessitates the best tires. Those in use come from Riga and Moscow, and are heavy and tough, lasting with ordinary usage from nine months to a year. When they become badly worn they are cut into pieces, strung on strong steel wires and placed on ordinary public carriages for hire.



Sections Commonly Used in Automobile Construction.

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Improvements in Foundry Work.

While the requirements of automobile construction have been a powerful factor in bringing about improvements in machine work, forging, and other branches of the metal trades, there is probably no branch of industry where its effects have been more strongly felt than in the foundry.

As a usual thing we do not know the degree of excellence attainable in any art; all that we know is how well the work is being done and what are considered the limits of accuracy commercially attainable. These limits are in most cases fixed by the demands of the class of work commonly done. So when the making of automobiles in quantities first began there were only a few foundries which could make the castings required. In this work it was absolutely necessary to reduce the weight as much as possible, so all the sections were made as small as they could be and have the necessary strength. This meant that the foundry work must be accurate, for only a small margin could be allowed for variations in the castings.

As the demand for automobiles increased their power, speed and weight also increased, and the demand for light weight parts became more and more exacting. But foundries generally had become accustomed to this thin section work, and it soon became possible to get successful castings almost anywhere.

At the present time there are foundries in most cities of considerable size which can make practically any casting required on an automobile. Often when the question of choosing a foundry for a particularly difficult job comes up the only thing to consider, after the price, is the quality of the metal, there being usually a number of foundries which can do the molding equally well.

Quite lately in the search for compactness, light weight and low first cost, the casting of three and four cylinders in a unit has become rather common. When, as is sometimes the case, the inlet and exhaust manifolds are cast with the cylinders the core work becomes very complicated, and the fact that such castings are produced with considerable success is a high compliment to the founder's art.

Probably we have about reached the limits of what automobile work will require of the foundry. The long aluminum castings, which include the crank case for a multiple cylinder engine and the housing for the change gears, are apparently the limit in that direction. And it is hardly likely that we shall ever make a practice of casting more than four cylinders together. We believe that some six cylinder "bloc" castings have been made. But as it is unlikely that any designer will attempt to place more than four crank pins between bearings it is more likely that two units of three cylinders each will be employed for six cylinder work. However, the casting of six cylinders together would have one advantage which can by no means be overlooked for high grade work: the unit thus formed would be very strong and the crank case could be made correspondingly light. So even six cylinders cast together may be a commercial possibility.

The Cooling of Piston Heads.

Despite all the painstaking effort which has been lavished upon the water cooling of automobile engines, and the generally satisfactory results which have been obtained, there is still one important part of the motor which constantly operates at an unduly high temperature. This is the central portion of the piston head. While the cylindrical face or side of the piston is maintained at a satisfactorily low temperature through conduction to the water cooled cylinder walls, there is a rapid increase of temperature from the periphery of the piston head toward its centre, where the maximum temperature is reached. The heat absorbed by the centre of the head must mainly be dissipated by conduction radially through the head to the cylinder walls. Considerations of lightness demand that the piston head shall be as thin as it can safely be made, and conduction is thus relatively slow, so that the temperature gradient from the centre of the head to its edges is quite a steep one.

Inspections of the pistons of vehicle engines which have been in service for a considerable length of time very often show an encrustation of so called carbon, quite heavy at the centre of the head, rapidly becoming thinner at a short distance therefrom, and disappearing almost, if not entirely, around the edges of the head. The surfaces of the combustion space may be nearly free from serious encrustation in a case like this, and it is often evident that it is the accretion of carbon at the centre of the piston head which is alone responsible for the preignitions that have led to the dismantling of the motor. If the temperature of the central portion of the head could be kept down the ill effects of carbonization could be greatly postponed in many instances.

In large stationary engines, as is well known, the pistons are frequently water cooled, but this fact has no practical bearing upon the trunk-piston type of engine used for motor car purposes. The only practical lines along which the reduction of piston head temperatures is to be sought are by increasing the conductivity of the head in a radial direction and by increasing the radiating effect of the lower surface of the head toward the cooler crank case portion of the motor. To increase the conductivity of the piston head to the cylinder walls the head must be made thicker, which in itself is objectionable, or the head must be wholly or partially composed of a more highly conductive metal such as copper, which has but a slightly specific heat and a conductivity about two and one-third times that of iron.

In order to secure more rapid radiation of the under side of the piston head, downwardly projecting pins or fins might be inserted therein. Indeed, this expedient has been adopted in one vehicle motor, but it is not known with what success.

It is believed that this matter of piston head running temperatures is an important one as determining the rate of carbonization of motors, and it is hoped that designers will take steps to remedy this remaining defect in the cooling provisions of vehicle engines.

Magnetic Alloy Steels.

Although it has been known to certain of the large electrical companies for some time past, the fact has only recently become publicly known that certain new alloy steels have been discovered which possess remarkable magnetic properties. Until quite lately it was universally believed that iron which was as free as possible from impurities and in the softest attainable condition mechanically possessed the most desirable magnetic characteristics for use in cores for transformers and induction coils. It transpires, however, that open hearth steel alloyed with silicon to an amount twenty or thirty times its usual accidental content, and which is mechanically hard even when thoroughly annealed, is far better magnetically than the softest wrought iron. The permeability of this alloy appears to be decidedly higher than the best magnetic iron, and its hysteretic coefficient is much lower. Furthermore, as its electrical resistance is high the loss of energy due to eddy currents is substantially reduced. A still newer alloy, silico-vanadium steel, is claimed to possess even greater advantages in point of low hysteresis and eddy current losses, and it is claimed that its use results in a 25 or 30 per cent. reduction of core losses over those experienced when ordinary transformer iron is employed.

These facts have a bearing upon the automobile industry in that they render possible improved efficiency and greater compactness in jump spark coils. A large part of the loss in these coils is due to the hysteresis and eddy currents in their cores, and the use of alloy steel therein instead of ordinary soft iron promises a reduction of this waste. This means less battery consumption per spark. The employment of cores of more permeable material means less ampere turns required and less copper loss, as well as units of smaller bulk. Magneto armatures may also be increased in their output by any increase of permeability in the material of the core and by any reduction of the hysteresis loss therein.

It is only quite recently that these magnetic alloy steels have been procurable in the open market in commercial quantities. But the demand of the large manufacturers of transformers has brought out a supply. There seems to be a probability that even better alloy will be discovered as research is carried further, and it seems not at all unlikely that some alloy of higher retentivity and vibration resisting qualities than the tungsten steel now used for the magnets of the better class of magnetos will be found, in which case lighter and more compact magnetos freer from the likelihood of demagnetization may be expected.

The Spare Wheel.

Usually anything that contributes to the comfort of the motorist meets with an enthusiastic reception, and the spare wheel, or emergency wheel, bids fair to follow this rule.

As usually built it would be more correctly designated by the term "spare rim," for it is simply a steel rim, adapted to be fastened to the outer side of the regular wheel by clamps or bolts. This spare wheel is carried with its tire inflated, and in case of a puncture it is only a moment's work to clamp it to the regular wheel, leaving the punctured tire in place.

It will be seen that by its use it is very easy to finish a trip without doing any tire work on the road in case only one puncture is met with; but, like everything else of this class, the only way to provide for a series of these misfortunes is to carry a number of the wheels.

There are several classes of motorists to whom this device for a quick substitution of tires should be very useful. The first is the tourist who goes into out of the way places, where repair shops are few and far between. Occasionally he is sure to suffer from a puncture when no help is near, and the emergency wheel offers a remedy for such cases. The lady who drives by herself, and who finds the repair of a tire a heavy and disagreeable task, will no doubt welcome some such device.

In cars used for business purposes, where it is often of the utmost importance to reach the destination on time, these wheels would often prove invaluable. This is no doubt the reason why they are being so considerably used on taxicabs

Of course everything which has been said in favor of the emergency wheel, and more, is true of the demountable rim. But these latter can be fitted to a car already provided with other rims only at considerable expense. And the high price asked for a set of them has thus far prevented their use on any but the highest priced cars. So the emergency wheel will probably have a considerable field for some time to come on low and moderate priced cars, and to a certain extent upon the more expensive machines.

The Proposed Illinois Automobile Bill.

A bill to limit the cylinder capacity of automobile motors used or manufactured in the State of Illinois is to be presented to the legislature of that State during the coming session. The above is the chief aim of the bill, the reasons for limiting the cylinder capacity being that high powered cars are only built to exceed the speed limit, and as these have motors of large cylinder capacity, by limiting this capacity and refusing to license cars having a power sufficiently high to develop a speed of from 60 to 70 miles an hour, high speeds could not be attained with the low and medium powered motors which could only be used legally in the State.

Such a proposition is by no means new, a number of measures of a like nature having been proposed in various States from time to time. If such a measure is passed, and no more enforcement of the speed laws is made than at present, the situation will be but little changed. There are today built in France and Italy light cars fitted with motors of 100 to 120 cubic inches cylinder capacity, which can run continuously at the rate of 50 miles an hour. The use of these or like cars in the State of Illinois would be perfectly legal, according to the proposed bill, and the object of the bill would be set at naught.

The bill in its entirety would call for extra expenditure on the part of the State by reason of the necessity of employing examiners for the driving license examination, and special officers, as in the State of New Jersey, to see that no false registration, etc., is carried on. The measure is of the type that reads well in print, but it is doubtful whether it will pass the legislature. The rigid enforcement of the existing law would do more to stop speeding than measures for limiting cylinder capacity and the like.

Motor Omnibuses versus Electric Trolley Cars.

By Roy Lindsay.

The following article is based upon conditions prevailing at the time of writing in England and Scotland. The enormous interest now being given to the good roads movement in the United States must tend toward considerable improvement of the surfaces along the suburban streets of cities and towns, and also of the principal connecting highways between towns. Such improvements cannot be long delayed, and as soon as completed the position will be duplicated in America that exists at present in England, hence it is hoped presentation of carefully considered arguments relating to the trolley car as against the motor omnibus may prove useful. The reader should remember that the representative vehicles of each type in nearly universal use in Britain are for the omnibus, the double decker, carrying thirty-four passengers, similar to the De Dions running in New York, and as to the trolley car the double decker carrying from fifty-two to seventy-two passengers; the seventy-two seated type trolley works the whole of the London tram service. All figures quoted are from officially verified sources.

For many months past discussion has been raised concerning the merits of the two most prominent systems of passenger carrying on public roads. As is usual when any big question of public policy comes along, both parties have their too enthusiastic partisans, who endeavor to distort facts and twist figures until the average reader becomes lost in a maze of technicalities. The "pro-trammers" are perhaps the most blameworthy, for they seem to have but the vaguest notion of the capabilities of the modern internal combustion engine, and officials connected with existing tram services are worse informed on this subject than many members of the general public.

Municipally owned tramways are the rule rather than the exception in Great Britain, particularly in the large cities—London, Glasgow, Liverpool, Manchester, Birmingham, Cardiff, Leeds, Sheffield, Bradford, etc.—while companies working for the benefit of shareholders are confined to the smaller towns. Nine years ago there was only a single trolley tram system in the whole of the United Kingdom, but in the comparatively short time that has since elapsed they have penetrated to every corner, and in the manufacturing districts of Lancashire and Yorkshire all the towns are linked together by the trolley wire. Railway companies who have spent hundreds of millions of dollars in the encouragement of short distance and suburban traffic have already felt the stress of competition from the ubiquitous electric tram, and now comes along the motor omnibus to fight them both. It needs no very great foresight to discern that between the railway and the motor road vehicle, the trolley will sooner or later be squeezed out of existence. The railway will again fall into its proper sphere of usefulness as a long distance carrier for goods and passengers, while the motor, whether omnibus or something else that the needs of traffic will develop, will link up all towns and villages with main electric long distance lines running north and south or east and west. Steam as a propulsive power must be wiped out of existence by electricity or the internal combustion engine. Time only can show which will survive for distance work. But for local services the gasoline motor has so many overwhelming advantages that it must inevitably oust the trolley or conduit tram.

INITIAL COST OF TROLLEY CARS.

The average cost of trolley car tracks in England has been about $62,500 per mile of track (not per mile of street) for rails, columns and supports for the wires, and making good the road surface with granite cubes or wood blocks. Where street widenings have had to be made, gas mains and sewers diverted, the initial cost per mile has been greatly increased. The cost of the track is but a small portion of the capital outlay, as the generating station buildings, equipment of steam engines, dynamos, switchboards, etc., mounts up into sums varying according to the size of the districts to be served. The car sheds can be considered as necessary for any class of vehicles, and may be taken for granted as equal in cost, whether for omnibus or trolley, with a saving in favor of the bus, because no rails have to be laid inside the depot. The cost of the generating station bears a remarkable ratio to eventual annual working costs as between a large and a small system, the larger the number of electrical units to be provided the more economically can each such unit be supplied. When the track is completed and generating station fully equipped there are yet to be purchased the actual vehicles, to propel which all the preliminary outlay has to be made. (The greater portion of the system built and worked by the London County Council, nearly 200 track miles, has been laid with electric conduit or central slot rails, the average cost per track mile, inclusive of underground bare copper cable but exclusive of generating station or vehicles, having been $275,000, and as the laying of two pairs of rails is compulsory the cost for track alone per route mile averages $550,000. Up to date the total capital expenditure for everything on the London County Council service has been over $140,000,000, and there are still some sixty street miles of horsed tracks awaiting conversion. A conservative estimate of lines to be laid in the very near future along the principal thoroughfares only, outside the central business "ring," places requirements at about another 200 route miles. The capital expenditure will therefore have reached at least $320,000,000 by the end of the year 1915. For the twelve months ending December 31, 1907, the net profit earned, after payment of interest on debt, laying aside a sum for sinking fund redemption of debt, for repayment of capital in twenty-five years, and after allowing for $100,000 loss on the horsed trams still working, was $240,000, which sum was paid over in reduction of the county rates.)

In considering the cost to a city of the adoption of trolley trams there is a particular phase of expenditure which the writer

How Double Deck Trolley Cars Monopolize a Narrow Road.

does not remember to have ever seen adequately treated when this subject has been under discussion. Costs per mile of track, buildings, vehicles, etc., are tangible enough, and can be readily ascertained, but the cost accounts, whether of operating companies or municipalities, never include the huge losses sustained both by shopkeepers and private residents along the different routes concerned when the rails are being laid. Nearly every reader of these notes must be interested in a town where rails have been or are being laid, and cannot fail to have noticed the inconvenience entailed upon every class of the community while the works are in progress. What usually happens when contractors obtain possession of a town? For days or weeks beforehand rails, columns, granite cubes, concrete material, and all the other paraphernalia appertaining to a contractor are dumped down on the public sidewalks. The convenience of foot passengers is quite ignored, and more than half the pavement is converted into a combined engineers' and builders' yard. All thought of peace and quietness is beyond hope after the early morning hours, and the crash of steel rails and granite cubes as they are shot down on the road from the carrying wagons continues day after day until the job is completed. It is one of the mysteries of local government why a contractor is permitted to use the town streets as a provisional store; whether trams, sewers, gas or water is the object, there is not an atom of difference in the procedure. There can be no question that the blame for this sacrifice of residents' interests to contractors' profit making rests primarily with the surveyor of each town thus raided. Special committees of a town council, such as tramways or highways, never interfere in these matters, they being treated as one of the sacred rights of the surveyor upon which no man dares to trench. The surveyor will usually fall in amiably with the wishes of the contractor, and permit him to wreak his will as though he owned the freehold of every square yard. Some day an exasperated town will rise up and make an example of a reckless surveyor; the writer has served in an honorary capacity on a town council, and writes whereof he knows.

While all the work is actually in progress, what of the shopkeepers who have to pay rates and taxes? They are usually the last people to be considered when a tramway is mooted, and have to suffer loss and inconvenience while their premises are quite unapproachable for week after week. It is no exaggeration to place a single large sterekeeper's losses at a good many hundred dollars from the day a contractor takes posession of a street until the cars are actually running. Did space serve, any number of specific instances could be adduced. One in particular, within the personal knowledge of the writer, was the cause of considerable financial anxiety, as the tradesman relied for his business almost entirely upon folks who drove up to his doors in their own horsed carriages; his premises being entirely cut off from communication along the roadway for some weeks, the daily receipts fell to vanishing point, and months of hard work were necessitated to bring his sales up to their original figure prior to the time when the street was pulled to pieces. Take any town, large or small, and allow the very moderate amount of $250 for actual average loss of sales for each shop upon the line of route, and it must total into some thousands of dollars. Add to such a sum the damage to stock inevitable from the clouds of dust always accompanying street operations of any character, and the "hidden" cost can hardly be calculated.

Owners of dwelling houses, equally with the shopkeeper, suffer all the inconvenience of dust and noise, although the financial question has to be looked at in quite another way. The staple argument of tramway promoters, and the one upon which the greatest reliance is usually placed, is that the laying of tram rails into suburban districts encourages erection of buildings upon land which might otherwise lie idle for years. Buildings certainly do spring up in a remarkable fashion in the wake of trolley cars, land in the particular neighborhood served appreciating in value for a time. It is also frequently urged that the facility for cheap traveling the electric tram provides is an inducement for workmen to live away from the smoke of cities in the fresher country air. These newer houses must draw residents away from portions of the city previously occupied, and therefore the question arises as to where owners of the older houses are to find tenants, and what will the rental of these be under the altered circumstances? In one district of London conduit trams have in six years actually effected a transfer of population to such an extent that 25 per cent. of the houses are unoccupied. Most all of the 30,000 people who have moved 7 miles find themselves now no better off for fresh air than they were originally, hundreds of acres of fields having been built over to such an extent that the new neighborhood is as densely covered with houses as the older district. In their anxiety to save long walks morning and night these workpeople rent houses fairly adjacent to the tram routes, and consequently a fierce struggle occurs every morning to secure seats. (The police authorities prohibit people standing in any vehicle plying for hire in the streets, and this regulation is rigidly enforced by the infliction of fines upon any conductor daring to carry more passengers than the number for which the vehicle has seating accommodation.) Rail and tramway officials describe their lines as "permanent way," this very term accurately denoting its fixity. It is frequently contended that because of the permanence of tram rails, once they are laid down in a neighborhood, there is an immediate inducement to capitalists to build houses on the frontages the cars will serve. This is true only in degree, because where a working class district is linked up to the factory quarter by rails laid along one main thoroughfare, there inevitably arrives a period when the traffic becomes so vast that passengers can only be carried at a loss. This sounds ridiculous, and is quite contrary to all the preconceived ideas of tramway management, yet the writer of this article is quite prepared to substantiate opinion by official figures. Here is the proof. The London County Council not only runs conduit tramcars, but has also parliamentary sanction to build houses for worsmen, and at Tooting, 8 miles from Charing Cross, purchased a large quantity of land that is being rapidly covered with houses. Trams and these dwellings are

THOMAS TILLING
JOB MASTERS
Chief Office, PECKHAM
LEE GREEN & PECKHAM

Typical Thirty-six Seated Motor Bus in a London Suburb.

part and parcel of a policy initiated with the praiseworthy object of securing artisans' homes in healthy districts, with the ability to travel quickly to their work at very low fares. Before 7.30 a. m. any person can take a return ticket which will be available for the double journey out and home of 15 miles for the very low sum of 4 cents. At Tooting the inevitable result has happened in attempting to segregate a vast population with only a single connecting link between the worker and the work. The cars are taxed beyond their capacity for some two hours morning and evening to carry the up and down passengers respectively; yet the neighborhood is as yet not a quarter built upon. At a point 6 miles distant from the suburban terminus the rails from several districts converge where six main roads cross, the whole of the traffic—tram, horse and motor—being chaotic, and only a personal visit can enable one to realize the monopoly of the roadway that a busy tram service involves. During the rush or "peak" period the cars follow each other so frequently along one street as to barely leaves a couple of yards between each, all other traffic being forced into a single line on either side of the roadway between the rails and the sidewalk. It is impossible to foresee how any more cars can be worked past this spot, yet thousands of Tooting residents are clamoring for an increased service. Even on the Tooting road itself the cars run at intervals of four seconds, while at the city terminus the empty cars waiting to pick up passengers extend for more than a quarter of a mile down the road at the busiest times. This raises another difficulty which faces all tramway enterprises—two very busy periods sandwiched between a long interval of comparative idleness. The generating plant for the transmission of electrical energy must be ample to cope with all traffic the service is capable of carrying; there must be a sufficient number of cars to carry all the passengers offering, and drivers and conductors must be permanently engaged to run them. The last item is a revenue expense only, but the first two entail heavy capital expenditure. During the low pressure periods of traffic a large number of cars, together with drivers, etc., are standing idle, and this applies to all routes. Cars cannot be run on better paying roads because they are all in exactly the same position. No matter where a tramway is laid, whether it be in a big city or a small provincial town, the definite rule applies, viz., vehicles crowded with passengers traveling from the suburbs inward to the central portion of the city in the morning, outward from the centre in the evening, and about a fifth only of the capacity of the roads carried during the middle period, say, from 10 a. m. to 5 p. m.

(To be continued.)

Nineteen cars have been entered for the **Coupe Florio**, to be run for on the Bologna Circuit on September 6.

The Automobile on the Plains of Wyoming.

By J. Tidball.

The city of Laramie, the greatest automobile town in the State of Wyoming, lies at a central point on the Laramie Plains at an elevation a little more than 7,000 feet above the level of the sea. The surrounding country varies greatly in elevation and general topography characteristics. There are few points whose elevation is below 7,000 feet, while the Snowy Range, lying some 40 miles to the west, reaches a height of over 12,000 feet. The Big Laramie River and the Little Laramie River are the main streams feeding the Laramie Plains, they having their sources in the mountain ranges encircling Laramie at a varying distance of from 20 to 100 miles.

The obstacles to be met and conquered by an automobilist while traveling the roads spanning these mountains, plains and valleys at different seasons of the year, and with different kinds of machines, are diversified indeed. Yet all problems connected with such travel have been successfully solved, and now, for all practical purposes, wherever the horse goes the horseless vehicle is to be found likewise, making the journey with greater speed, economy, and less fatigue to the traveler. Those accustomed to automobiles as used on the carefully graded roads of the East or the level plains of the Middle States will be startled at the conditions under which the auto is successfully and easily employed in the Rocky Mountains. Here, when necessity holds the wheel, the automobile is driven up the mountain slopes over steep grades almost to the land of perpetual snow; at other times compelled to break its way across the uneven prairie through snow and sage brush, and again to ford the rivers through mud and rocks. Hundreds of passengers have been transported under such conditions as these on the Laramie Plains during the last season. The accidents to the machines doing this work have been rare, while injury to any of the passengers has been unknown. Every kind of car has been employed, varying in size and strength from a small runabout to a 60 horse power touring car, comprising all makes and kinds of machines.

From Laramie as a centre, wagon roads radiate in all directions—west to the Centennial Valley and across the Medicine Bow Mountains, north through the entire State of Wyoming, giving access to the Yellowstone National Park, east to Cheyenne and Nebraska over the Black Hills, and south to Denver and other Colorado points. These roads resulted directly from the existence of the horse, as traffic without them was impossible. These same roads hastened the substitution of the automobile for the horse, the horse thus proving the purveyor of his own destruction. For the most part these roads are well adapted to the use of automobiles. The Wyoming seasons are dry and the soil sandy, so that it is very rarely that muddy roads interfere with the progress of a machine. A man who has been using an automobile in the vicinity of Laramie for several years stated that he used his machine eleven months in the year; while another, the owner of a garage, claims that there is not thirty days in the year that an auto cannot be run, and with the use of a mud chain it is very seldom indeed that the weather puts them out of commission. Sharp pointed rocks and pebbles are the worst features of the Laramie roads, a feature having a tendency to materially increase the cost of re-tiring a machine.

The great usefulness of the automobile

Inspecting a Ranch.

At Chimney Rock.

in Laramie and its vicinity is understood when it is realized that Laramie is the county seat of Albany County, and that spread out on every side of Laramie is a fertile farming and cattle country tributary thereto. At Laramie all the business of the county is transacted and all its produce sold. There is only one railroad intersecting this country, and most of the traffic is by horse or automobile. Thus it is that the ranchman and the real estate dealer, the professional man and the county official, the tourist and the pleasure seeker have found the automobile indispensable.

Probably the real estate man is making greater use of the automobile than any other person. Industrially the Laramie Plains are in a state of transition. The great cattle ranches of the last forty years, containing hundreds of thousands of acres of agricultural land, are passing from the hands of their owners to colonizing companies. These lands are being reclaimed to intensive farming by irrigation and colonization. The disposal of these vast tracts of land in small farms to thousands of purchasers, who desire to view the land before buying, has been greatly facilitated by the automobile. The Talmadge-Buntin Company, of Chicago, is the largest real estate concern operating on the Laramie Plains. Its method of procedure is to run a special car of homeseekers, about one hundred in number, from some Eastern point to Laramie. At Laramie the land buyers are placed in automobiles and sent out over the holdings of the company. The machines carry five or six passengers each, and travel swiftly and easily, covering about 100 miles a day. In making such trips the roads are not followed, the automobiles traveling directly across the prairie and meadow land, giving the prospective buyer an ideal opportunity to view the lands in which he may desire to invest. The trips are made without fatigue and with greater satisfaction and cheapness than would be possible with horses and rigs. In this case, however, the greater saving is made in the time saved, as a party of land purchasers cover in one day, by the aid of automobiles, an area of country greater than horses and rigs could traverse in three. The Talmadge-Buntin Company has been following this procedure of displaying their lands to colonists for several months, and their continued and increasing use of automobiles for this purpose would seem to indicate its superiority over any other means.

The ranchmen around Laramie employ automobiles only to a limited extent. They are but beginning to realize and appreciate the inherent possibilities in its use. The prejudice which they once bore toward it has passed away, and several ranchmen now own their own machines. To how great an extent they will use them in the future is problematical, but that they have been a success where used in the past is an assured fact. So far the main purpose to which automobiles have been put by the ranchmen is in making trips to the city and neighboring ranches. It can readily be seen what an advantage they are for this purpose when one considers that many of the ranchmen live 20 or 30 miles from Laramie, and often wish to go to town and back to their ranches the same day, besides being desirous of conducting a good deal of business while in town. In making quick trips to town for repairs for different articles of ranch machinery the automobile also serves a long needed purpose. Not far from Laramie a wealthy sheep man makes use of a four cylinder machine for the purpose of herding sheep, and his reports would seem to indicate that soon the art of herding sheep on foot will be a thing of the past.

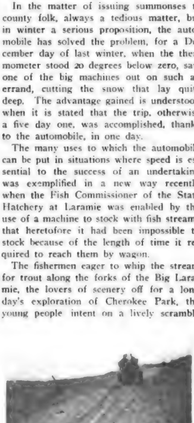
Probably no other class of individuals on the Laramie Plains has benefited as greatly through the introduction of automobiles as has the medical profession. Certainly none has taken to it as kindly. What has made the automobile so valuable to this profession is the fact that much of its practice is in the country adjoining Laramie and some of it many miles distant. By the use of their machines they are enabled to attend to this practice almost as expeditiously and conveniently as though it were in the city. To cite one case: Not long ago a Laramie physician received an early morning call to attend a patient dangerously ill at a ranch 80 miles distant. The run over rocky, mountain roads was made in four and one-half hours, the life of the sufferer was saved, and the doctor made a quick return trip to Laramie the same day. Without the use of an automobile the trip would have taken not less than three days, and the arrival of the physician have been so delayed as to have made the trip almost useless.

Second only to the use that the physician makes of the automobile is that realized by the county officials. The extent of such use is shown by the fact that the Albany County commissioners pay yearly an automobile bill amounting to many hundreds of dollars. It is easy to see that speed is of the greatest importance in the apprehension of criminals or in the matter of procuring legal evidence, and that the automobile furnishes the one means of realizing such speed. The sheriff and the county attorney can cite many instances where the automobile has made it possible for them to capture fugitives from justice. Only recently the county attorney reached the ranch where a murder had taken place before the arrival of the wagon that had set out from town two hours before the automobile. A riot at another ranch 20 miles to the west was ended by the unexpected and hasty arrival of the county officers on the scene.

In the matter of issuing summonses to county folk, always a tedious matter, but in winter a serious proposition, the automobile has solved the problem, for a December day of last winter, when the thermometer stood 20 degrees below zero, saw one of the big machines out on such an errand, cutting the snow that lay quite deep. The advantage gained is understood when it is stated that the trip, otherwise a five day one, was accomplished, thanks to the automobile, in one day.

The many uses to which the automobile can be put in situations where speed is essential to the success of an undertaking was exemplified in a new way recently when the Fish Commissioner of the State Hatchery at Laramie was enabled by the use of a machine to stock with fish streams that heretofore it had been impossible to stock because of the length of time it required to reach them by wagon.

The fishermen eager to whip the stream for trout along the forks of the Big Laramie, the lovers of scenery off for a long day's exploration of Cherokee Park, the young people intent on a lively scramble-



Coming Down a Hill.

over the boulders that flank Chimney Rock, all find their desires realized by means of the automobile. Ideal hunting for birds and bigger game may now be had in a single day, where before a week's outing would have been necessary to reach the hunting and return.

Long distance trips from Laramie to neighboring cities, principally over mountain roads, are made daily and with uniform success. The road from Laramie to Cheyenne is about 50 miles, involving in its passage the climb of Sherman Hill, the highest point on any transcontinental railroad, reaching an extreme elevation of 8,100 feet. This trip is made on an average of about two hours and forty minutes, though it has been made in two hours and twenty minutes, which is the railroad time for the same trip. Denver, lying 141 miles to the south of Laramie, is reached in less than eight hours, and with considerably more comfort than is had on a railroad trip.

At the same time of writing this article there are about sixty machines in Laramie, among which is represented every standard make of car. As Laramie contains less than 9,000 inhabitants, the number of machines for its population is large. The most popular and successful car used in Laramie is the medium sized machine of from 20 to 30 horse power, seating five persons. There are two efficient and well equipped garages in Laramie, which have proved eminently capable of handling the automobile business of the city. In addition to the automobiles there are several motorcycles acting as delivery wagons, which are cutting in considerably on the lighter drayage business.

These are the principal uses to which automobiles have been put in Laramie and the country tributary thereto. The question now arises as to the cost of maintaining an automobile as compared with the cost of horses. So far in nearly if not all cases where on the Laramie Plains the automobile has supplanted the horse we find the element of time more important than the bare cost of operation. The professional and real estate man employ the automobile not because they desire to save money, but because their time is of value. Indirectly, of course, and to a very considerable extent, this saving of time means a saving of money, but primarily the conservation is in time and not in the cost of maintenance. To compute this indirect saving of dollars and cents the personal equation must be known; that is, whether the traveler be a professional or non-professional man, or the commodity carried be of perishable or non-perishable nature.

As regards this saving in time by the use of automobiles sufficient has been said in the matter used throughout this article. From our experience on the Laramie Plains a fair conclusion in regard thereto would seem to be this: Whenever time becomes an element of the equation, as effecting either the commodity or passenger carried, the automobile is clearly superior to the horse, and must supplant it, the value of the time saved varying in each case according to the nature of the individual or freight carried.

After the Hunt.

In many cases, however, where the automobile might be employed the element of time is unimportant, the proposition as to the cost of maintaining an automobile or a horse being the only one involved. Which then is the cheaper per mile operation, the horse or automobile? The final determination of this question must largely answer to what extent the automobile is destined to commercially supplant the horse. From the most carefully compiled and accurate figures available on the subject it appears that the cost per mile of automobile travel is appreciably cheaper than horse conveyance. In gathering the figures submitted below, wherever a doubt arose, that doubt was resolved in favor of the cheapness of horse traffic and against the automobile. An analysis of these figures will show many places where the charges against the horse might reasonably be increased, and a corresponding decrease in the cost of automobiling. The figures given are not based upon garage or livery stable charges, and in neither case include the services of a groom or chauffeur, but are gathered on the supposition that the automobile or team is maintained by the owner at his own home. The figures given embrace respectively the life of a horse and automobile, both supposed to extend over a period of twelve years, during which time it is estimated that the team will cover 40,000 miles and the automobile 100,000 miles. The life of an automobile is supposed to extend over a period of twelve years in order to secure a basis for figuring interest on the money invested in the automobile. The 100,000 miles' service attributed to the automobile might be rendered in three or four years' time, in which case the interest charges would be considerably less.

At rough usage the life of an automobile might not exceed 60,000 miles, though certain machines have been employed here under the very severest conditions up to 50,000 miles, and are still in good condition. The same condition holds good with a team, which if compelled to excessive labor for a few years would probably find their limit in 20,000 miles.

We see then that even eradicating the element of speed and comfort, still the automobile has a big handicap over the horse.

Horse.	
Miles traveled	35,000
Cost of team	$250
Cost of wagon	150
Cost of harness	50
Total investment	$450
Cost of maintaining a team for twelve years, including hay, grain, shoes and veterinary services, $250 per year	3,000
Repairs to wagon	300
Interest on original investment of $450 for twelve years, at 6 per cent. per year	324
Total	$4,074
Miles traveled	35,000
Per mile cost	$0.116
To determine cost per passenger mile divide by 4	.029

Automobile.	
Miles traveled	100,000
Cost of automobile	$1,800
Gasoline, at 18 cents per gallon, 1 gallon per 18 miles, on basis of 100,000 miles	1,000
All oils	100
Repairs and overhauling, including re-tiring	1,700
Interest on original investment of $1,800 for twelve years, at 6 per cent. per year	1,296
Total	$5,896
Miles traveled	100,000
Per mile cost	$0.058
To determine cost per passenger mile divide by 5	.0116

Maintenance and Repairs

A Method of Preventing Freezing in Garages.

By the "Trouble Man."

Despite the general realization of the destructive effects of freezing temperatures upon the cooling systems of motor cars which are unprovided with special cold resisting solutions, and despite the oft repeated warnings of the automobile press during the winter season, thousands of dollars' worth of damage from freezing is no doubt annually suffered by automobiles. Human judgment and care are very fallible in this connection, and often a freezing and bursting episode happens through pure carelessness to the car of a user who is perfectly aware of what will happen if the temperture to which his machine is exposed falls below the freezing point. Our weather changes are so sudden and unexpected that they are very likely to catch one napping.

The general employment of non-freezing solutions has greatly reduced the chances of damage to cars by low temperatures, but by no means eliminated it. Too often procrastination in exchanging pure water for the anti-freeze compounds upon the approach of cold weather is fatal to radiators and jackets. A sudden cold "snap" comes before it is expected or guarded against, and the damage is done.

Even though a wood alcohol solution is in use carelessness in maintaining its quality may prove disastrous. Unless carefully watched the proportion of alcohol in the mixture may become so low, through evaporation, that it affords but very slight protection. Especially is this the case if it has ever been necessary to replenish the losses of the system with pure water, as an emergency measure, when no alcohol mixture is at hand. Such a circumstance may easily be forgotten or the supplying of alcohol may be put off until it is too late. When a saline solution like calcium chloride is used it is customary to make good the loss due to evaporation by adding water, but occasionally part of the loss may have been due to an unnoticed or unregarded leak, and in the course of time the density of the solution becomes so much reduced that it offers but little protection.

Occasionally one reads of a wholesale damage of cars stored in a garage, due to the temperature having dropped below the freezing point. Cars placed on storage at an automobile station in the fall very often are left with their radiators filled with water, and, especially if they are used occasionally for short trips during the winter, this may not be drawn off. There are usually cars under repair in a garage during the cold season which have water in their cooling systems for testing purposes. Then there are the cars with cooling systems, which are supposed to have been drawn off, but upon which the work has been imperfectly accomplished, leaving water in the pump, parts of the piping and even in the jackets of some horizontal motors.

Damage from freezing suffered by cars left on storage in a garage may prove a very serious financial matter to its proprietors. Even though a man is kept in charge of the building day and night, there is still the possibility that he may be of the somnolent or unreliable variety, and let the fire go out some bitter zero night with serious results. A door or window may be left open unwittingly and a freezing temperature be realized. The chances of a private stable becoming dangerously cold are perhaps even greater, as the heater is likely to be entirely neglected occasionally. Even though no actual damage happens to result, the difficulties in lubrication and starting the cars brought about by the cold are likely to be very annoying.

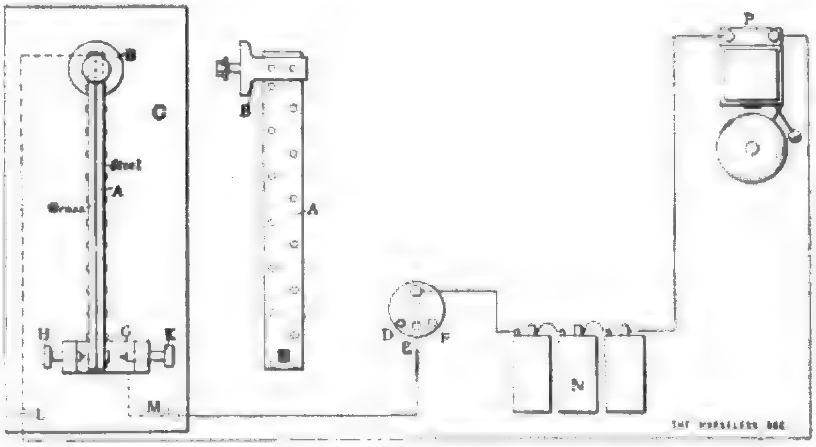
It is possible, at small labor and expense, to arrange, in any private stable or public garage, a low temperature alarm, which will give notice of the danger point of temperature having been reached. All that is necessary in the private stable is a single thermostat, a loud ringing bell, a few dry cells and the necessary wiring. The thermostat, as most readers probably know, is simply a composite bar of two materials A, having different rates of expansion, which are riveted together through their full length. A flat strip of steel one-thirty-second inch thick, 9 inches long and five-eighth inch wide riveted to a brass strip of the same dimensions makes a good arrangement. One end of this composite strip is firmly held edgewise in the end of a brass post B rising from a wood or fibre baseboard C. As the brass strip contracts more rapidly with falling temperature than does the steel strip, and as they are held from relative motion by the riveting, the tendency is for the bar to bend to a concave form on the brass side. Since one end of the bar is fixed this results in a movement of its free end.

Upon both sides of the bar near its free end is soldered a small piece of thin platinum. The U shaped brass piece G, fastened to the base, is provided with the two platinum tipped adjustable screws H and K tapped into the upright arms of G, and so located that their points are in line with the platinum contacts on the bar. B and G are connected by wires running on the back of C with the binding posts L and M. The threeway switch D E F is mounted near the thermostat and when the switch arm is on point D the thermostat is out of service, when on E it is in service and when on F it is short circuited and gives a test of the battery, bell and wiring by causing the alarm to sound.

Contact screw H is so adjusted that when the thermostat is at a temperature of 40° Fahr. (or whatever safe minimum temperature may be decided upon) its point is just making electrical contact with the platinum on the bar. N is a battery of three dry cells and P is a loud ringing vibrating bell, the wiring being as shown. The thermostat should be placed in a vertical position with the contacts down upon a post or wall of the stable, not too far from the cars to be protected and slightly above ordinary reach. The bell should be located in the house, in case of a detached stable looked after by the owner, and in the chauffeur's sleeping room in case one is employed. The contact K may be used or not as desired. It will serve as a fire alarm if it is so set that the bar touches it at some temperature around 100° Fahr., according to individual judgment. The two strips forming the bar, being usually riveted together at a temperature of about 70° Fahr., it will hang straight vertically at that temperature about midway between the two contacts. The two arms of the U shaped piece G should be about 1½ inches apart, and the screws H and K of good length threaded all the way.

If the "hot side" of the thermostat is not to be used a hard rubber plug or even one of wood can be screwed in in place of K.

In a large garage free of these thermostats should be placed at several points upon posts or on the wall of the storage floor and connected in multiple to the same battery and bell. If a night man sleeps in



the building the bell should be located in his room and otherwise at some point where it may be heard from all parts of the building. If there is no one in the garage at night the bell can be placed in a protecting box on the outside of the building and an arrangement made with the policeman on the beat to telephone or otherwise notify the person in charge in case the bell rings.

As installed in a private stable, this arrangement saves a deal of worry, and when employed in a public garage it is an assurance to its patrons and a check upon the employees.

Thermostats such as above described are occasionally offered for sale by electrical supply stores, but it is a simple piece of work to make one in any small repair shop.

A Magneto Tip.

A number of magneto contact breakers gradually lose efficiency through wear on the ball heel of the bell crank carrying the moving platinum point, and on the fibre cam, ring or roller, as the case may be, which actuates the aforesaid bell crank. There is a simple cure for this disarrangement which obviates the purchase of any new part. The fixed platinum is to be unscrewed, and with a fine file a sixty-fourth part of an inch should be taken off its bed. This corrects the timing of the contact breaker, but increases the gap between the points. The gap may then be corrected by inserting a very thin washer beneath the platinum point on the bell crank. Care should be taken not to reverse this process by sinking the platinum on the moving crank and raising that on the fixed part of the contact breaker, as in this case the amount of break would indeed be safeguarded, but the timing would be made worse instead of better. The defect of this adjustment is that when new parts are at last required the fresh fixed platinum point will need packing up to the original height, a detail which may be easily overlooked. Care in the fitting of the new magneto breaker parts is always requisite, as patterns are continually changing and a very minute divergence in the shape or measurements of contact breaker spares will effect the ignition timing. The date and number of the magneto should always be given in ordering replacements, and we have often found that this precaution has not availed to secure spares exactly corresponding with the parts scrapped. A minute comparison is therefore always advisable.—*Autocar.*

A long taxicab journey was recently made in Great Britain, the route being from London to Plymouth and return. The meter registered 414 miles and a charge of $76.96 was made. The time taken was thirty-one hours and ten minutes, which included stops for meals and refreshment. A regular London taxicab hired at random was used.

Consular Report on the de Dion Automobile Works.

Special Consular Agent Capt. G. L. Carden describes a visit to the de Dion-Bouton & Co. factory at Puteaux, near Paris, as follows: The de Dion-Bouton & Cie. works are employing at present about 2,700 men in all departments. The outputs are confined largely to automobiles, and the engines manufactured comprise 8, 12, 18 and 30 horse power machines. The 8 horse power engine has two cylinders, while the others have four. Firms like de Dion-Bouton & Cie. have been heavy purchasers of foreign made tools, and the fact that so much equipment has to be purchased abroad was doubtless the underlying cause for the interest which the Marquis de Dion has taken in the new French machine manufactory, known as "Société Française de Machines-Outils." In a previous report I mentioned that the Marquis de Dion proposed in the course of the speech following a banquet at the Automobile Exposition of 1906 that his friends unite with him in building in France a special machine tool works for supplying the automobile industry. The new French machine tool works, known as the "Société Française de Machines-Outils," is now engaged in building machine tools for the French trade. * * *

I estimate that there are about forty Draper lathes in service. Lathe hands receive at the de Dion works wages ranging from 85 centimes to 1 franc (19c.) per hour. This is on engine lathes. On the Alfred Herbert turret lathe the wages run from 85 to 95 centimes per hour. * * * Brown & Sharpe have supplied about eleven millers, and I find that the company are employing women operatives for these machines. One woman was caring for four millers and was receiving, I was informed, about 70 centimes per hour. I also found women operatives running Gleason gear cutters, one of whom I was told had worked at these machines for four years steadily, with the exception of four months' absence as a result of injury. The women operatives are receiving 70 centimes per hour. Seven women were found at work running millers and gear cutters. It is the first time that I have found women intrusted with high grade machines.

The business at the de Dion works is fairly good, though in common with other automobile establishments this firm has experienced a considerable falling off in the orders of the last year. The grade of work turned out from the shops is of high order, and the equipment is sufficient for an output equal, I should say, to that of any other automobile house in France. Practically all the material used in automobile construction is of French origin, and only such foreign tools are purchased as cannot readily be obtained in France. In this respect attention is invited to previous reports in which it has been emphasized that the future of the American machine tools in Europe rests largely with the medium sized machines possessing exceptionally good features. Some of the machines now being turned out by French machine tool houses possess more than ordinary merit, and it is natural to expect in a country where the national spirit is strongly developed that foreign tools will only be called upon as a last resort. At the de Dion-Bouton & Cie. works there are in all about 1,575 tools in service. The greater part of the American machine tools used were purchased during the past three years.

How Not to Do It.

Contrary to common belief gasoline is not dangerous if it is properly handled. Frequently, however, it is used in ways that would give trouble even with less inflammable substances.

Two recent accidents will serve to illustrate some of the things which should not be done where gasoline is kept: A certain manufacturer of lubricating oils had employed a new man to inspect empty barrels sent the company. One of these barrels excited the man's suspicions. He thought that he could detect the odor of gasoline. The teamster who had brought the barrel assured him that it was empty and dry inside. To make sure of this the tester lighted a match and held it to the bunghole, intending to look inside and see if any liquid remained. People in the vicinity heard an explosion which brought visions of a black hand outrage. When the crowd gathered they found the tester some yards away from what had once been the barrel.

About 1 o'clock in the morning a sleepy doctor went to his automobile house preparatory to answering a hurry up call. He noticed the sound of a liquid dropping, so lighted a match to investigate. The next thing he recollects is sitting in the middle of the alley, having been blown through the door. Part of the auto house and the ironwork of the automobile were saved by the fire department. The doctor's brother answered the call.

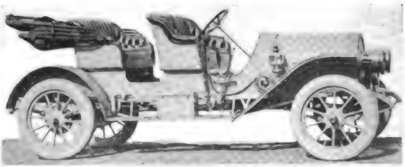
A. C. A. Requests Abolition of Grade Crossings.

The Public Service Commission of New York has recently received a request from the A. C. A. for the elimination of a number of dangerous grade crossings throughout the State, those on Long Island and in Westchester County being particularly mentioned. John S. Kennedy, secretary of the commission, stated that under the present law the commission could only authorize the abolition of such crossings as the Legislature provides funds for. The present law reads that the State pays one-quarter, the municipality one-quarter and the railroad pays one-half. Twenty-five thousand dollars was appropriated for that purpose last year, but it is estimated that at least $500,000 will be required to execute the State's share of the cost. The railroad companies are reported to be in favor of the abolition of grade crossings.

NEW VEHICLES AND PARTS

The Adams-Farwell Model 9.

The Adams Company, of Dubuque, Ia., are bringing out their Model 9 car as their 1909 product, which may be fitted with either a five or seven passenger or a runabout body, as well as various closed types. This model generally resembles the Model 7-A, which has been brought out by the company since 1906, but the method of control and the change speed gear have undergone some changes. A description of the car is as follows:



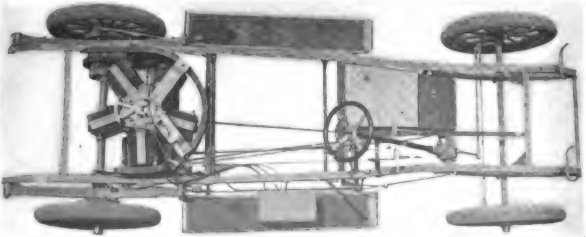
Model Nine.

The motor, which is one of the unique features of the Adams-Farwell products, is of the five cylinder, air cooled type, with cooling ribs cast integral. The bore is 5½ inches and the stroke 5, giving 50 horse power at normal speed. The pistons are ground and fitted with five piston rings, three above the wrist pin and two below. The crank shaft has but three bearings, and is only 17 inches in length. Unlike standard practice, a stationary vertical crank shaft, with a single crank pin, is employed, and the five cylinders revolve around the crank in a horizontal plane, the cylinders being set radially and equally spaced like the spokes of a wheel. The connecting rods are, of course, connected up to the single crank pin. The method of ignition, carburetion, etc., is similar to that of Model 7-A, a description of which will be found in The Horseless Age for April 17, 1907.

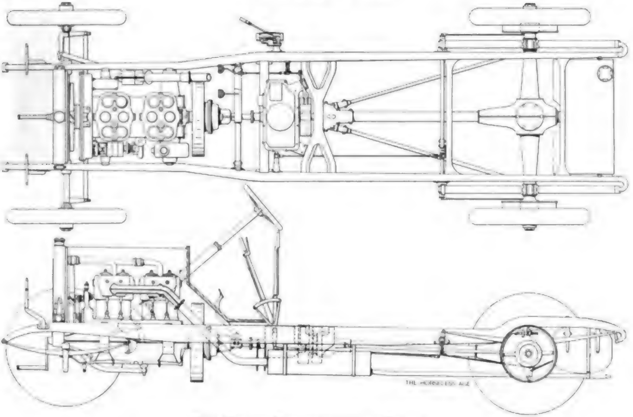
Power is transmitted as follows: The motor is located directly over the change speed gear, and a bevel pinion secured to its revolving elements meshes with a bevel gear in the change gear casing. This bevel gear is fastened to a transverse shaft in the change gear to which is attached the male member of a cone friction clutch. The corresponding female member is keyed to the line shaft, which is squared to allow a combined single pinion and dog clutch to slide axially, and in addition is fitted with a large gear fastened by means of feathers to the shaft. The projecting end of this shaft carries a sprocket which drives the differential upon the rear live axle by means of a short chain. Parallel to the line shaft is a side shaft upon which slides a spur gear and a two pinion train, the one being the countershaft gear, while the other gives first and second speed, and reverse. A pinion is interposed between the rigid gear on the line shaft and the smaller pinion of the train on the side shaft to give the reverse. On all but the third speed the side shaft spur gear is meshed with a corresponding rigid gear on the line shaft, but on the third these are unmeshed and the dog clutch on the combined pinion and clutch is meshed with a similar construction on the rigid line shaft gear. The gears are operated by three slider arms fitted with racks and operated by a sector on the rocker shaft from the lever at the side of the frame. In this arrangement everything is enclosed in the gear casing, the clutch members themselves having their own special covering to prevent the entrance of oil.

The motor is supported by means of two feet bearing on a curved member and at a third point by an extension of the gear casing. The gear casing is supported in its turn by broad feet bolted to the longitudinals of the frame, and has a third bearing around the rear axle, a relative movement between the two being allowed for. The rear axle is of the tubular type and supports the springs by a saddle in the usual manner on one side and by a special bearing saddle on the differential casing on the other. The frame, as in Model 7-A, is of angle steel, well trussed. The front axle is of I beam section, with integrally forged spring saddles. Semi-elliptic springs are fitted all around, those in the rear being 48 inches and those in front being 44 inches long. The wheels are of the artillery type, and fitted with 36x4½ inch tires. The wheel base is 128 inches and the tread standard. The clearance is 15 inches.

Steering is by worm and segment, the end thrust lying longitudinally and operating laterally instead of the usual practice. The drag link is behind the axle and is fitted at the left end with a bearing for the steering rod. Spark and throttle levers work over sectors upon the steering wheel, and provision is made for fitting an accelerator pedal. The left hand pedal on the footboard operates the clutch and the right hand pedal the internal expanding brakes



Adams-Farwell Chassis.



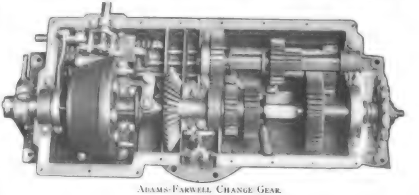
Plan View and Elevation of Mercedes Chassis.

on the hubs of the driving wheels. Speeds are changed by means of a ball end lever working in a three slot quadrant, placed well forward, while the contracting brakes on the driving wheel hubs are operated by a hand lever which is interconnected with the clutch, and situated at the right of the frame. Fuel and oil are carried in tanks under the footboards, leaving an ample carrying space under the bonnet in front.

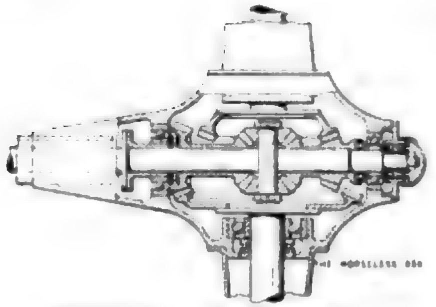
The Mercedes Town Car.

The Mercedes automobile headquarters in the Times Building, New York city, are exhibiting a new model from the Mercedes factory, which has a number of radical changes from the usual Mercedes construction. The most notable of these is the substitution of shaft drive for the heretofore exclusively used chain drive. Another is the substitution of a multiple disc clutch for the spiral constricting clutch. These two changes are the most noticeable, although the car has a number of other new features. This car will be known as the Mercedes Town Car.

The motor is the four cylinder Mercedes type, with cylinders cast in pairs with integral heads and water jackets. The bore is 4$\frac{5}{16}$ inches and the stroke 5$\frac{1}{8}$ inches, the motor being rated at 35 horse power. The regular Mercedes carburetor is fitted. The crank case is divided horizontally into two sections, the lower half supporting the three main crank shaft bearings, and carrying the engine in the frame. The crank case is provided with large hand holes for the purpose of making adjustments. The distribution gears for the cam shaft, magneto, oiler and pump are in a separate aluminum casing in the front of the motor, the casing being both dust and oil proof. The pump, oiler and magneto are situated on the exhaust side of the motor, and are driven each by a separate shaft. Oil is forced from the oiler to cylinders, main bearings, magneto drive shaft, and in addition to the steering column. The oil pumps have a set stroke, and if additional oil is required it is pumped to the crank case by a hand pump situated on the dash. A single sight feed is provided on the dash to indicate whether the oil is flowing or not. A gear driven centrifugal pump circulates the cooling water, and this pump may be lubricated by a compression grease cup, also upon the dash. A honeycomb type of radiator is used, fitted with the usual belt driven fan. The shaft of the fan is mounted on an eccentric bearing so that belt slack may be taken up when required. As in the usual Mercedes practice the flywheel is fitted with helical arms which assist the fan in creating a draught through the radiator. Ignition is by means of a Bosch low tension magneto, with the Bosch magnetic plugs a new feature of this car. A switch for cutting out each plug for testing, etc., is situated on the dash. Power is transmitted through a multiple disc clutch to the gear box, the connection being through an ordinary flange coupling. The clutch works is an oil tight casing within the flywheel, and is composed of



Adams-Farwell Change Gear.



Differential of Mercedes Car.

twenty-eight brass and twenty-nine steel discs, a brake being provided for stopping the rotation of the discs when changing speed, and means for lubrication being fitted upon the clutch casing. The change gear provides four speeds forward and one reverse, operated selectively, with direct drive on the fourth speed. The gear box is quite compact, and contains the selectors and shifter rods. A large brake drum is fitted on the end of the line shaft of the change gear. Final drive is through a propeller shaft, fitted with a single telescopic universal joint in the spherical casing of a torsion tube. This torsion tube encloses the shaft, and terminates at its rear end in an extension of the differential casing, with which it is practically integral. This casing is a steel casting, and is divided vertically, the two halves being bolted together. A circular inspection plate is fitted at the top of the casing. The outer members of the rear axle are steel tubes secured to the steel casting. The weight is supported by the live half axles, the wheels being mounted direct on them, connection being made by dog clutches. The rake of the drive wheels is got by the construction of the differential, and not by the use of universal joints as in other makes. In this case pinions are secured to the extension tubes through which the propeller shaft passes (see cut), while the corresponding gears are mounted on a flange on each half axle, the differential proper being rigidly mounted on the propeller shaft extension itself. Ordinarily the differential with its extension tubes revolves with the propeller shaft, but when turning corners, for example, the tubes revolve independently, thus accomplishing the balancing action. By this construction the driving axle can be altered in any desired degree vertically from the horizontal plane.

In addition to the torsion tube, which also acts as a radius rod, two tubular braces are provided, these being attached at their rear end to the axle casing, and at the front to the spherical casing of the torsion tube. This spherical casing articulates in a specially formed cross member, which also acts as a support to the two feet of the gear box. In addition there are four other cross members, one at the front of the frame, another supporting the front of the gear box, a third supporting the frame where the spring hangers are bolted, and the fourth at the rear. The frame is of channel section pressed steel, and is arranged with a drop of about 5 inches just forward of the rear axle, and narrowed in front to secure a good angle of lock. The front axle is of I beam section at the centre, tapering to a square section near the steering knuckles, these being inclined to give a rake to the front wheels. The springs are of the semi-elliptic type, and are flexibly supported in shackles at one end as in the usual practice. The wheels are of the regular artillery, running on ball bearings, and are fitted with 875x105 mm. tires on the front, and 880x120 on the rear. Steering is by nut and screw, the steering column being rigged at an agle of 45 degrees, bringing the wheel in a very convenient position for the driver. The drag link is placed behind the wheel, the connections with the knuckle arms being readily adjustable, and of the ball and socket type. A similarly equipped link goes to the end thrust on the steering gear.

Three pedals are fitted from the footboard, the left hand pedal draws the clutch when pushed forward, while the right hand pedal first draws the clutch, and then operates the brake on the transmission. The centre pedal is the accelerator pedal, which is interconnected with the gas lever upon the steering wheel. The gas lever, as well as the spark lever, works upon a circular quadrant upon the steering wheel, connections being made at the base of the steering column. The gears are changed by a lever at the right side working through a three channel quadrant. The hand brake lever is of the pull back type, and actuates internal expanding brakes upon the rear hubs through the medium of a countershaft and cables. The footboard is fitted with a large inspection door, which is held in place by turn buttons, and which gives access to the clutch. In addition to the oil pump, circulation gauge and compression cup for the water pump, a pump for giving initial pressure to the fuel tank at the rear of the frame is fitted.

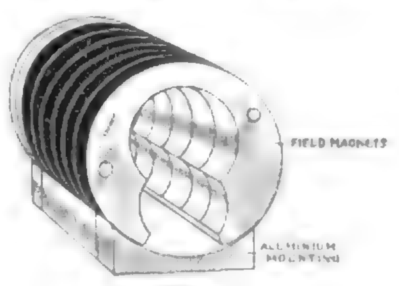


Fig. I.

Herz Magnet System.

Fuel is carried in a 22 gallon tank at the rear of the frame, and is fed by pressure from a pressure valve operated by the exhaust from the motor. Oil is carried in a cylindrical tank on the right side of the frame, and this also is fed by pressure. Protection to the motor and change gear is assured by means of a metal mud apron, and all joints are fitted with leather boots to prevent the ingress of dirt, etc. A large muffler is supported under the frame at the left hand side to the straight pipe leading to the extreme end of the vehicle.

The Herz Magneto.

Herz & Co., 203 Lafayette street, New York city, are bringing out the Herz high tension magneto for one, two or four cylinder motors. This magneto differs from the standard practice in a number of ways, particularly in the shape and construction of the field magnets. These are cylindrical in shape and are thoroughly enclosed on the ends by means of circular plates, instead of being the well known "horseshoe" open type. The magnet system is in reality composed of several flat steel rings clamped together, with the polar space or armature "tunnel" cut in them. The surfaces of the rings are ground with extreme accuracy and perfect magnetic contact is obtained. Another striking feature is that the usual independent pole pieces are entirely dispensed with. In the Herz magneto the idea of having a one piece magnet system is obtained quite simply, the armature space being bored out of the rings. The magnets being circular there is very little leakage of "lines of force," and the net result is that a magnetic field of the highest possible intensity is obtained across the polar space of a very light and compact magnet system, Fig. 1. To utilize this field to the fullest extent the armature, Fig. 2, which is of the conventional shuttle shape design, is turned and mounted to an accuracy such that it can be rotated within one-tenth of a millimeter of the poles with perfect freedom. The bearings are all of the ball type, the balls being retained in cages, which also serve to carry the vaseline for lubrication, the ball cage being detachable from the outer ball race. The bearings are visible at the end of the armature spindle. The winding of the armature consists of a primary and secondary coil, insulated from each other. The condenser is arranged in a neat manner in a deep circular recess or box at the end of the armature. The make and break device, Fig. 3, is arranged as a complete detachable unit fitted to the armature shaft by means of a small keyway and feather. Contact with one end of the primary winding of the armature is made by a small carbon brush fitted into the contact disc, which presses against a ring alongside the front ball race of the armature. The contact device is very simple in construction, there being but three parts—a curved spring having a platinum contact at one end, a small steel piece or block set angularly and carrying an adjustable platinum contact, and a small fibre roller loosely centred on a pin. The roller is set so that if it is given a slight push at the edge it must tend to move up the inclined plane formed by the steel piece referred to.

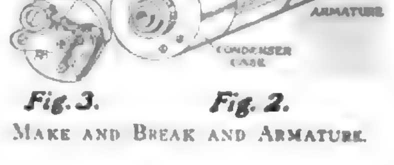


Fig. 3. *Fig. 2.*

Make and Break and Armature.

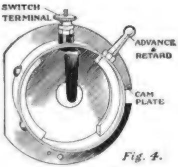


Fig. 4.

Contact Maker.

and in doing so it pushes against the end of the spring and separates the contacts. The contact maker turns around bodily with the armature, and when rotating the fibre roller strikes against two curved steel projections held in a case, Fig. 4, and the break is made twice per revolution at the point of maximum induction, and current is induced in the secondary winding. The electrical circuit is very simple, there being no exterior connections. For cutting off the spark when desired a terminal is provided on the contact maker case. This makes connection by means of a spring, which presses on the head of a steel screw, the screw being connected with the insulated end of the primary winding, which can be short circuited at will. The contact maker case is capable of an angular movement of about 30 degrees for advancing or retarding the spark, a small projecting arm being provided on the case for the purpose of attaching the control linkage.

The high tension end of the armature has a deepuly recessed V insulating collar mounted upon it, containing a metallic sector at the right hand end of the armature. This is not visible in the figure. Upon this sector press small carbon brushes for taking off the high tension current.

The machine illustrated is a two cylinder pattern, and there are visible (Fig. 5) two high tension terminals set at 90 degrees. In the four cylinder pattern a high tension distributor is fitted. To obtain the two sparks the high tension contact piece or segment previously referred to as fitted in the insulating collar does not go quite half way round, and thus makes alternate contact with the two carbon brushes set at 90 degrees, sending a spark to the respective cylinders. The safety spark gap is obtained between the high voltage sector and the armature. If the spark produced exceeds three-eighths of an inch it jumps across the insulating collar to the armature. The casing of the machine is aluminum, forming a dust tight covering. The machine may be taken apart and put together with a small screwdriver, no other tool being needed. The single cylinder magneto weighs but 4¼ pounds, and the four cylinder but 7 pounds.

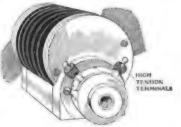


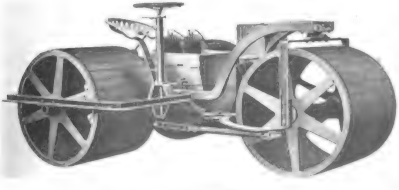
Fig. 5.

Herz Magneto Complete.

The Pfarrer Gasoline Roller.

The Chase Motor Truck Company, of Syracuse, N. Y., are marketing the Pfarrer gasoline motored roller for road and farm service, an illustration of which is here given. The roller is fitted with a two cylinder, air cooled, two cycle motor similar to those used on the Chase trucks. The bore is 4½ inches and the stroke 5 inches, giving 15 horse power at normal speed. A planetary gear giving two speeds forward and a reverse is fitted, final drive being by gearing to the rear axle. The motor and change gear are contained in a metal tray with deep sides suspended on the frame of the roller, the cylinders projecting from the tray to get the benefit of the air. The frame is of angle iron, and three rollers are fitted, the two rear rollers being the drivers and the front one the steerer. All the rollers are of hollow construction, with six armed iron spiders and 36 inch broad wooden faces. The rear rollers are mounted in axle boxes attached to the frame, while the front roller is mounted in a double yoke, the upper yoke working in a pivot joint allowing a traversing motion for steering. The second yoke lays horizontally and bears in a slot fashioned from flat stock for the purpose of giving added rigidity to the steering suspension, but allows of a traversing motion. Steering is by hand wheel, working on a vertical pillar, at the lower end of which is a sprocket on which the link belt to the ends of the steering roller works. Large coil springs connect the link belt with lugs on the roller end bearings to take shocks, etc. Throttle and spark levers are fitted under the steering wheel. A hand lever at the side of the driver operates the forward speeds and a foot pedal operates the reverse. The wheel base is 62 inches and the tread 84 over the rear rollers. Fuel and oil are carried in tanks on one side of the power plant, and the steering and control mechanism at the other, the driver being furnished with a stamped plow seat. The roller complete weighs 2,000 pounds, and is geared to 6 miles an hour "all out."

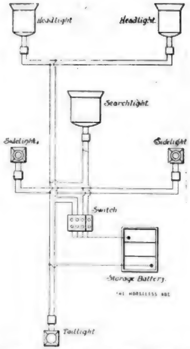
The roller may be used as a traction engine, and draw various machines, as lawn mowers, reapers, etc. The first roller put in service frequently assisted teams in the roads in wet weather.



Pfarrer Gasoline Roller.

The Willard System for Motor Car Lighting.

The Willard Storage Battery Company, of Cleveland, Ohio, have adopted their railway train lighting system for motor car use, the source of current in the system being the storage battery. The headlights,



Wiring Diagram of Willard System of Automobile Lighting.

THE DETROIT EMERGENCY WHEEL.

searchlight, dash lamps and tail lamp are fitted with tungsten bulbs fitted in non-vibrating holders, and connections are made as in the diagram. The battery used is either the company's E L B type or a good six volt 100 ampere hour element. The installation of the system is simple and can be readily made by any electrician. The battery may be installed on the footboard and the switch panel on the dash or at any convenient place.

New Pierce Models.

The George N. Pierce Company, of Buffalo, we learn will turn out four different models during the coming season, as follows: A new four cylinder 24 horse power model, a new six cylinder 36 horse power car, the improved four cylinder 40 horse power model, and also a six cylinder 48 horse power model. All 1909 cars will be fitted with four speed selective type change gears. All the cars will be furnished with either runabout, roadster, seven passenger touring, landau or limousine bodies.

The Wineburgh Carburetor.

The American Automart, of 1621 Broadway, New York city, are bringing out the Wineburgh carburetor for motors of from 6 to 60 horse power. The carburetor is made of brass and has an interior mixing chamber, which is surrounded by the regular float chamber. Fuel regulation is by means of a needle valve conveniently operated from a handle on the bowl of the float chamber. Great economy in fuel and perfect gasification are claimed by the makers.

The Detroit Emergency Wheel.

This new emergency wheel, or, more properly speaking, rim, consists of an ordinary steel rim, such as is used on the regular wheel, adapted to be clamped to the regular rim. It is carried with its tire inflated, and when a tire is punctured can be clamped to the side of that wheel, and the car is ready to proceed without taking the time necessary to remove the punctured tire.

These features it has in common with other emergency wheels. Its claim to distinctiveness lies in the handy and secure method of clamping. The clamps are heavy manganese bronze castings, two of them being merely hooks riveted to the spare rim, about 90 degrees apart. The other two are locking clamps. They consist of hooks that are free to slide under cams, which swing in brackets riveted to the rim. These cams are furnished with short levers that are swung over by hand to bring the clamps in place. They are then securely locked by powerful thumbscrews in the clamps, which act on the cams.

This combination of screw and cam makes a very powerful lock, as any pressure needed may readily be applied.

These rims are the product of the Detroit Emergency Wheel Company, Detroit, Mich.

Hummocks to Be Placed at Grade Crossings.

Owing to the large number of speed mad motorists on Long Island who race over macadamized roads and take grade crossings at high speed, it is suggested that hummocks about one foot in height, built of concrete, be located 150 feet on either side of such crossings. The number of recent accidents to motor cars by collision with trains is responsible for this suggestion, the hummock idea being in successful use at Babylon, L. I., at present.

At a conference held on August 31 in which the Long Island Railroad, the Long Island Automobile Club and the Long Island League were represented, the hummock plan was reported favorably on, and is expected to be adopted shortly. Another plan brought up was that of a "ha-ha" or hollow in the road, but this was considered too dangerous, as it would be invisible at short distances. The railroad company signified its willingness to bear half the expense of erecting the hummocks if the league would bear the remainder.

New York Trade Association's Economy Contest.

The New York Automobile Trade Association will hold a two day mechanical efficiency run on Long Island, beginning Wednesday, September 16. The run is strictly limited to stock cars of any year's model, which must be fully equipped with bodies and seats, as shown in the makers' catalogue. No extras or replacement parts are allowed. There will be fifteen classes, graded by selling price, and in addition a class open to taxicabs. An improved system of checking is to be used during this run.

Milwaukee Orphans Have Their Annual Outing.

Three hundred orphans participated in the annual outing given by the Milwaukee Auto Club on September 1, forty-eight machines being used. The cars lined up at 8:45 and took the children to the park, where they were amused in various ways. After luncheon the orphans were given a long ride about Milwaukee, returning to the asylum at dinner time.

San Francisco Dealers Want a Speedway for Demonstrating Purposes.

The San Francisco police have so persistently pursued speeders that the dealers of that city are anxious to have a speedway in which demonstration can be made without interference from the police. The dealers will confer with the chief of police and try to secure a place where they will not be disturbed. A private road is being negotiated for.

Obituary.

Louis Kissel, president of the Kissel Motor Car Company, of Hartford, Wis., died in the Milwaukee Hospital of septic peritonitis on August 28 from the effects of wounds inflicted by an employee on August 20. Mr. Kissel was born in Germany on August 14, 1838. He went to Washington County, Wisconsin, at the age of nineteen. Thirty-five years ago, having gained a competency on his farm, he moved to Hartford, the county seat, and with his sons established the city's first important industry, the Hartford Plow Works. He founded the Hartford Lumber Company, the First National Bank of Hartford, the Northrup-Tenteal Fur Company, the Hartford Electric Company, the L. Kissel & Sons Company, manufacturers of implements and vehicles, and, lastly, the Kissel Motor Car Company. He leaves a wife and six children.

METEOR CLUTCH AND CHANGE GEAR, WHICH WAS DESCRIBED IN THE ISSUE OF JULY 22

Drafting and Engineering.

By Joseph A. Anglada.

In this country drafting as a profession is considered but a stepping stone to something better, and it is unique in the respect that it requires practically all the application and learning that is necessary to the full fledged engineer, with the exception of the executive ability.

In foreign countries drafting in itself is considered a profession, and a draftsman remains a draftsman to the end of his days. That this is not so in this country is proven by the scarcity of draftsmen who are above thirty-five years of age.

In our restlessness we are constantly striving for something better, and in consequence the ranks of our superintendents, managers and owners are largely recruited from the ranks of the draftsmen.

It is often said in the machine shop that the drawing room is impractical and entirely theoretical. On the contrary, it is both practical and theoretical. There is hardly a designer who has not had some experience in the shop, and, although not able, probably, to go into the shop and finish a piece of work with the man at the bench, it is an even chance that he could indicate the best and cheapest way of doing it.

A draftsman has the advantage over the machinist in that he is brought into contact with all classes of work, and consequently his process of reasoning has been lifted out of a narrow groove, and he considers various sides of a subject before deciding on the best way of proceeding, and I am free to confess that older machinists very often see only one way and that very thoroughly.

Far be it from me to say one word that would detract from the honorable and ancient craft of machinists. I only desire to place the designer in the position that he rightly deserves, and help him to avoid being crushed between the machinists' scorn of his so called impracticability and the employer's desire to get good work in one-quarter the time that should be expended upon it.

It is only of late years that the employers have begun to realize that the prosperity of a plant depends in a great measure upon the drawing room. Thousands of dollars' worth of mistakes could be easily made, and it is to the credit of the draftsmen that the employers seldom think of such a thing as a bad mistake coming from the designing room.

Suppose, on the other hand, the draftsmen did not keep up with the latest designs and improvements in engineering, the effect would soon be seen in the decreased sales. It is to their credit that as a whole they do their best work cheerfully, and are as interested in each design as if it were their own. They follow the construction of it through the works, and if it is a special vehicle that has been constructed they have an interest in that vehicle until it is out of service, and without doubt in many instances can tell what the machine is doing many years after its construction.

It would be interesting to jot down a list of the wealth and comfort producing ideas that have crystallized in the minds of draftsmen, or of engineers that have graduated from their ranks. It seems impossible, however, that the engineer will ever make a name for himself as a financier, for an engineering brain seems to have as much idea of dealing in stocks and bonds as the financial head has of the action of the differential or a carburetor.

What is an automobile engineer? We often hear this question asked, but there is generally a great deal of hesitation over the answer. The fact is very few people outside of the profession know exactly what an automobile engineer is, and even those who know are apt to have difficulty in trying to tell anyone. And why should there be so much doubt about the meaning of the title? It is not so with other professions. When a man says he is an architect we know at once what he means; so, also, if he is a physician, surgeon, lawyer, actor or artist. Most people know what a civil engineer is, but all are at sea when it comes to automobile engineering. The question is, what does an automobile engineer know? What can he do? Well, he has studied mathematics in all its branches, theoretical and applied mechanics, hydromechanics, pneumatics, heat, strength of materials and metallurgy. He has also become proficient as a mechanical draftsman, and he has had some practical experience in the pattern shop, foundry and machine shop. Broadly speaking, these studies have given him a knowledge of nature's laws governing the motion of matter, be it solid, liquid or gaseous, of the transmission of forces, of the transformation of energy, of the properties of the materials which nature has given him.

Knowledge of this kind has enabled the engineer to give us machines which are capable of carrying us and the articles of commerce thousands of miles with no more attention on the part of the operator than to see that sufficient fuel, oil and water is placed in their proper containers.

Club Notes.

The Bureau of Tours of the A. C. A. have decided upon a 935 mile route for the club's annual autumn tour. The route includes the Pocono Mountains, the Adirondacks, and the lake region of central New York. The tour will start on September 28 and finish October 8.

The Automobile Club of Luverne (Minn.) was organized on August 28 with the following officials and board of governors: Dr. C. O. Wright, president; J. W. Gerber, vice president; O. P. Huntingdon, secretary; Dr. C. L. Sherman, K. G. Oldre, E. H. Moreland and R. B. Hinkly, the governors.

An automobile club was organized at Great Bend, Kansas, on August 28, to which was given the name of the Great Bend Automobile Association. There are twenty-five charter members, and it is expected that the remaining motorists in the county will join in a short while. H. H. Meade is president, C. S. Allison secretary and C. P. Aldrich treasurer, these officers being elected at the time of the organization.

The Milwaukee Automobile Club is planning another two day tour, from Milwaukee to the Mississippi River and return, the date of which will be shortly announced.

The automobile owners of the city of Newark, Ohio, have decided to form an automobile club. One of the aims of this new organization will be the bettering of the roads in and around Newark, and to that end the club will co-operate with the Good Roads Association.

Of a total of 200 accidents involving motor cars recently in England there were only thirty-five in which the motorists were to blame.

The thirteenth annual exhibition of the Manchester and District Motor Trades Association, Ltd., will be held February 19 to 27, inclusive, at Belle Vue, Manchester, England. The exhibition will include motor cars, commercial vehicles, motor tricars, motorcycles and motor boats.

The International Congress for the Protection of Industrial Property, which was held at Stockholm on August 28, passed resolutions protesting against the new English patent law, and recommended that an official congress be held in Washington next year to form some sort of retaliatory combine against Great Britain by the majority of nations composing the International Patent Union.

Trade Personals.

Chas. R. Greuter, formerly designer for the Matheson Motor Co., will shortly organize a company in Wilkes-Barre, Pa., for the purpose of manufacturing high class touring cars after Mr. Greuter's designs.

Robert K. Davis succeeded A. I. McLeod as manager of the Maxwell-Briscoe-McLeod agency in Detroit on September 1. Mr. McLeod becomes district manager for the Maxwell product in the States of Michigan, Ohio and Kentucky.

H. M. Coale, of the sales department of the Autocar Co., Ardmore, Pa., is now in charge of the newly opened Philadelphia branch. Mr. Coale has been identified with the company for four years in the engineering, sales and executive departments.

E. von Rothweiler has resigned as manager of the Fort Pitt Motor Manufacturing Company, New Kensington, Pa., and J. Sturtevant is acting in his stead. Mr. von Rothweiler, who designed the "Pittsburg Six," has established the Mercedes Motor Manufacturing Company at Kensington, and will build a 75 horse power, six cylinder car, to be known as the "Vanderbilt."

Coming Events.

September 5 to 9—San Francisco-Los Angeles Reliability Run, Automobile Dealers' Association of San Francisco.

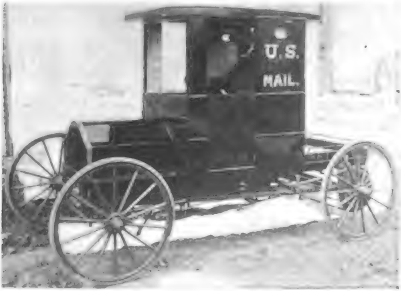
September 11—Hill Climb of Springfield (Mass.) A. C.

September 14—Annual Economy Run, Chicago Motor Club.

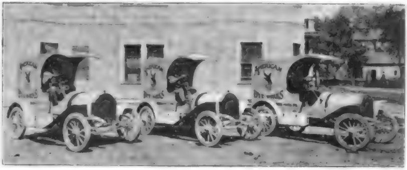
Commercial Applications.

R. F. D. Motor Cars in Michigan.

As yet the use of motor cars for rural free delivery work is not very extensive, doubtless from a lack of knowledge of the cost of upkeep, etc., on the part of carriers and their consequent unwillingness to abandon a tried system for one of which they know little or nothing. Owing to the nature of the R. F. D. routes around the city of Jackson, Mich., the high wheel type of cars was found to operate to greater advantage than the European type for all year service, although the latter type performed well in fine weather and after a light rain fall. A number of specially built cars upon these routes have recently been put in service, one of which is here illustrated. The first illustration shows a car in use on an R. F. D. route, 26 miles long, including steep hills, a number of sand stretches and a few miles of good road. This car was built by the Steel Swallow Auto Company, of Jackson, Mich., and is fitted with a two cylinder, opposed air cooled motor of 10 horse power. The transmission is of the planetary type, final drive being by double side chain. The frame is of channel steel, and the axles are of square section drop forgings. Spiral springs are fitted instead of the usual elliptic type. Thirty-six inch wheels are fitted with solid rubber tires. The car has a wheel base of 84 inches and weighs 1,300 pounds in full running order. The body, as will be seen, is capable of being totally enclosed by means of folding glass panes and curtains, and at the same time it may be thoroughly opened for summer service. The side doors are made to fold in two sections and return automatically to a closed position at all times. A space back of the driver's seat allows for the carrying of a delivery bag and a number of sacks if necessary. The route is covered in a little over three hours, which is an improvement of nearly five hours on the time taken by the horse and wagon. In addition to the specially built cars, a number of Buick and Jackson stock runabouts are employed in Jackson County.



Specially Built R. F. D. Car.



Converted Runabouts Used for Delivery Service in Los Angeles, Cal.

Converted Runabouts as Delivery Trucks.

The automobile in the delivery service of dye works in Los Angeles, Cal., has been such a decided success that the third firm in that city has just equipped itself with three light delivery motor vehicles, intending to increase the number as business grows. The American Dye Works is a new concern in the Los Angeles field, but the success attained by the Berlin Dye Works, with the its sixteen motor delivery wagons, and by the City Dye Works, with seven cars, induced the proprietors of the new plant to omit the usual experiment with horse drawn vehicles and begin operation with automobiles.

The three delivery wagons used by the American Dye Works are shown in the accompanying illustration. They are regular stock runabouts, manufactured by the Jackson Automobile Company, with the seats removed, and a covered wagon body built on the chassis. The total weight of the rebuilt runabout is 1,500 pounds.

The experience of the other two Los Angeles dye works using an auto delivery service shows that one motor truck performs the work of two horse drawn wagons, thus saving the wages of one driver and the maintenance expenses of one team. Besides, one auto truck, as experience has shown, renders more satisfactory service on account of its higher speed and makes possible emergency deliveries that keep particular customers in good humor, without causing extra expenses. The new firm started in the right manner by hiring experienced, careful drivers to handle the machines.

Commercial Notes.

The Council Bluffs and Omaha (Neb.) Transfer Company have purchased three Rapid trucks, which they will put into freight carrying service between Omaha and Council Bluffs.

The New Haven, Conn., fire department invites bids for an automobile runabout for fire chiefs' service. New Haven is following the lead of Hartford and Bridgeport in gradually acquiring motor vehicles throughout the fire, police and public works departments.

The Twin City Motor Company, of Hancock, Mich., has been recently organized for the purpose of running a line of automobiles between Hancock and Houghton and the adjacent towns, and also over the Portage Lake bridge at Hancock. This is the second line in this vicinity, the Calumet-Laurium Company running cars between Red Jacket and Laurium, a distance of 1½ miles, on regular schedule, and charging a 5 cent fare. The cars used on both lines are of the twenty passenger type, with ample protection to the passengers from storm or sun.

LEGISLATIVE and LEGAL

Recent Decisions.

RESPONSIBILITY FOR CHAUFFEURS' ACTS.

An owner of an automobile is not responsible for the acts of his chauffeur while the latter is driving for his own pleasure and in his own interests.—Sarvor vs. Mitchell, 35 Sup. Ct. (Pa.) 69.

EVIDENCE OF SPEED.

The occupants of an automobile may testify as to its speed.—Shaffer vs. Coleman, 35 Super. Ct. (Pa.) 386.

NEGLIGENCE QUESTION FOR JURY.

Where the plaintiff was driving a buggy constructed for two persons, but containing himself and another and two children, and the defendant's automobile suddenly turned a corner about 200 feet ahead without warning and came toward the plaintiff at high speed, causing the plaintiff's horse to become frightened and run away, the question of negligence of both parties is for the jury.—Shaffer vs. Coleman, 35 Super. Ct. (Pa.) 386.

RIGHTS ON TURNPIKES.

An automobile is a "carriage of burden or pleasure" within the Pennsylvania act of April 29, 1874, P. L. 73, relating to turnpike companies, and may be run over such highways on payment of reasonable toll.—Scranton vs. Turnpike Company, 14 Lug. (Pa.) 97.

Owners Need Not Heed Telephone Calls Purporting to Come from Highway Commission.

Information having come to the knowledge of the Massachusetts Highway Commissioners that some irresponsible person is sending unauthorized communications over the telephone, to the annoyance of owners and operators of automobiles and motor vehicles, claiming to act for the commission and in some cases using the names of members of the board, the commission desires to notify all owners and operators of automobiles and motor vehicles who have been threatened in this manner by telephone that no communication of such character as those made either oral or written, are sent out by the board unless formally made through the secretary of the commission, and that in all cases of complaint the owner or operator is summoned before the board by a formal written communication signed by its secretary, A. B. Fletcher.

Complaint came from Cambridge in one instance that an automobile owner was called up by someone on the telephone and informed in a peremptory manner that he was overspeeding his machine and unless he stopped his recklessness he might expect summary treatment. When the request was made to know who was talking, the answer came back "Chairman Parker." Another case of the same kind was reported from Boston in which the statement over the wire was "This is the Highway Commission." Other complaints of a like nature have been made from suburban towns. Last year a wealthy Beacon street resident, who never speeds his machine, received a letter through the mail which purported to come from the Highway Commission containing similar threats of prosecution. It was quickly stamped bogus by the commission, but this season the joker seems to be using the telephone.

Court Upholds Anti-Smoke Ordinance.

At a hearing on August 31 Justice Dugro, of the Supreme Court of the State of New York, upheld the validity of the Department of Parks ordinance against the emission of smoke by motor vehicles, and dismissed the writ of habeas corpus sued out in behalf of William Tupper, a taxicab driver, who was arrested on August 27 for violating the ordinance.

The New York Taxicab Company sought to make a test case of Tupper's arrest and got a writ of habeas corpus before he had been arraigned in the police court. J. B. Ker, counsel for the company, tried to convince Justice Dugro that Park Commissioner Smith had exceeded his legal powers in making such an ordinance, but Justice Dugro replied that in his opinion the park commissioner had ample power to exclude undesirable vehicles from the city parks, and that he thought the ordinance thoroughly justifiable. He remanded Tupper to the jurisdiction of Magistrate Harris, sitting in the Yorkville Court, who promptly fined Tupper $1 on hearing Justice Dugro's ruling.

Rhode Island Motorists Hold Off Registration Fees.

A number of Rhode Island motorists have held off from paying registration fees for automobiles under the new law, as they are awaiting a decision from the courts on the questions that have been raised as to its constitutionality. The point has been raised that the taxing of automobiles by the town and city assessors as personal property and the registration fee required by the State law, graded according to the horse power of the machine, constitute a double taxation, and that such a fee as the State demands, on top of the local property tax paid in the cities and towns, is unwarrantable. A test case was recently made, and the decision is awaited with interest by both resident and visiting motorists.

To Limit Cylinder Capacity of Automobile Motors.

A bill to limit the cylinder capacity of automobile motors is to be presented to the Illinois Legislature this fall. This measure has been gotten up after an investigation of the conduct of cars of all powers, and the effects of large cars upon the roads. One section proposes that the State should refuse to license automobiles having a horse power great enough to develop a speed of 70 miles an hour, especially where the legal limit is only 15 to 20 miles. It is set forth that the only purpose of the high horse power car can be to exceed the speed limits, and the State should therefore refuse to countenance the manufacture of such cars.

Another section is designed to prevent the transferring of license tags from one car to another, inasmuch as a tag may now be obtained for a 10 horse power car and soon after transferred to a high powered car. A clause in the registration section proposes the use of different styles of tags for cars of different capacity. An adequate examination for chauffeurs before licenses are issued to them is also asked in the bill.

Small Sum from State for Mercer County Roads.

The Freeholders of Mercer County, N. J., will only receive $1,000 from the State Automobile Fund for road repairs, according to the ruling of the Attorney General. His interpretation of the law reads that all strictly country roads which have been improved, as well as macadam streets in cities and towns, must share in the repair fund. Consequently, the money must be distributed for the benefit of all improved roads in the State, whether they were built under the State aid law or not. Mercer County with its State built roads instead of getting $8,000 gets only the above sum.

Jersey Motorists' Licenses Revoked.

The Commissioner of Motor Vehicles of the State of New Jersey revoked the licenses of Harry E. Crane, of Elberon, and Robert Pitcanio, address unknown, on August 26. Crane was driving the motor car that killed Van Dorn Hendrickson at Eatontown on August 18, and he is now in jail at Freehold on a charge of manslaughter. Pitcanio gave as his address Hastings square, Pittsburg, Pa., and on investigation, after being charged with violation of the speed laws at Manasquan, the address was found to be fictitious, nor could anyone of the name be located in Pittsburg.

Central Committee Refuses to Audit Automobile Bills.

The auditing committee of the Republican Central Committee of Alameda County, California, has refused to authorize the payment of bills incurred by C. E. Klinkner and N. J. Pendergast for automobile hire for the committee. The bills amounted to $200, and a collection agency is now trying to get payment from Klinkner and Pendergast personally.

A motor car service has been established between Damascus and Palmyra, a distance of 120 miles. The journey is covered in about ten and one-half hours and is made daily. Formerly the distance took several days to cover.

OUR FOREIGN EXCHANGES

The Taxicab Situation in Paris.

According to a report made recently to the Institution of Civil Engineers of France by M. Lucien Périssé, the companies operating taxicabs do not appear to be improving financially. A careful estimate was made on April 30 last of the number of vehicles of all classes which used the streets of Paris daily, and this number is found aproximately to be 98,000. Of this number 12,000 were estimated as being privately owned motor cars, 3,500 were classified as livery or hackney automobiles, while 12,000 appeared to be horse drawn cabs and vehicles for hire, the balance being made up of private carriages, carts and vans, market vehicles and wagons belonging to the municipality of Paris. M. Périssé then goes on to say: "The motor cab has, therefore, become a necessity in Paris, but it exists under very precarious conditions. The increase of motor cabs has not been accompanied by a corresponding decrease in the number of horse drawn vehicles. This is in a large measure due to the higher tariff under which the motor vehicle plies; the middle classes do not, therefore, patronize them to any large extent. As for the rich clientèle it still shows a preference for the carriage which may be hired from a livery stable. The result is as follows: For every fourteen fares that are counted daily as being carried by the horse drawn cab, eight or nine only can be reckoned upon for each motor cab. There is, of course, some compensation in the larger number of miles covered by the automobile.

"It must be remembered, however, that the older style of vehicle costs nothing or next to nothing in mileage upkeep, while the motor vehicle is running up its expenses at no mean rate all the time it is on the move. In order to popularize the motor cab and assist in its development it is of primary importance to accustom the public to its use. It is of no less importance to reduce the running expenses under the following heads:

"The cost of upkeep and replacement of the pneumatic tires, the cost of lubricants and fuel, the daily cost of undertaking large repairs, the cost of making good the damage due to accidents, and the high depreciation charge which is at present deemed necessary."

The difficulty of fixing an equitable figure for the depreciation of motor cabs is dwelt upon at some length, and M. Périssé considers that the full purchase price of the chassis should be written off in seven or eight years, and that the body work should be similarly provided for in three or four years. He is of the opinion that the purchase price of motor cabs is too high at present, and is of the opinion that this price will be reduced considerably in the future in accordance with the mechanical improvements in the factories. The price of a chassis is actually nowadays 87 cents to 90 cents per pound weight, which is considered quite high when compared to the cost price of a locomotive, taking into consideration the respective weights of both machines.

"Lastly, both the speed and the weight of the machines must be reduced. If a maximum speed limit of 21 miles per hour were allowed in Paris, accidents would be rarer than they are at present. Some relief in the matter of weight may be looked for by the employment of tubular frames and air cooled motors, and by simpler construction of the coachwork. A carriage body made in one piece of aluminum opens out a new horizon," says M. Périssé.

As a final suggestion, the author states the necessity of distinguishing clearly between vehicles intended for city use only, and those which on occasion may be used for excursions or trips into the country. Electric transmission, gears always in mesh and improved methods of lubrication are treated as possible factors which may reduce the cost of operation, and perhaps the purchase price. The notorious methods of juggling the taximeter by taxicab drivers is well known to the Parisians, and this knowledge tends to discourage custom, though this factor was not considered in the above report.

Motor Trench Digger for the French Service.

Lieutenant Colonel Espitalier, of the Engineer Staff of the French Army, has recently made a report recommending the adoption into the service of a motor "trench digger," the invention of a young engineer, M. Riester. Although the inventor calls it a "motor plough," the machine does plough in a way, but digs a trench, not a furrow. It is devised for that purpose, and is intended to be used for throwing up earthworks rapidly and effectually.

The machine, which is horse drawn on the road, consists of an ordinary gun carriage, to which is coupled the motor plough proper. When the plough is put in use on ground in which a trench is to be dug, a lever lowers a share and starts the motor, which then propels the vehicle, the horses being required only to guide it. The engine at the same time sets in motion a flywheel weighing 880 pounds, armed with four steel blades, and turning at the rate of 1,000 revolutions a minute.

The motor, which is of four cylinders and 100 horse power, spends only 10 per cent. of its energy on propelling the plough, the remainder being used for the excavating apparatus. The ploughshare having drawn the furrow, the revolving blade digs the trench, and the spades and a harrow, also moved by the machinery, throw up the earth. The flywheel by its weight and velocity is powerful enough to turn up the hardest soil.

The machine is said to be capable, while traveling at 6 miles an hour, of digging a trench 2½ feet deep and nearly 6 feet wide, and of throwing up corresponding earthworks some 3 feet high.—*R. A. C. Journal.*

Motor Omnibuses in the Tyrol.

Automobile omnibuses in rapidly increasing numbers are being employed in the post and tourist service in the Tyrol, especially in the Dolomites country, opening up magnificent resorts in the mountains hitherto only accessible by long and costly carriage journeys. The new conveyances have so far proved an unqualified success. They cross the highest mountain passes, sometimes over 6,000 feet, in less than a third of the time occupied by the old diligences.

No less than three fairly long lines have been opened this summer. One running from Trent, over Tione to Pinzolo, will be extended later to the picturesque Madonna di Campiglio and down to Riva on Lake Garda. Another beautiful route traversed is that from Neumarkt-Tramino to Predazzo, which has proved so attractive to tourists that more cars have been put on.

The type of omnibus mostly employed is of light and elegant build, carrying ten passengers besides a fair amount of small luggage. For heavy luggage and larger articles specially heavy motors are used.

The State and railway authorities are greatly delighted with the success of these automobile lines, which often induce the tourists to leave the more beaten track in the neighborhood of the railways and go further into the mountains, thereby spending a longer time in the district than they had intended.—*London Engineer.*

A fruit grower in Normandy has found something of benefit to his vines from the automobile. He noticed that the grapes and plums growing close to a highway upon which automobiles passed constantly were not so susceptible to frost and grubs as were other fruits on the plantation. He states that the dust raised by the machines settles on the buds and adheres to them by reason of the sap or liquid secreted, thus forming a protective coating. The grubs and other insects doubtless do not like the flavor of the dust.—*Omnia.*

Under a new rule non-resident motorists who wish to tour in Germany may secure permits for various lengths of time at the following rates: One day, 3 marks; 2 to 5 days, 8 marks; 5 to 15 days, 15 marks; 15 to 30 days, 25 marks; 30 to 60 days, 40 marks; 60 to 90 days, 50 marks. Number plates obtained at the registration bureau when returned upon leaving the country cost 2 marks for one day and 5 marks for 2 to 90 days.

MINOR MENTION

We have received a copy of "The Car and the Lady," by Grace S. Mason and Percy F. Megargle, for which we hereby acknowledge our thanks.

Charles E. Worrell, formerly with the Pope-Waverley branch at Indianapolis, is now identified with the sales department of the Overland Automobile Company.

It is reported that the Marvel Automobile Company, of Detroit, will remove its factory to Elkhart, Ind., taking over the Kimbark factory buildings in that city.

A petition in bankruptcy has been filed by the Hoopeston Auto and Machine Works, at Hoopeston, Ill. The assets of the concern are $1,300 and the liabilities $1,600.

The Stillson Motor Car Company, of Springfield, Mass., are reported to have completed several of their 1909 model runabouts, and expect to send these to their agents in a short time.

The Cadillac Motor Car Company, Broadway and Sixty-second street, New York city, moved on September 1 to the corner of Broadway and Fifty-ninth street, where a building has been entirely remodeled for them.

A valuable work on "Interlocutory Motions in the United States Patent Office" has recently been received. The author, E. J. Stoddard, is both a mechanical engineer and a lawyer, and has twenty years' experience in patent work.

Ralph King, of the King Motor Vehicle Company, at Auburn, Ind., announces that the company will specialize in the manufacture of runabouts for R. F. D. service. This is the first company that has turned its attention wholly to such vehicles.

The Huntsman Automobile Company, of Tucson, Ariz., was recently purchased by Charles F. Hoff, of that city, who intends to secure the agency for a number of well known automobiles, and, in addition, will conduct a renting and repair business.

The One Cycle Gas Engine Company, of East McKeesport, Pa., have moved their plant to outer Fifth avenue, that city. The company is building a remarkable motor, which is adapted to the use of either steam or gas, and is self starting and reversible.

The authorities of Scotland Yard, the London police department, will shortly place a number of motor driven "Black Marias," or prison vans, in service, and it is purposed to replace the horsed vans in service at present in course of time by motor vehicles.

A. J. and George Bertschy, president and secretary of the Nevada Motor Car Company, of Reno, Nev., will shortly build a factory for the manufacture of motor trucks in Council Bluffs, Ia., which are to be used in the service of the Independent Transportation Company of that city. The Bertschy brothers have a large interest in the transportation company, and it is intended to have the offices and shops of both companies located in Council Bluffs in the near future.

The Buggy Car Company, of Cincinnati, Ohio, has taken over the plant of the Indiana Auto Manufacturing Company at Bedford, Ind., and will remove the same to Cincinnati. Motor delivery wagons and motor buggies will be manufactured.

The C. P. & L. Lauson Company, manufacturers of gas and gasoline engines in Milwaukee, Wis., has changed its name to the Christensen Engineering Company and increased its capital stock from $75,000 to $150,000. N. A. Christensen is president, R. L. Gruber vice president and A. H. Lauson secretary and treasurer.

It is reported that a number of tricars of the Contal type are to be imported for light delivery service in New York and other large cities. These tricars are in use in Paris and the larger cities of France for delivery and collection services for laundries, groceries, etc., and will doubtless find a fair market in this country.

The Premier car, which was started on a 10,000 mile run not long ago, is reported to have completed 10,062 miles on August 25. The run was made to determine whether a standard American built touring car could cover such a distance without experiencing serious trouble. The roads traversed in the run were the ordinary country roads, no attempt being made to pick out a series of fine surfaces or to run over the same course continually. The company reports the car to be in good condition.

Garage Notes.

A new garage is to be erected on Bluff street, Beloit, Wis., by Alonzo Aldrich.

Mager & Kost have opened a new garage on Commercial street, Lynn, Mass.

H. E. Smith, of Fond du Lac, has opened a garage at 721 Erie avenue, Sheboygan, Wis.

The Irvin Automobile Co. have fitted up the Gray & Kellog plant at Jefferson, Ia., where they will conduct a general repair and storage business.

H. W. Kakaska has opened a motor repair shop on Seventh street South, Grand Rapids, Wis., and will shortly build a garage on the premises.

The Audubon Auto and Machine Works, located at 415 West 150th street, New York city, has been appointed New York agent for the Schacht runabout.

Hackett & Witham, of Skowhegan, Me., will enlarge their garage next season, the present building not being sufficiently large for the business carried on.

Wm. Killmer and Foster Boyd will shortly open a garage at Ashton, Ill. The building is to be constructed of concrete, and will have a floor space of 40x45 feet.

The Gamble Motor Car Co., of Toledo, Ohio, report that they will not remove to their new location on Madison street until April 1 next, owing to a change in the building plans.

The Thief River Falls Automobile Co., Thief River Falls, Minn., has been organized with P. N. Winton as president, G. A. Penney vice president and F. J. Stebbins secretary and treasurer.

Ten automobiles were destroyed in the garage of Ed. Trauser at 77 Virginia place, Buffalo, N. Y., on August 29. In attempting to get the cars out of the garage an employee was badly burned by the explosion of a gasoline tin. The building was a frame structure, and was burned almost to the ground before the fire apparatus arrived. The loss is figured at $25,000.

Norman Chilson has established the first garage in Merrill, Wis., at 305 East Main street. The structure will have accommodations for twelve automobiles, and a general repair business will be carried on.

The Willis-Haywood-Holcomb Co., of Indianapolis, Ind., announce that they will take over the garage recently vacated by the Fisher Auto Co. and conduct a general repair business in addition to handling the Packard product for 1909.

The E. C. Long Mfg. Co., of Hannibal, Mo., has consolidated with the Bluff City Plumbing and Heating Co., and the combined firms purpose establishing a three story structure in Hannibal, which will combine a garage and plumbing establishment.

The Herschede Motor Car Co., which recently took over the premises of the Reliance Motor Car Co., at Reading road and Maple avenue, Avondale, Ohio, announce that they will handle the American car in addition to their present garage and agency business.

Robert R. Ashwell, Hartford, Conn., agent for the Franklin, is having a garage built that will afford 30,000 square feet of floor space. The building will contain four floors, elevator and repair room 40x60 feet, and is being erected on Trumbull street.

The Autocar Co., of Ardmore, Pa., formally opened its Philadelphia branch on September 1. The branch is located at 249 North Broad street, and was formerly occupied by the General Motor Car Company, who were Philadelphia distributors for the Autocar. The building is admirably equipped for repairing and garaging in addition to its exhibition rooms.

The Swendeman Automobile Co. have opened a garage on Fuller avenue, Helena, Mont. The building is 100x50 feet, is of stone construction and thoroughly fireproof. The lower floor is devoted to a machine shop, washing rack and space for cars on live storage, while the upper floor accommodates forty vehicles on dead storage, and in addition has a tire repair department.

New Incorporations.

The Franco-American Taximeter Co., of New York, has increased its capital from $1,050,000 to $1,500,000.

Twin City Motor Co., Hancock, Mich.—Capital, $50,000. Tto operate motor vehicles for interurban service.

Straight-Roberts Auto Co., Chicago, Ill.—Capital, $75,000. Incorporators, J. R. Roberts, J. J. Straight and N. Goltra.

Pines Inn and Garage Co., Westport, Conn.—Capital, $2,000. Incorporators, Louis Long, Morris Long and Irene Long.

Atlanta Motor Co., Atlanta, Ga.—Capital, $100,000. Incorporators, William Knox Cleveland, Herbert L. Wiggs, Eugene Callawny and V. L. Smith.

Four-Drive Auto Co., Chicago, Ill.—Capital, $250,000. To manufacture and deal in automobiles. Directors, C. T. Murphy, A. P. Dewey and S. E. Hill.

Pittsfield Motor Transportation Co., Springfield, Mass.—Capital, $50,000. The officers are: President, Alden Sampson; treasurer, Rodman Schaff. To sell and operate automobiles and motor trucks, and the erection of automobile machinery, stands and garages.

New Agencies.

Seattle, Wash.—M. S. Brighman, Cadillac.

Cumberland, Md.—McFarlane & Shaffer, Crawford.

Seattle, Wash.—George W. Evans, American Mors.

Milwaukee, Wis.—Wisconsin Automobile Exchange, Stearns.

Milwaukee, Wis.—Electric Vehicle and Garage Co., Grand avenue, Babcock.

Washington, D. C.—Commercial Automobile and Supply Co., Chalmers-Detroit.

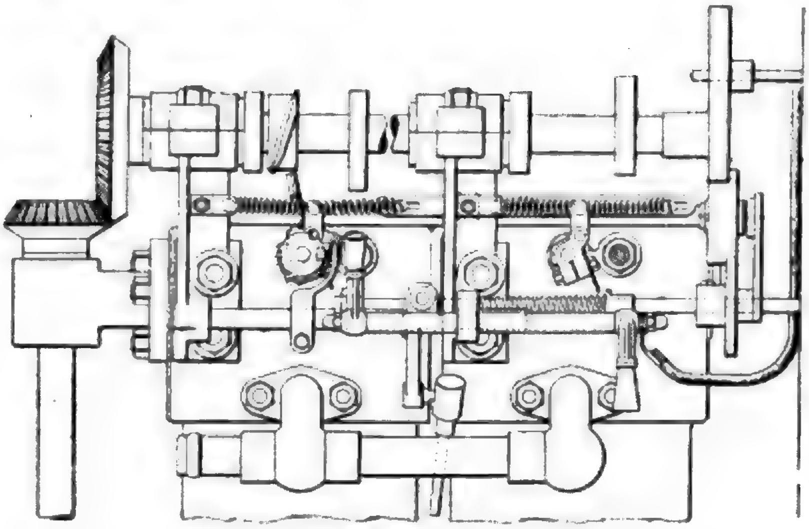
Washington, D. C., and Baltimore, Md.—Arthur Stanley Zell, Chalmers-Detroit.

Indianapolis, Ind.—Indianapolis Motor Car Co., 27 North Capitol avenue, Regal.

MOTOR VEHICLE PATENTS

Review of Specifications.

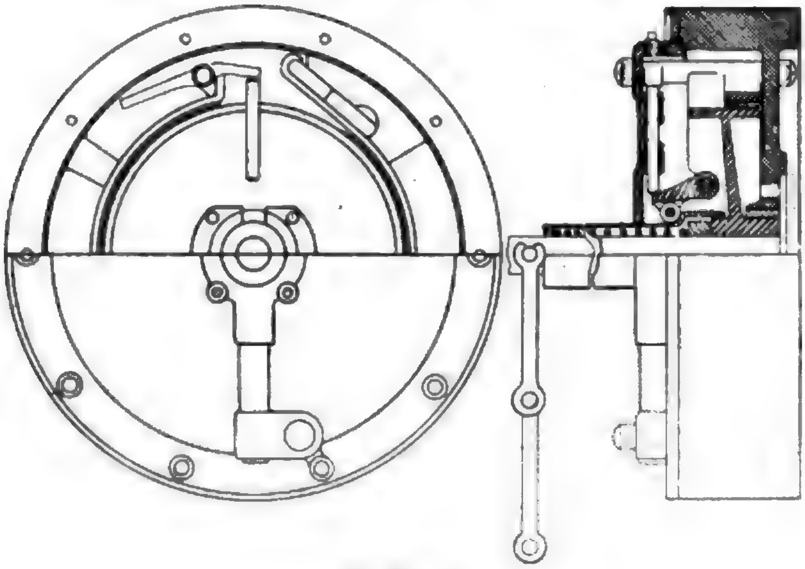
894,775. Sparking Device for Explosive Engines.—Charles R. Gunter, of Wilkes-Barre, Pa. July 28, 1908. Filed April 25, 1907.


No. 894,775.

This invention relates to a make and break sparking device, and the means of operating the hammer of the device to accomplish the break. Upon a shaft to which is attached the hammer of the make and break is loosely mounted a lobed plate fitted with a grooved portion attached thereto. The plate is provided with a spring arm to which is fastened a pad or plate, which is designed to be acted on by a cam mounted on and rotated by an overhead shaft driven from the motor. The lobed plate has a hole in its smaller lobe; through this hole projects a pin which is attached to a rocker plate parallel to the lobed plate and clamped to the hammer shaft. An arm integral with this rocker plate is attached to two equalizing spiral springs working in opposite directions, as shown. The lobed plate is further provided with a U shaped spring fastened at one end thereto, and acting upon a link loosely connected with the pin attached to the rocker plate. This spring is a relief spring, and is designed to take the strain from the spring arm. An arm fitting into the grooved portion of the bed plate imparts to it an axial movement giving the advance or retard of spark. This arm is mounted upon a shaft rotatable at the will of the driver. A slight play of the lobed plate is permitted by having the hole in the smaller lobe larger than the pin projecting therein. When the cam "wipes" the spring arm the lobed plate is partially rotated, carrying with it the rocker plate and causing the hammer to touch the anvil, at the same time putting tension on one of the spiral springs. When the cam releases the spring arm, this spring acts upon the rocker plate and the hammer and causes the "break," the spiral springs causing the hammer to vibrate and thus maintain the spark during the period of vibration. A similar device is fitted to all the cylinders of the engine.

894,426. Clutch.—David E. Dolson and Elbert R. Pease, of Charlotte, Mich. July 28, 1908. Filed November 25, 1907.

This relates to a friction clutch of the contracting band type. The flywheel is flanged deeply, and within the same is a drum keyed to the clutch shaft, but rotatable separably from the flywheel. Two bands or brakes encircle this drum, one being pivoted opposite of the clutch from the other. These bands are each supported at one end by bending the end over one of a pair of blocks fastened to the flywheel. These blocks have their faces in contact cut at an angle, so that by moving one upon the other adjustment in the length of the band may be made. The other end of each band is frictionally held by a cam piece forming the short arm of bell crank operating upon a pin attached to the flywheel. Radial pins bear against the long arms of these bell cranks at one end, and at the other against lifters pivoted upon a facing bolted to the flywheel and forming a cover for the whole mechanism. These lifters are fitted with rollers which rest against a shouldered collar which is movable axially along the clutch shaft by suitable connections to the clutch pedal. This collar acts as the bearing for a spiral spring, the other bearing being against a plate fixed to the clutch shaft. This spring tends to force the collar back so that the rollers ride upon the shouldered portion, lifting the radial pins and tightening the bands upon the drum, locking flywheel and drum together. Upon pushing the collar inward the lifters and rollers ride down upon the smaller diameter and slack off the bands.


No. 894,426.

Patents Issued August 25, 1908.

896,755. Horse Power Hour Meter.—Johannes Picht, Halle-on-the-Saale, Germany. Filed October 23, 1906.

896,844. Steering Gear.—Theophilus Mayhew, Detroit, Mich. Filed January 2, 1908.

896,863. Canopy Top for Vehicles.—John E. Smith, Atlanta, Ga. Filed March 23, 1908.

896,893. Internal Combustion Engine.—Dugald Clerk, Little Woolpits, England. Filed February 15, 1904.

896,897. Vehicle Wheel.—Herman Cramer, San Francisco, Cal. Filed December 13, 1905. Renewed May 27, 1908.

897,099. Transmission Gear.—Philip Hayward, Hanging Rock, Ohio. Filed March 6, 1908.

897,151. Pneumatic Tire.—Walter C. Rocheleau and Louis T. Rocheleau, Woonsocket, R. I. Filed March 2, 1907.

897,200. Automobile or Vehicle Tire.—Godfred Knadler, Cleveland, Ohio. Filed August 20, 1906. Renewed October 16, 1907.

Trade Literature Received.

Chase Motor Truck Co., Syracuse, N. Y.—Catalogue of motor trucks and gasoline rollers.

F. A. Brownell Motor Co., Rochester, N. Y.—Catalogue of marine and automobile motors, etc.

Bendix Co., Cragin Station, Chicago, Ill.—Catalogue of the Bendix four cylinder, high wheel runabout.

Irvin Manufacturing Co., Tenth Street and Canal, Indianapolis, Ind.—Circular of the Irvin glass wind shield.

The Horseless Age

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VOLUME XXII NEW YORK, SEPTEMBER 9, 1908 NUMBER 11

Suggestions on Taxicab Design.

By Chester S. Ricker.

Ostensibly the following article will be a consideration of some taxicab details. However, some of the suggestions I think might well be applied to touring cars. Indeed the article suggested itself to me while making some repairs on my own car, which is in many respects similar to the design which I will try to describe in the following lines.

In an automobile for such service as a cab is used it is highly advisable that repairs, which unfortunately must always come sooner or later, can be made with the greatest celerity. With such small and compact motors as are necessary for taxicab work, it becomes decidedly inconvenient to make any repair to the motor while in the frame. Further, with many motors it is necessary to take the whole motor out of the frame anyhow, in order to adjust the connecting rod bushings or the crank shaft bearings, if the latter are plain. Thus it is evident that when such adjustments have to be made they will be facilitated, and time and money will be saved, if the motor or such parts as are to be repaired are readily removable.

Now if we build the motor and its accessories as a single, easily removable unit, the transmission and rear axle as another, will not time be saved in the removal and replacement of such parts? And why not have a multiple unit construction of this kind so that the whole chassis will not be useless while one part is being repaired? This system appeals from the commercial as well as from the mechanical standpoint. One would not think of putting up a car because of a punctured tire; on the contrary, in these days one carries an inflated tire on a detachable rim, or a complete wheel, with an inflated tire on it. The delay in either case, to make the replacement, is but a minute or two, the latter method being the present practice with taxicabs, and offering a striking contrast to the old methods of changing tires. This represents a method by which an injured member can be replaced with a new one with the least possible delay. Since this is possible with tires, why not go a step further and apply this scheme to taxicab construction in the form of a multiple unit system? The fact that a taxicab is not a pleasure but a commercial vehicle cannot be too much emphasized. In the former a delay in making repairs is only an inconvenience; in the latter it is a serious loss of money. It is only too well known that if it is difficult to make an adjustment or repair, it is always put off "a little longer" until something worse happens. With a multiple unit system an injured unit could be taken out and replaced by a perfect one without putting the car, as a whole, out of commission for more than an hour or two. This very fact recommends the system more than anything else, for it is a safeguard against costly repairs, and keeps the chassis earning money continually. Such being the case it is almost self evident what would be gained by building a car in several large and integral units, easily removable and replaceable.

MULTIPLE UNIT SYSTEM.

With the methods of manufacture now used in the United States, interchangeability has become a fact beyond question. This was recently demonstrated to our brethren across the Atlantic by the three Cadillac cars in the Interchangeability Contest which was described in The Horseless Age, Vol. xxi, No. 13. The success of this event alone proves without doubt the practicability of a multiple unit construction. It only remains to consider into what units the chassis should be divided. A possible solution might be as follows:

I. Motor unit, including *a*. Motor. *b*. Carburetor. *c*. Lubricator. *d*. Magneto. *e*. Water pump. *f*. Radiator.

II. Transmission unit, including *a*. Transmission. *b*. Rear axle and wheels. *c*. Propeller shaft and Cardan joints. *d*. Torsion and strut rods.

III. Frame unit, including *a*. Frame. *b*. Front axle and wheels. *c*. Steering gear complete. *d*. Springs. *e*. Muffler. *f*. Gasoline tank.

IV. The complete body unit.

(It must be understood that this article does not include chain driven cars.)

I.—THE MOTOR UNIT.

Let us first consider the motor unit. The object which we should have in view is to make the motor, with all its accessories, a single unit. Present construction usually includes only the carburetor, magneto and water pump in the motor assembly, leaving out the radiator and lubricator. The latter, however, is now often permanently built in the crank case, the place where it belongs and where this construction requires it to be. Nevertheless, if a separate lubricator or a sight feed unit is desired it can be attached directly to the rear cylinder of the motor. (See Fig. 3.) The oil reservoir should be included in the crank case somewhere; below the crank case is good practice now. As to the radiator, I would pro-

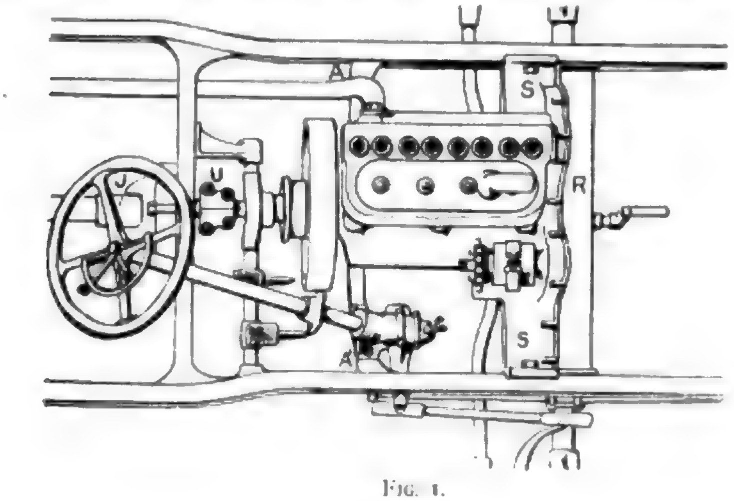

Fig. 1.

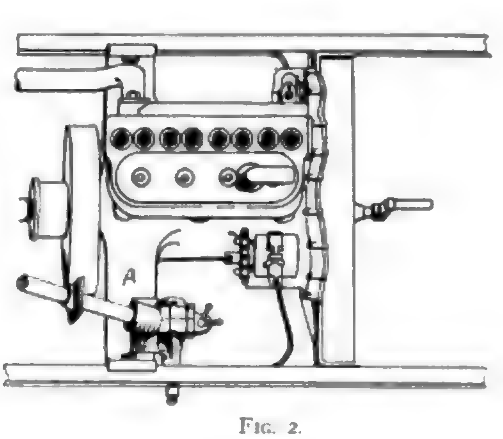

Fig. 2.

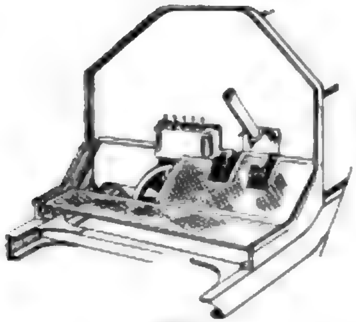

FIG. 3.

pose that it be included also. A method which I have in mind is the following: The timing gear cover plate may be extended forward to form a support, R, Fig. 1, for the radiator and starting crank. This construction offers several advantages, besides the fact that it makes it integral with the motor unit; first, because it carries the radiator where it is not subject to any strains arising from the twisting of the front frame members, and, second, it has the advantage of reducing the number and length of connections between the motor and radiator. If this is done we then have motor, magneto, carburetor, lubricator and cooling system in one unit.

This construction will be further aided if the motor is hung on three points, as shown in Fig. 1, S S being the two front supports, which are bolted to the frame, the third point being directly under the crank case on the cross member A A'. The latter connection should be supported by a spring or some yielding support. There is an alternative three point suspension construction possible, as shown diagrammatically in Fig. 2. The greatest difficulty involved in this type would be that the steering gear would have to be removed, in addition to the other parts, which will be mentioned shortly, whereas in the construction illustrated in Fig. 1 the steering gear is absolutely independent of the motor unit. Of course if the steering column was placed back of the supporting arm A, Fig. 2, it would not conflict with the motor unit when the latter is being removed. The steering column, however, would be then almost vertical, a thing which should be discouraged. Moreover, the front single point support would prevent several difficulties if the removability of the unit was not impaired.

REMOVAL OF THE MOTOR UNIT.

Let us now suppose that the motor is in the chassis and it is desired to remove it. There are several things which it is necessary to do before the unit can be removed. With careful designing this, according to my deductions, can be accomplished in six operations at the most, namely,

1. Removal of the dash.
2. Disconnecting motor from propeller shaft.
3. Disconnecting spark and throttle connections.
4. Removing exhaust pipe.
5. Uncoupling gasoline pipe.
6. Unbolting the motor from the frame.

Having completed these operations the motor can be removed immediately from the frame with a block and tackle or some similar attachment, and another complete unit installed in its place. Judging roughly, the removal of one and the replacement of another unit ought easily to be made in an hour and a half, if so hurried a repair is necessary. With some practice there is no reason why this cannot be done in an hour.

CONSTRUCTION OF THE UNIT.

Now we will consider each one of these parts and its removal separately. First, taking the dash. I would suggest that this be made of pressed steel, as shown in Fig. 3, with aluminum or pressed steel toe plates. The special feature about the dash, however, is that there must be no attachments upon it, such as lubricator, sight feeds, etc., which it will be necessary to disconnect when it is removed. The above paraphernalia if used may be attached to the motor and project through the dash, as shown in Fig. 3. Four bolts should suffice to hold the dash in place on the frame, hence the time required to remove the dash depends wholly on the time required to remove the four bolts.

The next member which requires our attention is the universal joint U in Fig. 1. The object of this is to aid rapid disconnection of the motor from the tail shaft, and not so much to take care of the misalignment of the two shafts. The latter duty should be left to a second joint on the end of the propeller shaft. The construction of a joint which will permit rapid disassembling offers no great difficulty. The designing of a clutch operating fork which will not require disconnecting or interfere with the removal of the motor ought not to be difficult either. An example of this is shown in Fig. 4, together with a simple universal joint, the Oldham coupling being shown in the illustration. It will be understood that these are only suggestions.

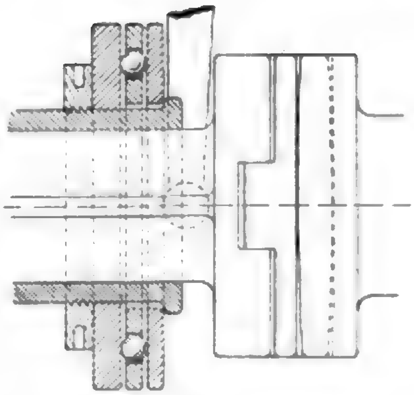

FIG. 4.

The spark end and throttle levers are usually connected by a pin held in place with a split cotter, and only requiring a pair of pliers and a couple of minutes to disconnect. The same may be said of the gasoline supply pipe.

Those motors which have the exhaust manifold cast integral with the cylinders, like the Thomas or Darracq motors, see Fig. 5, need only one conection between the pipe and cylinders. This requires but a moment to disconnect. If on the other hand an applied manifold is used, as shown in Fig. 6, it will be necessary to place a joint in the pipe, as at A.

The unbolting of the motor from the frame can be accomplished very rapidly if the designer takes care that the nuts are placed so that they are accessible. One other point should be observed, that is, the dust pan should have a small opening of

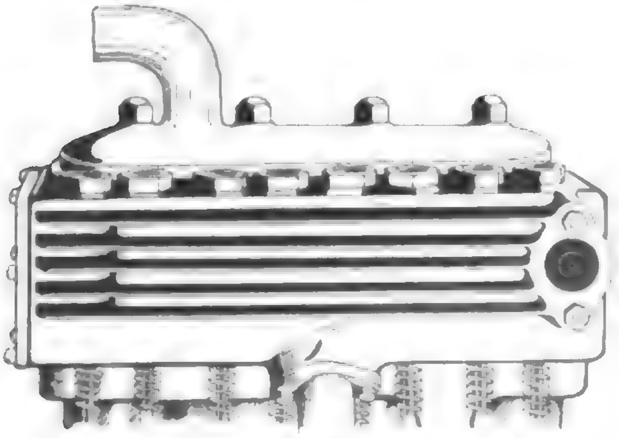

FIG. 5.

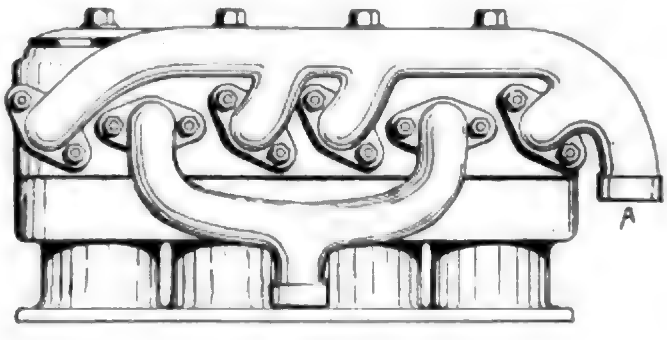

FIG. 6.

some kind, so that the single point bolt may be easily reached. If these things are done this, which is probably the hardest of the operations, should be very simple. It will be noted that the removal of the motor does not require the removal of the dust pan also, as the motor is taken out from above and nothing except the single bolt mentioned above has to be reached from below.

There is no doubt as to the practicability of constructing such a motor. Every detail of its construction has been or is used in one car or another. For example, the placing of the radiator as proposed is now practiced by the Stearns in the latest model. The type of three point suspension used is exemplified in the Autocar, Maxwell and Stevens-Duryea, where it has proved exceedingly successful. The providing of an easily removable dash may be a curiosity, but beyond that nothing is strange about it. The tendency at present is to clear the dash of everything possible, a thing which ought to be encouraged. Steel or aluminum and wood dashes also are becoming quite the style. For such work as a cab is required the steel dash is undoubtedly the most practical. With the exception of the three above features there is nothing different from the standard practice. Briefly, the above construction for a taxicab is advantageous, simple, and above all practicable.

THE TRANSMISSION UNIT.

The transmission element is much less difficult to construct provided one is allowed to incorporate the change speed gear case with the rear axle casting. This is especially advantageous, because it makes a single unit out of two otherwise separate ones. Fig. 7 is a rough sketch of the rear part of a recent taxicab frame. This represents the type of transmission and rear axle combination that I propose. In this special case it will be seen that there are three main points of contact between the frame and the driving members, these points being the two spring perch plates and the coupling J. The universal joint U is the same joint described under the motor unit and serves the same purpose as before, namely, that of a disconnecting element. Inside of the coupling J there should be another universal joint, whose purpose is to correct for the angle between the shafts and not to act as a connecting link (see Fig. 8). Besides the above four points there are six other joints which have to be disconnected, the four brake actuating rods having joints at 1, 2, 3, 4, and the two gear shift rods having joints at 5, 6. The last six should be made so that only a pair of pliers are necessary to disconnect them. In most cases these joints are of the ordinary pin variety, anyway. In all there are but ten joints to disconnect, the hardest being the coupling J.

CONSTRUCTION OF THE UNIT.

Now let us take up each part separately as in the motor unit. First comes the coupling U, which was discussed and shown under the motor unit. Next comes the joint J. This may be made as shown in Fig. 8, of the ball and socket type. It is evident from the figure that if such an elaborate joint is used it will be difficult to disassemble it when the unit is withdrawn. What I would propose is that the stationary part be bolted to the cross member of the frame, so that the whole joint intact may be removed from the frame when the unit is taken away. This certainly would be less difficult and no wearing surfaces would have to be carefully adjusted when assembling if the above method is used. As part of the driving stresses as well as torsion stresses come upon the socket so constructed it is highly important that this member should be carefully lubricated. The coupling further acts as an efficient cover for the universal joint and the torsion tube R, which connects the rear axle with the coupling, encases the propeller shaft also.

The transmission had best be of the three speed and reverse selective type. A transmission of this kind requires only two operating rods and two joints, 5, 6, Fig. 7, whereas three would be required if another speed was used. The rear axle ought to be of the full floating type. If such is used many repairs to the rear axle will be greatly facilitated. The use of bearings rests with the designer. Personally I prefer Hess-Bright bearings. All the brakes must be on the rear axle, acting on the wheel brake drums. If this is done no difficulty will arise in the removal of the axle, while if the drum were on the forward end of the propeller shaft, impossible within the example shown, or on the tail shaft, it would be difficult to withdraw the rear axle.

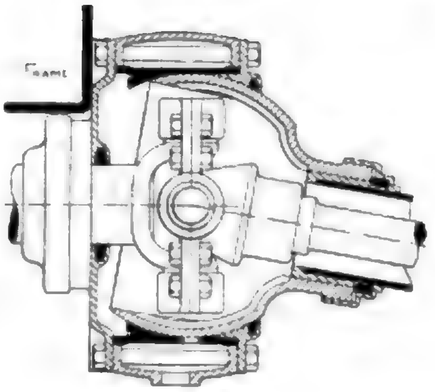

Fig. 8.

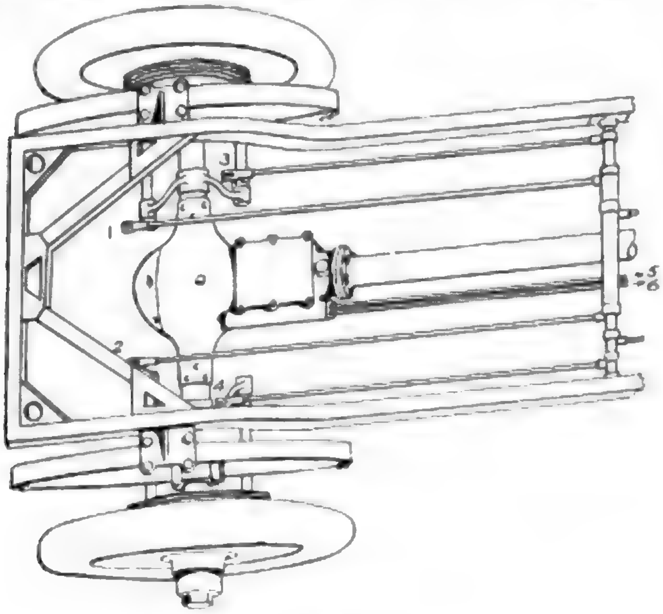

Fig. 7.

The spring clips demand quite a share of our attention. They should be carefully designed, with an object to make their removal easy, and yet not so as to endanger the occupants of the car by leaving the axle somewhere along the road. Some better scheme should be used to hold the nuts in place than riveting the bolt ends over, as is very common practice.

The brake actuating rods must not be overlooked. The adjustment of the brakes on one axle is seldom the same on another, hence if the axles are supposed to be replaced rapidly some rapid means of adjustment should be found. If some means of rapid adjustment are not provided the brakes are sure to be either too tight or too loose, the later being naturally very dangerous.

THE FRAME UNIT.

The frame unit really consists of six separate ones, but I will consider them under this one head. The frame itself is a unit which if injured puts the whole machine in the repair shop. But in this case as in the previous the separate units will be of advantage. Instead of having a good motor lying idle, as well as the rear axle, they can be substituted in the first chassis, requiring a repair on one or the other of the above units. Thus we see this system will work two ways. The front axle and wheels as a unit needs no comment, for present practice can hardly be improved upon.

The steering gear can be replaced very easily in this case. This, I should add, only applies to the steering column wheel, etc., and not the parts attached to the running gear. Referring back to Fig. 1, it will be seen that after the dash is removed and throttle and spark levers disconnected there is nothing in the way to prevent this unit from being withdrawn.

The springs as they are at present constructed are not always easily removable; other than this they require no further change.

It would add much to the simplicity of the construction if the gasoline tank is attached to the chassis; it will not interfere with the removal or replacement of the body.

THE BODY UNIT.

This last unit hardly needs comment as to its construction. Indeed, this article is not a consideration of body construction, but deals with the mechanical side. However, I would like to propose a couple of things in regard to bodies other than concerning unit construction. There ought to be a place for baggage or a trunk other than the roof. It has often puzzled me to know of what use the seat beside the driver was. If this seat is removed there would be room for a small trunk or the usual amount of hand baggage. If this is not possible the rack at the rear could be used. The latter has the disadvantage of offering great inducements to thieves. It is almost impossible to watch the baggage so placed from the car, and certainly seems like taking unnecessary chances when the other proposition is possible.

SUMMARY.

What I have tried to show in this brief sketch is that it is possible to construct a taxicab chassis in such a manner that the motor or transmission units may be taken out of a car and others substituted in a very short time. By doing this the chassis may be kept continually earning money.

For example, suppose a crank shaft broke in any taxicab today what would be the result? The cab would have to go to the repair shop. The time required in removing and replacing the motor to be repaired would be considerable with the present construction. The repair would cost the same in either the present or multiple unit type of cab. In the latter, however, the removing and replacing of the unit would not require less time, and further, the chassis would not be idle while the repair was being made, but would be earning money with another motor unit in place of the old. Why be like the man who goes out without a tire repair kit, has a puncture, and either has to wait until the repair man can come to him or run home on a flat tire and ruin it? It is analogous to the present situation, only the taxicabs are so new that the punctures have not come yet. The taxicabs are still new in this country, so that we can tell little about their qualities as they grow older. Although most of the cabs now used are of French manufacture, I expectantly await the time when we will show European manufactures that we can build better taxicabs than theirs, just as we have shown them that we can build touring cars without an equal for American roads. The European manufacturers simply gained a certain advance because they were first in the field.

The Ratio of Live to Total Weight in Motor Cars.

By Albert L. Clough.

In the discussion of the motor car problem, which has covered almost every conceivable phase of the subject, very little seems to have been said of the relation of the live or useful weight carried to the total weight moved by the motor. Economically this is one of the most important considerations in the whole problem. Economic considerations have, as is well known, been overshadowed by questions of speed, reliability and smoothness of operation, but, nevertheless, they are beginning to come to the front. From the dollars-and-cents standpoint the passenger automobile problem is that of moving the maximum live load at the minimum cost, and this aspect of the problem has, of course, been at least implicitly considered by the manufacturers, though generally in a rather cursory manner. It is a truism to remark that it costs just as much to move a pound of dead weight as to move a pound of live or other useful weight, and that no useful object is effected by moving the former, but rather that a waste is thus incurred.

Other things being equal, the car which carries the largest passenger or freight load in respect to the total load moved is economically the best car, as the cost per passenger per mile is thus at a minimum.

In certain reliability contests the cost per passenger carried has been taken into account in determining the standing of the competing vehicles. Those who have watched recent announcements of the automobile manufacturers must have noticed that attention is being called to the ratio of live weight carried to gross vehicle weight. In a recently published description of a new model stress is placed upon the statement that this particular car weighs but little over twice the live weight of the passengers. This car, by the way, is a very able one, as regards speed and hill climbing power, and also is of the luxurious six cylinder type. One of the best known manufacturers of air cooled cars seems to be basing his advertising campaign very largely upon the low dead weight of his vehicles in proportion to their passenger carrying capacity. Thus this feature is beginning to be brought before the public as an important one.

As an extreme case of large useful passenger capacity in proportion to total loaded weight the motorcycle is a good example. With these little vehicles, weighing from 125 to 150 pounds, the ratio is well over one-half in many instances, assuming the weight of the average passenger to be 150 pounds.

In the same connection a two passenger buckboard weighing 600 pounds has a value of one third for this ratio. These two types of motor vehicles, however, do not possess the degree of comfort called for in an acceptable motor vehicle.

As an extreme case of the minimum ratio of passenger load to gross car weight may be cited the extremely high powered multi-cylinder car, fitted with a three passenger roadster body. Such cars frequently weigh 3,700 or 3,800 pounds, and not uncommonly 4,000 pounds and over, when fully equipped. With three passengers the gross weight rises to from 4,150 to 4,450, and the ratio becomes but slightly over one-tenth when the rumble seat is occupied, and considerably less than one-tenth when only the "real seats" are filled. A similar car equipped with a seven passenger body would weigh only about 200 pounds more and would show a ratio of over one-fifth.

There are four passenger, air cooled, light touring cars built which weight about 1,400 pounds in which the ratio of passenger load to total weight reaches three-tenths, and high powered, seven passenger cars, with the same type of motive power, may occasionally show as high a ratio.

Averaging the weights of a large number of five passenger touring cars shown at the last Grand Central Palace Show gives a mean unloaded weight of 2,325 pounds, and the ratio of live weight to total loaded weight is found to be 0.244.

The average stated weight of all the cars on this list rated at less than 30 horse power is 1,984 pounds, and the same ratio computed for these is found to be 0.274.

Taking the average stated weight of all the listed cars of 30 horse power or over the mean is found to be 2,668 pounds, and the ratio proves to be 0.219.

This gives a good idea of the decrease of the useful load carrying efficiency as the horse power and speed increases. The lightest five passenger car in the list has a stated weight of 1,500 pounds, and is of 16 horse power. It is of well known make and noted for its satisfactory running. Its ratio is 0.333.

On the other hand, the heaviest five passenger car listed is stated to weigh 4,000 pounds, and is of 54 horse power. Its ratio is 0.157.

Among the seven passenger cars in the list which are found to weigh on the average about 3,010 pounds the ratio is about 0.255. It is not strange that this figure should be higher than for the five passenger cars, as the live weight carried is 0.4 greater and the seven passenger cars themselves not necessarily of very much greater weight. In the case of gasoline buses or sightseeing wagons intended for relatively low speeds and designed to secure a low operative expense per passenger mile, larger ratios of passenger load to gross weight moved are found. These cars have seats for from twelve to thirty people, and weigh from 3,100 to 6,600 pounds. The ratio for these cars ranges from 0.3 to 0.45, and probably averages at least 0.35. Among commercial vehicles handling useful loads of dead material the ratio of useful load to total weight of car and load is much higher

Google

than for any type of pleasure vehicle, the average ratio being probably around 0.53 and sometimes rising to nearly 0.70. These are, of course, low speed vehicles, and this fact "tells the story."

To return to the pleasure car question. The maximum number which anyone is likely to care to carry in a private automobile is seven, and the custom of carrying such large parties is certainly not on the increase, as it has been found by many a motorist that the entertainment of so large a party "runs into money" very uncomfortably. The only difference between a seven passenger body and a five passenger body is in the increased length of the tonneau to allow for the two swing seats. To carry the lengthened body the wheel base must be increased by about 20 inches. It is a fact that almost any of the five passenger cars on the market, so far as their motive power is concerned, could be converted into seven passenger cars by lengthening the wheel base, stiffening the rear springs, using a slightly heavier frame and rear axle in some instances, and perhaps gearing down somewhat. Consider a well known five passenger car rated at 24 horse power and of a stated weight of 1,750 pounds. This is a car of excellent hill climbing ability and capable of a speed of 40 to 45 miles an hour on the level. If this car were geared down to a maximum speed of from 30 to 33 miles per hour and converted into a seven passenger vehicle by making the changes above noted, its dead weight might be increased 200 pounds, but probably not more. This car as a seven passenger vehicle would then possess a live load ratio of 0.35, which is much higher than any seven passenger car on the market possesses. The car would be fast enough for all practical requirements, and would be a better hill climber as a seven passenger car than it was as a five passenger vehicle. This example is cited simply to show that a seven passenger car of sufficient speed and power to meet reasonable requirements may have a much better live load ratio than is usually found among such vehicles.

Similarly almost any of the runabouts upon the market (I refer to genuine runabouts of the low powered type) may be converted into four or five passenger cars by a slight lengthening of the wheel base, gearing down and the other changes mentioned above. As an example may be chosen an extremely serviceable car of 10 horse power which weighs about 1,100 pounds. When equipped as a five passenger vehicle, and geared down to a maximum speed of 20 miles per hour, it is a fine hill climber, and indeed enjoys an international reputation in regard to its ability in this direction. It weighs about 1,400 pounds. As a five passenger car its live load ratio is about 0.35, while the average live load ratio of five passenger cars for high speeds is but 0.24.

The writer bought a runabout in the antediluvian age of the motor car. It was capable of a speed of rather more than 30 miles per hour and weighed a little over 1,800 pounds. It had very stiff springs and good stout axles. This old car a few years ago blossomed out as a five passenger rig through the addition of a detachable tonneau—a gear reduction to 20 or 22 miles an hour having been effected. The weight of the tonneau is 150 pounds. This veteran machine is now doing good service over very rough roads, and its speed is as high as comfort and safety permit. Its live load ratio was increased from 0.14 to 0.27.

In the case of two cars costing the same to operate per car mile, one having a useful load ratio of 0.2 and the other of 0.4, the cost of moving a unit of useful weight per unit of distance is twice as great in the former as in the latter case. It is to be considered also that the total cost of operation per car mile is generally greater for vehicles having a low useful load ratio, on account of the fact that such cars are high speed vehicles, very subject to excessive wear and tear and short tire life, so that absolute cost of moving a unit of useful load by means of such vehicles is extreme.

The general conclusion to be reached in a discussion of the useful load ratio is that it may be increased by increasing the useful load capacity and decreasing the speed to as low a point as reasonable celerity of movement allows. This will, perhaps, be regarded by many as self evident.

Reduction of the dead weight of the car itself in proportion to its horse power is obviously the other direction in which the same result may be attained. Doing away with unnecessary parts, the use of the lightest and strongest materials, good spring suspension in order to reduce vibratory wear and tear, and the increase of engine efficiency all tend in this direction and are receiving their share of attention.

The question is whether the time may not come when a part at least of the automobile fraternity may be willing to accept the slower vehicle, more heavily freighted proportionally with useful load, in order to pay "a little less dear for the whistle" than at present.

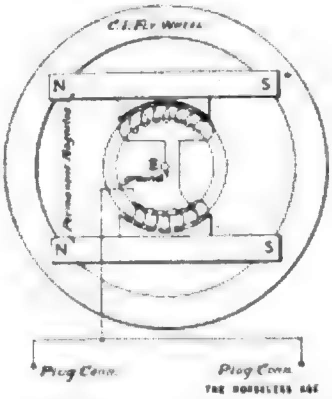

Fig. 1.—Scheme of Magneto Incorporated in the Flywheel of Lanchester Car.

Incorporating a Magneto in the Flywheel.

By Warren Noble.

The thoughtful editorial in the issue of August 12 upon the above subject leads me to add a little to the matter from the standpoint of one who has had much experience with cars having the magneto located within the flywheel scope.

Few Americans know that most ingenious of all cars, the Lanchester, one of Britain's leading productions, but from invention to the product of the present day this firm have invariably used a built in magneto. In the old 12 horse power model the flywheel had two permanent bar magnets bolted to it, the mass of the flywheel forming the magnetic bridges and the centres of the magnets the poles. The armature was stationary in running or starting position and was located on the rear crank shaft bearing, being automatically retarded by the starting catch. There was no advance after the engine started and the full compression was attained by the disconnection of this auxiliary starting catch.

I handled very many of these machines and had others under the closest observation, and in all my experience I never knew of a single magneto derangement or failure. Fig. 1 shows the scheme diagrammatically.

There is not the slightest reason why the system, used as it was for a two cylinder engine, should not be extended to four or more cylinders; it is simply a question of more armature coils and the advance a question of a slip-ring, so that the current could be picked up throughout the advance.

There are a few difficulties, however, to be faced nowadays, chief among which I would count the fact that most of us are more than a little scared of soft iron fly wheels. This might be overcome by wire winding or by shrinking on a forged band to strengthen the wheel. Or better still, the armature still being stationary, the magnets might be mounted on a spider and keyed to the front end of the crank shaft. Should such an arrangement be adopted I would be inclined to make up the whole spider as magnets suitably laminated with soft iron pole pieces to follow the sweep of the armature. Fig. 2 indicates the formation I would suggest, which could be bolted to a flange on the shaft.

As regards cost, there is no doubt that the integral magneto has the advantage over the attached one. The average high tension magneto costs in the neighborhood of $100,

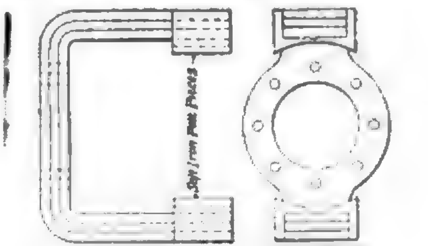

Fig. 2.—Suggested Design for Forward Set Integral Magneto.

the low tension type at least half as much. By making a magneto on the integral plan a good deal can be saved, beyond which fact there would be less of the present trouble many manufacturers are experiencing in getting delivery of magnetos. Considerable saving is also effected in the delivery from magneto driving and attachment riggings. The scheme lends itself ideally to automatic spark advance should the designer favor this; it also tends greatly to silence, since at slow speeds and light load the drag of the armature is enough to steady the engine nicely without any gear noise. The current derived from it by reason of its size is stronger than that from the usual magneto, consequently robustness of spark is a certainty. Personally I must own to a penchant for the low tension ignition system, and think that an integral magneto shows up as a better proposition in this connection than adapting it to a high tension system. I am sure that its use will find favor among designers in the future, who like less and less to be dependent, now that real manufacturing of automobiles has begun, upon the whims, foibles and promises of an under equipped accessory maker.

Cams and Cam Shafts.

By James F. Bourquin.

It is generally admitted that the most important parts of all four cycle motors are the cylinders and pistons, the bearings, the gears and the cam shaft. In these parts the power, life and quietness of the motor chiefly depend. Even if these parts are correctly designed and made of the best possible material, the value of the motor will depend directly on good machine work and careful assembling.

The troubles that are caused directly by the cams and cam shaft are almost too numerous to mention. The cams may be soft, and if so in time they will wear away so that the motor will gradually lose the majority of its power and develop a great deal of extra noise. Cams may be loosely fitted and insecurely held to the shaft; in such cases they continue to loosen until they develop a knock and finally shear either the pins or keys which are holding them. The cams for one cylinder are sometimes not placed on the shaft in the same relative position as those for the other cylinders. That causes the exhaust of the motor to be uneven, and might also cause the motor to be unbalanced by the fact that one cylinder would be either stronger or weaker than the others. Of course the trouble would be multiplied if more than one or two cams were out. People who are not familiar with the setting of cams can hardly be convinced of the trouble that is caused by the centre of two exhaust cams varying from their correct positions by even .005 of an inch. A cam shaft is often slightly sprung, which, of course, causes either the time or commutator gears to run out. When they do that they act the same as eccentric gears, making a very disagreeable noise in the gear case. If a cam shaft is loose in its bearings or has end play there is also a liability of noise or a knock.

These are only a few of the troubles that may be caused by the cams and cam shaft. None of them are chargeable to either the design or the material, but are due entirely to poor machine work or careless assembling. Much trouble has also been caused by poor design. Some motors have the valve springs anywhere from 25 to 40 pounds too heavy. This causes the cam shaft and time gear to do considerably more work than they should. In some cases the cam shaft is too small in diameter and the bearings not long enough. Both of these faults are apt to cause a sprung shaft and to make the gears noisy.

Until the last two or three years, in nearly all the large automobile factories, the setting of the cams was considered the most difficult part of assembling the motors. Much of the trouble with loose and soft cams was caused by the way the cams and cam shaft had to be assembled. It was necessary to set the cams after the cam shaft was in the motor. Many times the cams had to be filed from one-thirty-second to one-sixteenth of an inch to get the correct valve timing. The cams and cam shaft then had to be removed so that they could be drilled. The cams were then hardened, usually one set at a time, and the process in many cases caused them to be warped a trifle out of shape, which would make them a little loose on the shaft or throw the valve timing out slightly. Many times the cams were cracked in pinning them to the shaft. It usually took a good man from six to ten hours to set the cams on an ordinary four cylinder motor.

In the more recent motors nearly all of these troubles are overcome. In many cases the cams are made integral with the cam shaft. Both the cam shaft and cams are ground to exact size. The bearings are arranged telescopically, so that all an assembler has to do is to slip the shaft into its place, which is about fifteen minutes' work where everything has been machined and fitted correctly. Of course the principal trouble with an integral cam shaft is that one side of one single cam may happen to be soft after hardening or the shaft may be slightly sprung. In either case there is the risk of having "to scrap" the whole shaft.

A better device even than the integral cam shaft is a ground shaft with attached telescopic bearings, which may be either plain or ball, and which has its cams keyed and pinned to it, so that it may be slipped into the crank case the same as an integral shaft. The keyways in the shaft can easily be milled and spaced in their proper positions with a jig attached to a small ordinary milling machine. After the two master cams, the inlet and exhaust, are made the cams can be cut by a forming cutter. A keyway, of course, is cut in the same relative position in each cam, the hole drilled for the pin, and then the cams hardened. When this method is followed a large number, if not the entire output, of cams can be machined and hardened in large quantities, thus lessening not only the expense but also the chances of defective ones. The cams should always be left a couple of thousandths small before being hardened, so that they will have to be lapped out a little, in order to make a good fit on the shaft. Then the cams are sure to fit tight, and if one should prove defective it can easily be replaced. As the shaft itself is not hardened there is not much danger of its being sprung. This process of making cam shafts gives a shaft at much less expense, with all the advantages and none of the disadvantages of an integral shaft.

A Suggestion for Accessory Makers.

By Warren Noble.

Mr. Clough's interesting series of articles on specialized accessories set the author to thinking of various ways and means for carrying out the design of auxiliary attachments for fitting to standard motors. Probably the most acceptable of such devices, from the public point of view, would be a good self-starting equipment, the adoption of which would render the battery and coil system unnecessary, as almost all cars are now fitted with high tension magnetos. One engine with which I am well acquainted—the Continental—carries its timer on a short vertical shaft, driven by a pair of bevels, the driver being on the flywheel end of the cam shaft. It appears to me that this shaft could be advantageously used for driving a self starter by the substitution of an attachment registering in the same ring as the bearing of the shafts.

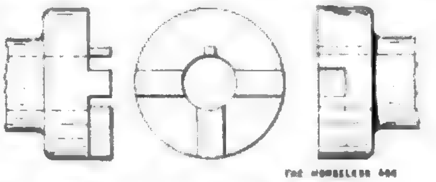

Fig. 1.—Clutch Capable of Engaging in But One Position.

As regards the design of the starter, it seems to me that air is the only system. The accessory attachment would then consist of the driving clutch (so that the device might be uncoupled or coupled in correct phase), the compression pump, the distributor, leads to the cylinders and check valve to the cylinders to be substituted for compression relief cocks, a storage tank attachment, with braces to clamp it to the main frame, and pipes from pump to tank and from tank to distributor. Considering the driving mechanism first, an ordinary dog clutch would do very well if it was arranged to couple only in phase. A clutch, such as is shown in Fig. 1, has the advantage of coupling only in one position.

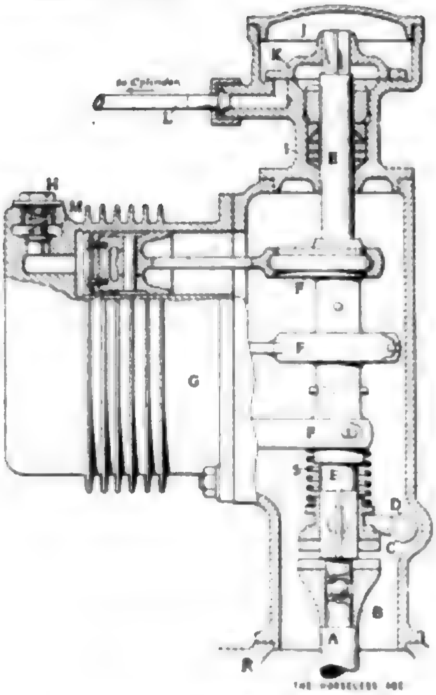

FIG. 2.—THREE CYLINDER "BLOCK" AIR PUMP.

A—Vertical shaft of engine. B—Driving portion of coupling clutch. C—Driven portion of coupling clutch. D—Striking gear shaft. E—Driven shaft. F_1F_1—Eccentrics on sleeve. G—"Block" of cylinders. H—Outlet valve. I—Stuffing box. J—Distributing valve box. K—Disc distributing valve. L—Lead to cylinder. M—Port to tank filler head. R—Engine base. S—Spring for striking gear.

and would be mounted on a divided shaft. Engagement would be made by spring pressure, and disengagement by a yoke and collar, operated from connectors on the dash. It would be almost impossible in the space at disposal to make a single pump of sufficient dimensions to supply the necessary quantity of air, consequently the author recommends making a small "block" of three or four cylinders and driving the pistons by means of long throw eccentrics. The use of piston rings is thought unnecessary, leather packings being fitted to keep the pistons tight. The pump valves would be located in the piston heads and cylinder heads respectively, the outlet valves giving into a common lead to which the tank supply lead would be connected, and which would also carry a spring loaded pop—or safety—valve. A gland would prevent leakage to the pump eccentric chamber from the distributing box, which latter could advantageously be made in the same casting as the rest of the housing. Above this gland a disc distributing valve could be floated, carrying in its surface a concentric slot for air admission to the cylinder leads. Air would be best supplied to this chamber from the tank through a fitting screwed into its side. Small ball—or wing—checks would do nicely at the cylinder heads.

Such a combination, with the relief valves set at 150 pounds per square inch and a tank 30x6 inches, would be not only excellent as a self starting design but would provide a gratefully facile method of tire inflation.

Designing a Planetary Transmission.

By MORRIS A. HALL.

The writer recently gave an account in these columns of the method of procedure, together with the time required and the material used, in designing a 3 ton truck. In this article the time taken to design and the cost of designing a transmission of the planetary type for heavy service, as shown in the sectional elevation Fig. 1, will be taken up. The method of design was somewhat different from that of the previous case; that is, the design follows along the same lines as a previous planetary transmission, but was not roughed out by the chief draughtsman, as is usual, the actual work being done by the junior draughtsmen.

The writer noted, in looking over the last article, that there had not been given any idea of the blank forms used, although these were referred to. Consequently, a few of these are here given. The time card, Fig. 2, was an old form that had formerly been used throughout the entire plant and was still continued in the draughting room, although hardly suitable for that purpose. Except for the items key number, name, date, name of operation, time, total time and foreman's signature, the blank spaces on the form were not filled out. The name of operation was not exact, as the draughtsmen were not required to state what they did each time, as designing, drawing up details, etc., but simply the name of the job, as "No. 1 truck—nine hours," etc. In Fig. 3 was shown the index card used for the drawing. These cards were filed in two cases, one numerical and the other alphabetical; in fact, the only difference between the two was in the filing, the cards being filled out exactly alike, two cards being made for each and every drawing.

Fig. 4 shows the form used for issuing blue prints. As previously described, two of these were used for every blue print issued, although they were made out exactly alike, all spaces except the last two being filled. One of these was on thin paper and was firmly pasted to the blue print, while the other was signed as a receipt for the blue prints returned to the drawing room and kept on file there, thus keeping a complete and accurate record of all blue prints issued.

Taking up Fig. 1 we see that this transmission is one of the all spur gear type, giving two speeds forward and one reverse. The most prominent feature noticed is the method of operating the high speed clutch. In the ordinary case the clutch is independently pressed together or pressed against the transmission, but in this case the transmission is moved up to press against the clutch, which is contained in the flywheel. The clutch is composed of five steel plates, 11⅜ inches outside and 6¼ inches inside diameter, and five bronze plates, 10¼ inches outside diameter and 5¼ inches inside diameter, and runs in light oil. These latter bronze plates were all cast from one pattern, the difference between them being in the machining of the hub, if it may be called that. The steel plates drive through three large half inch by inch keys cut integral to the flywheel, while the bronze plates drive through three large inserted keys. The steel plates are separated by small coil springs, of which the first three are set in holes in the flywheel and act on the first steel plate. The second three bear

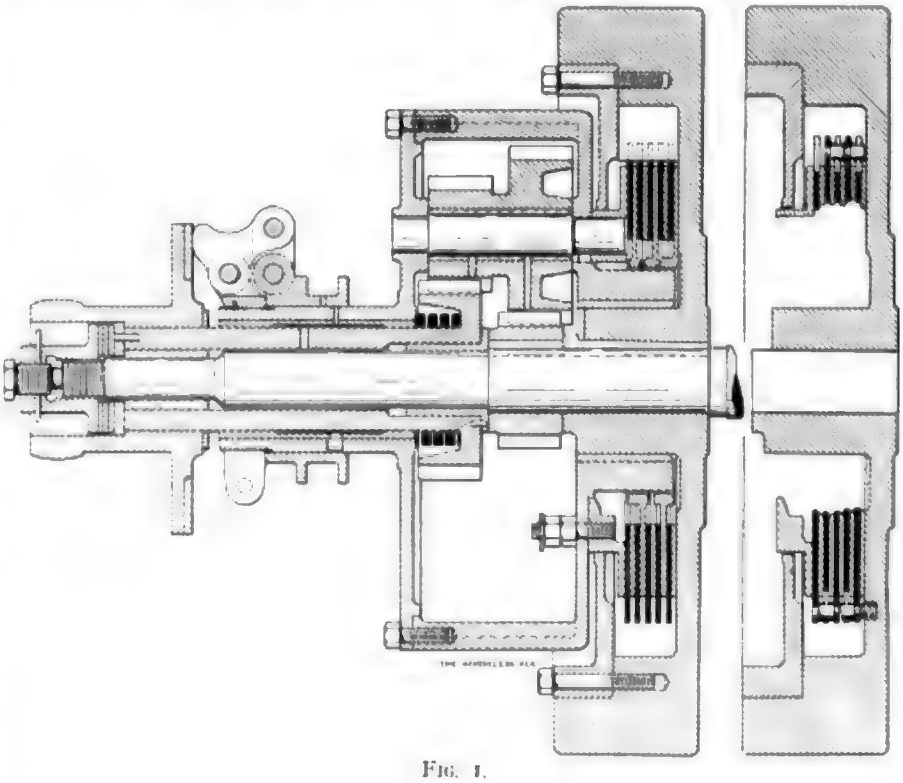

FIG. 1.

DAILY TIME CARD 66-46-150-2

CORRECT

_______________ Foreman.

KEY NUMBER_______________
NAME_______________
DATE_______________

Order No.	No. Pieces.	SYMBOL OR NAME OF PART.	No of Operati'n	NAME OF OPERATION.	For Dept.	TIME Day Work Hrs.	TIME Day Work Min	TIME Piece Work Hrs.	TIME Piece Work Min.	No. Pieces Finished.	Price Per Piece.	Amount Piece Work	No. Parts Defective
					TOTAL TIME					AMOUNT PIECE WORK			

No time allowed for unless accounted for on time card.
Cards must be filled out and handed in before leaving at night.

FIG. 2.

against the flywheel and act upon the second steel plate, while the other three act between the first and third, second and fourth, and third and fifth plates, respectively. Thus there are fifteen of these springs, which are of very high grade steel carefully hardened. The rest of the construction is self evident from the figure.

161-37-1-4

Drawing No. **Symbol** **Pattern**

Subject_______________

Remarks_______________

FIG. 3.

Now as regards the cost; we find this in Fig. 5 in tabular form. As in the previous article, this table is divided into five parts, design, details, tracings, checking and all supervisions, filing, issuing and all the routine work, the number of hours, cost per hour, total cost, percentage of the total time and percentage of the total cost being given for each part. In looking over this table it will be seen how nicely it is balanced. In the time column three-eighths for designing, one-fifth for detailing, one-quarter for tracing, one-tenth for checking and supervision, and the remainder for the miscellaneous work.

This is a very excellent division, and in contrast to the usual division of one-half for designing, one-third for tracing, shows that it was known at the start just what was desired, and that this, as was the case, was attained with speed and precision. In the cross column the figures are not quite so favorable, but still show up very well.

Material	Description	Amount	Unit Cost	Whole Cost
Detail Paper—Details	Duplex, 36 in. wide	5½ yds.	12¼c. yd.	$0.67
Detail Paper—Designs	Duplex, 36 in. wide	1½ yds	12¼c. yd.	.18
Tracing Cloth	Imperial, 37 in. wide	6 yds.	34c. yd.	2.04
Blue Print Papers (5 sets)	Keystone, 36 in. wide, Thin	30½ yds.	7c. yd.	2.14
Pencils	2B to 6H, Kohinoor	1 doz.	$1.00 per doz.	1.00
Leads	2B to 6H, Kohinoor	½ doz.	60c. per ½ doz.	.60
Erasers	Pencil and Ink	½ doz.	$1.00 per doz.	.50
Thumb Tacks	9-16 in. diam	4	50c. per doz.	.17
Black Ink	Higgins' Waterproof	1 bottle	$2.00 per bottle	2.00
Red Ink	Higgins' Waterproof	½ bottle	25c. per bottle	.18
Index Cards		80	$2.00 per 1,000	.16
Figuring Pads		No. 4	6c. per lb.	.24
			Total Cost Mtl.,	$9.88

FIG. 6.

Attention is called in this column to the low cost of everything, except the design, which is slightly above the normal. The figures obtained for tracing, 14 per cent., and for filing and miscellaneous work, 3 per cent., are unusually good. For two other cases which the writer has looked into, one a 3 ton truck design and the other a large engine design, these figures were: tracing 16 4-10 per cent. and 19½ per cent., filing 2 9-10 per cent. and 2 3-10 per cent., respectively.

MOTOR CAR DEP'T 197-37-5 2

Blue Print **Drawing**
Issued to
Order **M. C.**
Remarks
Rec'd **Date**

FIG. 4.

Passing now to the cost of material we find a number of drawings to be one 24x36, one 18x24, eight 12x18 and twenty-eight 9x12, making a total of thirty-eight. Figuring the area of these, and allowing 10 per cent., 15 per cent. and 25 per cent. waste, respectively, as in the previous case, we get the quantities given in the first part of the tabular form, Fig. 6. An extra allowance of drawing paper of two sheets, 24x36, for design is also the same as before. The other items are figured as before from a known average weekly consumption by reducing the number of hours to number of weeks

(Continued on page 313.)

Operation	Hours and Cost		Total Cost	Per Cent Total Time	Per Cent. Total Cost
Design	85 hours @ 46c. = $39.10		$39.10	37.0	48.1
Details	24 hours @ 46c. = 11.04 25 hours @ 18c. = 4.50				
	49 hours =	$15.54	15.54	21.3	19.1
Tracing	33 hours @ 22c. = $7.26 23 hours @ 18c. = 4.14				
	56 hours	$11.40	11.40	24.3	14.0
Check and Supervision	23 hours @ 56c. =	12.88	12.88	10.0	15.8
Filing, Indexing, etc.	17 hours @ 14c. =	2.38	2.38	7.4	3.0
	Totals 230 hours. Cost per hour 35.3c.		81.30	100.0	100.0

FIG. 5.

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Kerosene as Fuel for Motors Imported to Foreign Countries.

The recently issued report published by the Department of Commerce and Labor, entitled "Motor Machines," is a compilation of the reports of United States consuls, and contains a large amount of valuable information relative to the possibility of the commercial introduction of American automobiles and American internal combustion engines into foreign countries. It is worthy of the careful attention of all motor car and engine manufacturers who desire to build up a foreign trade, and who desire to know the peculiar requirements which their goods must possess in order to meet the conditions in these export fields, as well as the business methods acceptable to their populations.

These consular reports bring out very clearly the fuel conditions prevailing in the various lands offering export markets.

The average American motorist and manufacturer is accustomed to think of gasoline as a fuel almost universally obtainable, and to be had at a reasonable price. It is evident, however, from this report that in South and Central American countries, and in many other of the natural markets for American motors, gasoline is only to be had at an enormously high figure, ranging from four to eight times its price in this country.

In a great many sections of these countries it is obtainable only with difficulty, and sometimes is practically not procurable. In some places the trade in gasoline is virtually nil, and its handling and use are little understood, and regarded as dangerous. Kerosene, on the other hand, appears to be generally obtainable in most of these districts, even in those which are far removed from the main centres of trade, and it sells at prices, as a rule, not unreasonably in excess of the American figure. Its almost universal use for lighting purposes has brought about a general familiarity with its uses and properties.

In the reports of the consuls representing these districts the opinion is general that internal combustion motors, in order to be widely adopted, must be adapted to use kerosene as a fuel.

This journal has repeatedly urged upon the industry the desirability of so developing the oil engine that the heavier petroleum products, instead of gasoline, may be used therein, but the plentiful supply of gasoline in this country, its moderate price and its ready gasification have prevented any very determined effort in this direction.

Now that the time approaches when foreign markets must be sought, in order to absorb our rapidly increasing product, and in view of the fact that in many of these markets gasoline is almost prohibitively costly, it is believed that serious attention should be paid to the development of the kerosene engine for vehicle purposes.

The Chauffeur's Future.

The time will soon be at hand when the chauffeur will be compelled either to resort to some other means of employment or surround his calling with such restrictions that it may be preserved for the benefit of a class of men possessing more than ordinary ability and intelligence. The chauffeurs of this country appreciate the situation, and they are at present engaged in discussing ways and means for that protection.

The easier it is for the layman to operate an automobile, because of simplicity of construction and handling, the less value the professional chauffeur is to automobiling. Furthermore, the education which both automobilists and others have received, to more or less extent, concerning the automobile and its mechanical operation, is also displacing the necessity for expert mechanics who hire out for the purpose of driving motor vehicles. One who purchases an automobile is not now compelled to hire another to drive it, unless he so wishes. It is only those who desire to hire a chauffeur for the purpose of saving the labor and trouble of taking care of the machine who call upon others to do their driving. But in many cases owners themselves do about all the driving and merely keep a chauffeur for other purposes. It will be seen, therefore, that professional chauffeurs are compelled to do something in order to keep wages up and to preserve their profession. There are many representative chauffeurs of the United States who have either entered other lines of business, using automobile driving merely as a stepping stone, or intend to do so as soon as the opportunity presents itself.

The chauffeurs of this country are at present advocating the enactment of legislation which will debar all who wish to drive automobiles for hire unless they possess certain ability and intelligence in mechanical control of the automobile and in automobile driving. As a consequence, the automobile drivers have expressed a willingness to support, politically, in the State of New York at least, those who will endeavor to obtain for them the desired law. The chauffeur maintains that before one should obtain a chauffeur's license he should pass a very strict and severe examination covering his physical qualities, which will include hearing, eyesight and heart action, his knowledge of the mechanical construction of the automobile, including repair work and various other matters, and, lastly, his ability to drive on the public highway safely and legally. Not only is it for the protection of the public that the chauffeur should be proficient in the matters mentioned, but it is for the advantage of those who hire chauffeurs. An automobile driver who has passed such an examination may be employed by an owner with full confidence that he is competent. Such a chauffeur may be permitted to operate an automobile on the highways with full faith by the public that he can operate safely and legally. Furthermore, such an examination secures to chauffeurs of proficiency good wages, destroys unhealthy competition and preserves the calling.

Unless something is done very soon it will hardly be worth while for any person to drive an automobile for hire. The chauffeurs are realizing this, and are hunting around now to find some way to protect themselves.

A Possible Development in the Fuel Situation.

When the Governmental regulations favoring the production of denatured alcohol went into effect some time ago, many people expected to see an immediate large drop in the price, and a great increase in the consumption of this fuel. As was predicted in these columns, neither of these effects was realized to anything like the extent looked for in many quarters. The price of the fuel still hovers around 50 cents a gallon, consequently its use is not extensive, compared with the possibilities.

There are no apparent indications of any change in this situation, so far as the introduction of alcohol motors is concerned; for the price is far too high to render alcohol a competitor of gasoline.

But in other lines considerable experimental work has been going on for some time. Household appliances have been brought to a sufficiently perfect state so they are being sold on the open market, and some manufacturers are pushing their sale with extensive advertising. While many of their claims of economy are doubtless overdrawn, there is little doubt that stoves, lamps, flat irons, etc., can be successfully operated by alcohol, and it is extremely probable that they will be more cleanly and in many ways more desirable than the kerosene and gasoline appliances now in extensive use. In the country and in small towns where gas and electricity are not to be had at any price, it is likely that these alcohol appliances will find an extensive market.

Their common use would mean a great increase in the demand for denatured alcohol. And there is little reason to doubt that this incentive will lead to a considerable reduction in the price of alcohol. While it is not likely that the reduction will be carried so far as to render alcohol an economical motor fuel, it should prove a first step, and perhaps a long one, toward this end.

The Mutilated Thread.

Wherever two parts must be frequently separated, though a tight joint is required when they are assembled, mutilated threads form one of the best means of connecting them. The most conspicuous example of their successful use is in the breech blocks of cannon, and it is at once apparent that if they can be made to resist the extremely high pressures used in ordnance work no difficulty need be anticipated as to their making a tight joint for almost any other purpose.

Up to the present time but little use has been made of the mutilated thread in automobile work, although a few years ago a car was put on the market in which the valves, spark plugs and some other parts were attached in this manner. The construction was abandoned after a short time, largely owing to the cost of making the parts accurately enough to give satisfaction. Since that time a spark plug has been placed upon the market in which the insulated point is connected to the shell by a thread of this character, so a quarter turn of the attached handle is all that is required to remove the point and porcelain for cleaning. Quite recently in a car built on the unit system these threads were adopted on the connections from the engine to the radiator so that they could be instantly disconnected.

It is quite likely that as the design of commercial vehicles is perfected we shall see this method of connecting parts used more generally, for it is probable that each unit of the power production and transmission system will be so designed that it can be dismantled in the least possible time. It is also likely that in the commercial field the first cost of the machine will be a less important consideration than the cost of operation. So it is here that the useful, but somewhat expensive, mutilated thread will be most generally employed.

Universal Joint Improvement.

In the announcements of the new models of quite a number of concerns building high grade cars it is to be noted that while no changes of a radical nature have been made, among the late refinement special stress is placed upon improvements made in the universal joints. The provision of larger wearing surfaces, and, in some instances, the use of ball bearings at the points of motion; the improvement of lubrication facilities, even to the extent of providing the joint with a special oil feed; the more complete enclosure of the parts of the joint, and especially the dustproofing of the bearing portions, together with considerable strengthening of the parts and modifications in general design, are among the changes which are to be observed. In some instances a more nearly straight line drive has been attained through changes in the frame design, the manner of supporting the power plant and an increase in the road wheel diameter. The duty of the universals is thus made less severe.

Those who have followed the performance of a large number of motor cars during the last season or two are well aware that there has been considerable trouble with the universal joints. Breakages have not been uncommon, and the rate of wear of these parts, even on the best cars, has been in many instances entirely disproportionate to that suffered by other essential parts of the transmission mechanism. The practice in universal joint construction has evidently not kept pace with the increase in horse power and speed of the cars upon which they are used.

Manufacturers in their 1909 models are evidently striving to make reparation for past neglect of their drive shaft joints by endeavoring to give them a degree of strength and resistance to wear equal to that possessed by other parts of the car.

The function of the universal joint as a part of the transmission system is in a way peculiar. In a sense its office is of a secondary nature, as it performs no obviously vital part of the act of power transmission, such as the clutch does in throwing on and off the motive power, or the change gear does in varying the speed ratio, or as the driving gears do in changing by a right angle the axis of motion.

It is simply a necessary evil—as it were a *persona non grata* in the line of transmission elements—necessitated because the motive power and its work are not in a fixed space relation. Despite the fact that it is not an element of primary importance it is nevertheless indispensable, and as it carries the full working power of the car, and is, moreover, especially subject to shock, varying torque and reversed stresses, the attention which is at last being lavished upon it is well placed.

Motor Omnibuses versus Electric Trolley Cars.

By Roy Lindsay.

(Concluded.)

The question of high pressure and low pressure periods has a very important bearing upon the principal point which is used in all arguments by those who favor tramways instead of the more flexible motor omnibus, the tram enthusiast placing great reliance upon the greater carrying capacity of the car as compared with the bus. The largest tram will carry seventy-two seated passengers and the bus but thirty-six, and at first sight it appears that the traffic in any district would necessitate two motor vehicles to every tram. But anyone who will devote time to personal visits, as the writer has done to a number of systems, will quickly discover a peculiarity which at once abolishes the presumed advantage of the tram. It will be found that of the passengers entering a trolley car during the busiest time of the evening for the homeward journey, at least 30 per cent. will alight within a mile and a half to 2 miles of the commencement. In some towns the proportion is higher than this, but the figure given may be considered a general average. Therefore, if a tram covers from end to end a distance of 5 miles, it is only loaded to its full capacity for, at the outside limit, half that distance. Whether full or empty, the car must continue to the terminus and then return. This really summarizes the whole position of the trolley car, and it can be proved from statistics issued by municipalities and companies that a great proportion of capital expenditure is sunk in providing accommodation for but four hours only out of every twenty-four. This carrying capacity is only capable of use for 50 per cent. of the distance covered for the four hours. Or to put it in another way, the full carrying capacity of *all* the cars for each car mile is only needed for a total of two hours each day. There are exceptions, but these are of rare occurrence.

Five standard sizes of trams are employed in the principal services in England and Scotland, viz.: (1) the single decker of 22 seats, (2) the single decker of 31 seats, (3) the double decker of 56 seats, (4) the double decker of 64 seats, and (5) the double decker of 72 seats. In London only types 3 and 5 are used. Bearing in mind the previous reference as to the total capacity only being employed for two short periods in each twenty-four hours, the average seating capacity as regards London is sixty-four. Liverpool has found it essential to provide the small single deckers for working the suburban routes during the slack periods, so as to save the extra cost entailed in running the largest vehicles. Therefore the supposed extra earning capacity of the car is at once seen to be fallacious. The motor omnibus is invariably standardized to carry thirty-six passengers. It is rather interesting to understand how this last peculiar figure has been reached. When the motor omnibus was in its experimental stage, those horsed vehicle owners who were approached to try mechanical traction insisted upon the chassis being so constructed as to carry the old bodies of the horsed buses without alteration, twenty-eight seats being the maximum. When the first of these vehicles were converted it was found possible by a little scheming to add four more seats inside and four more outside. The London police regulations issued two years ago accepted this number as the permissible limit, and so it has come about that every licensing authority in England has taken this number as a model. But without adding a single inch to the wheel base of a bus at least ten more seats could be easily arranged by extending the upper deck over the engine bonnet (giving eight seats) and extending the inside body forward at one side, and thus adding two more seats here. We should then have forty-six seats for the bus, as against the average of sixty-four for the largest tram, or forty-eight for the trams most generally used in provincial towns. This would impose no extra strain on a 24 horse power engine, which, with maximum gear ratio of 12 miles per hour, can as easily carry forty-eight persons as it can thirty-six, and at no extra running expense. So far as actual capacity is served, sixty persons would not be an impossible number, the only limit imposed being that of manœuvring a lengthy vehicle around narrow streets and turnings or through the ordinary traffic of a city.

There can be no doubt that when the time arrives for the majority of vehicles to be mechanically propelled motor omnibuses will be double ended, driven and steered from either end, just as trolley cars are driven today. It is really a matter of wheel base, and as some American motor wagons have been built with a wheel base as long as 15 feet, such a method of construction is within the reign of practical design. However, considering only types likely to be used in the near future, the earning capacity of a motor bus may be figured at seven-eighths of that of the trolley car.

SOME FINANCIAL COMPARISONS.

Very few persons except those directly interested are aware of the capital sunk in tramway enterprises in Great Britain. The actual amount expended is $232,257,000 upon 3,680 track miles, the average cost per mile being $32,036 for all items, including cars, generating plant, buildings, legal expenses, etc. The total number of cars in use is 9,717, made up of electric trolley and conduit, 7,132; run by horses, 2,336, and worked by steam, 249 vehicles Of the total mileage 2,924 miles are electric, 470 are horsed, 216 miles worked by steam and 70 miles are run by underground wire cables. Each car running on rails in the streets has therefore cost initially, omitting the odd cents, $23,900 before a passenger can be carried. The net result is that for each street mile (equal to two track miles) there has been provided six and three-quarter vehicles. Before an estimation can be made of the facilities that motor omnibuses could provide, allowance must be taken for storage; this is already reckoned in the street car costs above, but it would not be stating the case fairly to

Ten Buses Owned by the Bath Tramway Company.

THE HORSE DRAWN BUS AND ITS WORSE COMPETITOR.

say that the $232,250,000 would purchase a particular number of buses. Therefore $250 per machine must be reckoned in either case. The average cost of a bus with 24 horse power engine, twin 5 inch solid tires and thirty-six seated double decked body, completely equipped ready to run on the road, is $4,250. Adding the $250 for storage buildings, this brings the average initial cost of a motor omnibus up to $4,500, as against $23,900 for each tramcar.

A simple calculation will show that for existing capital expenditure on the 9,717 tramcars, at least 51,612 motor omnibuses could have been purchased, or five and a half times as many of the more flexible vehicles. Considering these figures for each mile of route, we obtain thirty-five and a half buses, as against six and three-quarter cars. In a preceding paragraph proof was offered that the motor bus gives seating accommodation for three-quarters of the average car capacity, and that by a slight alteration in the design of the body this average could be increased to at least seven-eighths, in comparison with the tram. With all the millions of dollars upon which dividends ought to be earned, it will be supposed that shareholders must be reaping golden rewards. The average earnings (gross receipts) per car mile for tramcars throughout Great Britain is 18.11 cents, and the average of total expenses is 18 cents per car mile, the net profit being therefore decimal 11 of a cent for each mile run. Now the total of profits paid away in dividends, according to the most recent figures officially issued, is $950,000, covering the twelve months ending June 30, 1907. These figures look all right until inquiry is made as to the sums set aside for the depreciation of generating stations, fixed plant, vehicles and reserve fund for track renewal. Certain of the municipalities and companies owning tram services lump all these items together under the heading of "repairs." Those best able to judge are quite convinced that even if depreciation is omitted (it really ought to be considered) the wear and tear of the track rails cannot be less than one-quarter cent per car mile. The plain English of this last figure is that the dividends paid away are not being properly earned, and when the time comes shortly, as it must do for some of the older companies, to lay new rails, fresh capital will have to be found for that purpose or else bankruptcy will be the end.

WHERE THE MOTOR OMNIBUS SCORES.

The bus has the great advantage over the trolley that it is not confined to fixed tracks or line of route, and, unlike the trolley, a mishap to one vehicle does not disorganize the whole of the service on that particular line. The very expression "permanent way" happily describes a fixity of route that must seriously militate against any tram service attempting to open up fresh territory into suburban districts. Running along the main arteries in any city trams can reckon on securing a fairly regular number of passengers throughout the day, but the farther away the lines run from the central business quarter the smaller will be the volume of traffic during the middle period, when only chance passengers can be expected. It is the flexibility of the bus that will make it a dangerous competitor when some more practicable design than the present standard type has been evolved. With all its admitted mechanical disabilities the bus, although a long way from perfect, is well able to hold its own in the bid for popularity, and when something better is produced there is little doubt as to which will win out in the end. The breakdown of one bus is merely an incident in the day's service, and although it may have to be towed back to garage the stoppage of a unit does not extend to the rest of the machines. It is the ability of the bus to give the passenger just the service he desires that is another of the advantages. The tendency of the twentieth century is to walk less and ride more, and if the business man can be taken from the door of his house to the door of his office he is going to give his patronage to the conveyance that will supply his needs. When a man can manage to filch an extra ten minutes at home in the morning, by reason of saving a long walk to reach the tram, he will be glad to pay something extra for the privilege. Where there is no demand for traffic facilities in certain thoroughfares, it involves no trouble to transfer the machine to those streets where a large demand occurs. When the rush to business from the suburban districts ceases in the morning, central portions of towns and cities can be worked until the return rush in the evening. Cross routes that only offer traffic for a few hours in the middle of the day can be conveniently managed by some of the main route buses, which would help in the rush periods on the busier roads at night and morning. In the slack times, as on a rough winter's day, after the business portion of the population has been moved to the central quarter, there is no loss in laying up a bus for a few hours, as there are no heavy running expenses incurred for generating plant at the power house, as in the case of the trolley. This is perhaps the most convincing argument of all, for it must not be forgotten that whether one or twenty trams are running the steam engines and dynamos are essential, together with the staff of stokers, engine minders and electricians.

On the point of convenience the bus is immeasurably superior. It can draw close up to the edge of the sidewalk to permit passengers to alight or enter, and does not put them to the danger of dodging in between horses' heads. It can thread in and out of the densest traffic, and not being confined to a fixed rail the driver can select the first opportunity for forging ahead. One of the big worries of tramway management is the entire dislocation of the service through a horsed wagon coming to grief on the rails, a ten minutes' stoppage of this character being sufficient to hold up a line of cars in each direction for a half mile or more. Nothing of the kind occurs with a bus, and even the complete shutting up of a thoroughfare from this cause but necessitates steering around the first corner, a detour of a few hundred yards bringing it back again into the main route.

In all the great cities of the world, new as well as old, there is an ever changing movement of the population, the wealthier classes selecting for their residences districts west and northwest of the centre, the houses thus vacated being occupied by others lower in the social scale and paying smaller rents than were realized from the previous occupants. In course of time, dependent upon the size of the city, these same houses deteriorate, and as the neighborhood becomes less desirable for that very reason, so do the occupants become drawn eventually from the weekly wage earning class, made up of mechanics, laborers and artisans, until what were once the mansions of the rich are split up into tenement buildings for the poor. The change at this stage sometimes has the curious effect of causing a reversion to the original type of buildings on the site, viz., warehouses for the storage of goods belonging to wholesale merchants, or shops and offices. The sequence here outlined has actually occurred in one quarter of London in less than thirty-five years, so that the picture is not overdrawn. In Berlin an entire district has been completely revolutionized since 1882, and any visitor to Paris can see the same thing happening in the district southeast of the River Seine. The transfer of any large part of a city's population from one to any other neighborhood implies reorganization of passenger carrying facilities, both on the part of railways and trolley cars. This position is being exemplified at the present time in London, one railway alone—London, Chatham and Dover, which has linked up much of the southeastern district of the suburbs by branches in every direction—having lost 22,000,000 passengers in five years because of competition from trolley cars that have better served the requirements of those who have moved away from the sphere of operations of the railway. It is now the turn of the trolley cars to complain of the competition of motor buses, that, being free to run where they please, can follow the movements of the general population, and thus be adapted to the altered circumstances. The trolley car must swim or sink absolutely upon the outcome of rails laid in certain streets, and if from any cause its customers drift elsewhere the power of profit earning disappears simultaneously. Herein must lie the future stability of the motor omnibus business, for it is not tied down by any consideration of permanent rails, does not depend upon any neighborhood retaining any particular class of residents, and exigencies of traffic can be met instantly by transferring vehicles off a non-paying route on to one where more money can be earned.

A development as interesting as it is curious has been taking place during the past two years in many English towns where everybody supposed the trolley cars had established such a monopoly that no motor bus services could survive in free competition. The continual growth of these towns, with their ever extending suburbs, raised an extremely difficult problem for the managers of the tramway companies, because failures in other directions had forced home the conclusion of an unwise financial policy sinking capital in permanent rails along streets where there were only crowds of passengers morning and evening, the cars running nearly empty several hours in the quiet periods. To meet the position some of the companies established "feeder" lines of horsed buses, but these traveled so slowly, as compared with the trolley cars, as to repel rather than encourage growth of revenue. The motor bus has saved the situation, rescuing the trolley car companies from an awkward dilemma, and at the same time providing means for counteracting any possible trenching into a district by outside competitors. A good instance of these happenings is the city of Bath in the west of England, which possesses what is considered one of the very best trolley car services in Britain, in respect to miles of line proportionate to the size of the city, regularity and speed of the cars, and careful maintenance of the permanent way. The time had arrived when it became essential either to lay some 16 miles of rails on new routes or lose the street franchise altogether in that part of the city. Instead, six double decked motor buses were purchased, since increased to ten, and so successful have these been that no more trolley lines will be laid in or around Bath, and this decision is the more instructive from the fact that the district would not ordinarily be considered favorable to buses, because steep grades of 15 per cent. abound in every direction.

By Automobile Through North Park, Colorado.

By Oliver W. Hall.

For our vacation this year we decided to take a fishing trip through North Park, the party consisting of my father, my brother and myself. Accordingly we bolted a large box in the place of the tonneau, loaded our regular camping outfit, which we had always carried heretofore by wagon or pack horse, and with our guns and fishing tackle started north from Denver. At Greely we barely escaped a heavy rain and hail storm by exceeding the speed limit, reaching a friendly garage in the nick of time.

Proceeding to Fort Collins the next morning, we encountered the muddy roads along the Poudre Valley, flooded by the recent storm. We had much trouble in the adobe mud, but finally worked out further north on to more sandy roads. At Fort Collins we took in a supply of gasoline and started northwest for Tie Siding, Wyo. Just west of Fort Collins we unfortunately took the wrong road, going on the east side of the Hogback instead of the west side, and traveled some 12 or 14 miles through a newly opened farming district wet with the heavy storm and having many unbridged irrigating ditches. Most of the mud holes were negotiated by putting on the tire chains and "rushing" them, and most of the ditches were crossed by main strength, regardless of wheels and springs. At one ditch on a steep hill side (18 per cent. by our gradometer) we were obliged to get assistance from a farmer's team.

At a bridge over Owl Creek we found the ruts so washed out that we could not "clear," and because the road was so narrow it was impossible to "straddle" them. We therefore filled in one road with some bridge planks, which we found nearby, and took the steep hill on the low gear. Reentering the main road we passed through the beautiful Owl Creek Canyon and soon reached the Forks Hotel. The ruts cut by the freighting teams are very deep along this whole road, and projecting stones constantly endanger the differential, and even the steering gear.

We stopped for the night at Virginia Dale, near the Wyoming border, and next morning went over the bolts supporting the mud pan, which had become severely wrenched by the hardships of the day before. We then climbed 1,300 feet in 6 or 7 miles to the hill overlooking Tie Siding, passing meanwhile the boundary post between the two States. From the summit of this hill we could see, by aid of the field glass, the Ames Monument, on Sherman Hill, erected in honor of the promoters of the Union Pacific Railroad. My brother here wounded a coyote with his rifle, but we were unable to get him. At Tie Siding we filled up with gasoline, as it was the last railway point we should touch for a week. Thirty-two miles southwest we stopped at the Boswell Ranch, on the Laramie River, and got out our fishing tackle. Although we tried fishing for two days, luck was against us, as the fish were not biting as usual. We therefore started one morning for Cowdrey, 28 miles further on, and taking on two local fishermen went west to the North Platte River. Here my brother caught the best trout of the trip, a "rainbow" measuring 17 inches in length. The mosquitoes were very troublesome here.

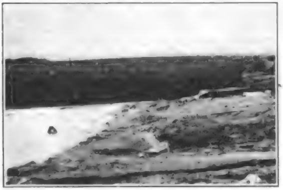
The worst roads in the park we found between Boswell's Ranch and Cowdrey. There are many 15 to 25 per cent. grades, rocky, often with projecting rocks or stumps, and in many places so narrow that one cannot go around the obstruction. We found one high rock in the middle of the Canyon road, near King's Ranch, which had four different colors of paint on it, showing that different machines had been hung up on it before our turn came. Accordingly we laid loose flat stones on one side of it and started the car, but failed to allow for the skidding due to the side slope, landing with the hind axle upon the stone. Applying levers the rear wheels were raised, we put in larger stones and got over safely. The road overseer was passing at this time, and we found the rock removed on our return trip.

The alternative route, by way of Pinkhampton, is more level. It has 5 miles of shifting sand, which makes it practically impassable for automobiles. From Cowdrey to Walden a fine road was encountered, and here we fished in the Platte, only a few miles west, but still with little luck. Next day we went up the Michigan River with a local fisherman and caught some fifty trout, brook trout, rainbows and German trout of very fair size. A quaking mud hole in the road prevented our going as far up stream as we desired, and we made preparations next day for overcoming the difficulty.

With a pickaxe, spade, axe and shovel we proceeded to the scene of our defeat. Poles from an old fence were loaded on to the box on the rear of the machine and carried to the mudhole. A part of it we corduroyed with poles and bridged the rest with planks taken from a bridge about 100 yards beyond. These 4x12 inch planks, 10 feet long, we carried to the crossing, passed

Carrying Bridge Planks to Crossing.

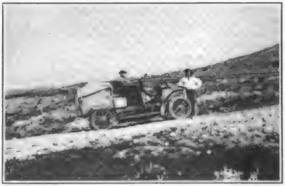
Sod Walls of Corral.



Bridge Over Poudre River Gone.

Horses to the Rescue.

"We Returned to the Cabin."



A Twenty-five Per Cent. Grade Near King's Ranch.

An Alkali "Lake" on the Laramie Plains

Projecting Stumps Endangered the Rear Sprocket.

over on them, loaded them into the machine and then took them back to their original place, where we relaid them and proceeded up the river. We found better fishing here and stopped at the cabin several days. The trout, well salted, were brought through to Denver in very good shape. On our return we took up the bridge planks, carried them to the mudhole, laid them, crossed the mudhole and returned the planks by hand and relaid them in twenty minutes, very good time, we thought.

On the way home we encountered a fearful rainstorm on the Laramie Plains. For many miles the ruts were so full of water that we ran over the sodden prairie on the low gear. Tire chains were a necessity, and several holes and ditches necessitated the use of levers and the shovel. The 70 miles to Tie Siding certainly were a "day's journey" at this time.

A very heavy rain fell all night, and we were fearful as to the roads in advance of us. We met four scouts coming in advance of the soldiers who were marching to the Crow Creek Reserve for summer manœuvres, and they anxiously inquired about the condition of the roads we had traveled. As we approached Fort Collins the deep ruts had been washed out deeper, the mudholes were even muddier, and three bridges were gone in less than 5 miles. We worked over one creek on planks taken from the abutment of the washed out bridge, and in another place were hauled through a deep and rapid stream by a near-by ranchman.

A link of our chain damaged with contact by a projecting stone broke near Fort Collins, and soon after a bolt in the steering gear also broke. The severe road conditions would have rendered anything possible. Only 6 miles from Denver we had to make the run through the wet sand of Sandy Creek, the bridge being closed for repairs. Our advice is that until road conditions are improved a pair of horses and a lumber wagon would be more in order than an automobile for this trip.

The Minneapolis A. C. Hill Climb.

The Minneapolis (Minn.) A. C. held a hill climb up Cedar avenue, Minneapolis, on August 29. Cedar avenue, situated about 10 miles from the City Hall, is 2,136 feet in length and quite steep, a sharp curve occurring about half way up. The best time for gasoline cars in the climb was made by a Corbin, driven by G. Bird, his time being 33.2 seconds. On the club's percentage figures, the *Journal* trophy when, however, to H. J. Clark, who drove a Pope-Hartford, his time being 43.8 seconds. In addition to the regular classification, there were events for motor buggies and steamers. Following is the table of results:

Driver.	H. P.	Car.	Time, Seconds.
		Class A.	
W. C. Rader	12	Holsman	72.
H. B. Allen	14	Schacht	80.4
		Class B.	
Chas. Nyquist	20	Buick	44.2
D. W. Onan	20	Buick	46.
		Class C.	
H. J. Clark	28	Pope-Hartford	43.8
G. Bird	30	Corbin	33.2
		Class D.	
A. C. Miller	35	Stoddard-Dayton.	35.
		Class E.	
P. Hoffman	60	Pierce Arrow	37.
		Class F.	
P. Hoffman	60	Pierce Arrow	38.6
		Class G.	
G. Bird	80	Corbin	33.4
A. C. Miller	35	Stoddard-Dayton.	35.
		Class H.	
H. J. Clark	28	Pope-Hartford	43.
L. Bousfield	20	Overland	64.
		Class I.	
G. H. Seeley	30	Moon	47.
J. B. Lee, Jr	20	Rambler	81.8
		Steamer Class.	
G. B. Webster	20	Stanley	30.4
C. G. Sigwald	20	Stanley	30.6

Strang Wins Lowell Race.

Lewis Strang, driving the 50 horse power Isotta car with which he won the Savannah and Briarcliff races, proved the winner of the Lowell (Mass.) 250 mile road race on Labor Day. His time for 254.4 miles was 4h. 42m. 34s., an average speed of 53.6 miles per hour. Second place was secured by H. F. Grant, driving a 60 horse power, six cylinder American Locomotive car; third place by Wm. Bourque, in a 40 horse power Knox, and fourth place by George Robertson, in a 60 horse power Fiat, the times of these three being 6:14:58, 6:33:22 and 6:38:32 respectively. A Buick 40 horse power retained a prominent position in the race during the first twelve rounds, but was disqualified for fitting a new radiator during the thirteenth round, which necessitated outside help. A Simplex car, also well to the fore during the early part of the race, cracked a cylinder in the nineteenth round. Strang won the Butler Ames trophy for the owner of the Isotta car, John Hamilton Tyson; he also won a cash prize of $500 and a prize offered by the Michelin Tire Company, whose tires were fitted to the winning car. Grant, who was second won $250, and Bourque, third, $150.

The city council of St. Petersburg, Russia, will shortly renew its trials with motor vehicles for the use of the municipal fire department. The two motor fire engines which have been used by the department for some time have not met expectations, the reason being that they are equipped with motors of only 12 horse power, and are not powerful enough to make good speed when carrying ten to fifteen men.

A German court recently condemned a motorist to pay damages to two pedestrians whom he had bespattered with mud by driving his car past them over a muddy road at a high speed. The two pedestrians were salesmen on a business trip, and so much mud was thrown onto their clothing that they were forced to abandon their trip. The case was appealed, but the decision of the lower court was confirmed.

Designing a Planetary Transmission.

By Morris A. Hall.

(Continued from page 306.)

worked. From the time book the number of men working averages a little less than five, so on a basis of fifty-four hours per week the total of 230 hours would just equal one week. On this the amount of material is based. Five sets of blue prints are figured, distributed as follows: Two to the machine shop, two to the assembling department and one kept in the drafting room.

Summing up, this gives a material cost of $0.83 and a total cost for the job of $91.13, or in round figures $91. In this small design so expeditiously put through the drafting room very little could have been saved —not over $6 or $11 at the outside. Therefore, we may give as a safe minimum figure for a planetary transmission design $80, if put through rapidly and worked to the best advantage from start to finish; otherwise the figure will be from $90 to $100.

Imports and Exports for July.

During the month of July, 1908, there were imported into this country 115 automobiles valued at $224,578, and parts valued at $47,360, as compared with 68 automobiles valued at $224,510 and parts valued at $55,753 during the same month last year. Of the 115 automobiles imported last July, 81 were from France, 23 from Italy, 5 from the United Kingdom, 1 from Germany and 5 from other countries. During the seven months ending with July, 1908, there were imported 558 automobiles valued at $1,170,624 and parts valued at $298,755, as compared with 559 automobiles valued at $1,827,590 and parts valued at $466,637 during the same period last year. A great decrease is thus seen in the average value of the imported cars.

During July last there were exported from the United States 238 automobiles valued at $588,560, and parts valued at $55,341, as compared with 345 automobiles valued at $727,391 and parts valued at $68,934 during the same month last year. The total exports for July, 1908, amounted, therefore, to $643,901, and during July, 1907, to $796,325. During the seven months ending with July, 1908, there were exported 1,528 automobiles valued at $3,223,166, and parts valued at $390,775, making a total value of $3,613,941. The figures for the corresponding period of the previous year were 2,052 automobiles valued at $3,825,969, and parts valued at $419,521, a total of $4,245,490.

Motor Transport in the German Army Manœuvres.

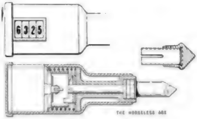
The German War Office has changed its plan with regard to the division of motor vehicles in the transport section from that of light and heavy columns to three columns. In the next Imperial manœuvres two of these columns will be used for the commissariat of two infantry divisions, and third being used for a cavalry division.

NEW VEHICLES AND PARTS

The Veeder Speed Counter.

The Veeder Manufacturing Company, of Hartford, Conn., has just put on the market a new speed indicator which is entirely different from anything else for the same purpose now on the market. It uses for the registering apparatus one of the revolution counters made by this company, which requires a complete revolution of its shaft to register one unit. The instrument is capable of being run up to 10,000, which gives it capacity enough for all ordinary cases. It works equally well at a high or low speed, the limit of speed for which the instrument is recommended being about 5,000 r. p. m.

The accompanying cut shows the interior of the instrument very plainly. The register or counter is shown at A. At B is one part of a clutch, and at C is the other part. When the point of the instrument is free the two parts of the clutch do not engage. They are kept separate by the spring D. This spring is kept from interfering with the parts of the clutch by the sleeve E. When it is desired to use the counter its point is placed against the centre of the shaft whose speed it is desired to measure. A watch is held in one hand, the counter in the other. The operator, after having placed the point of the counter against the end of the shaft, need only look at the watch. When the second hand of the watch gets to the beginning of a minute a slight pressure on the end of the counter makes the two parts of the clutch engage. The counter instantly begins to register. It will continue to register until the pressure is relieved. This may be done either at the end of a minute or any fraction thereof desired. If a count is wanted for a longer period it can be taken equally well. The operator merely releases the pressure at the end of the desired time and the counter stops registering.



Veeder Speed Counter.

To determine the actual number of revolutions the reading of the counter must be taken before starting the count, as no setback arrangement is provided for bringing the register back to zero. This saves the bother of setting the counter back, and is not inconvenient. It is claimed that any setback now made renders the instrument inaccurate. It is a very easy matter to jot down the reading of the register at the beginning and at the end of the period for which the count is taken. The difference between the two readings gives the count for the period desired. The counter works equally well in either direction. When run one way it subtracts; when run the other it adds. In either case the difference of the readings gives the actual count.

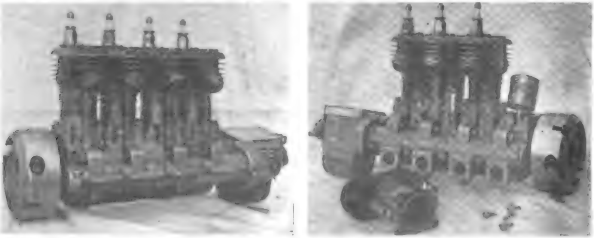
The two chief advantages claimed for this counter are: First, that an absolutely accurate count can be obtained, because the count begins and ends at the right instant, owing to the fact that the counter is placed against the revolving shaft before it begins to count, and can be held there for any length of time without disturbing the register. Second, that an accurate count can be obtained without the aid of a stop watch. The counter is very compact and weighs but a few ounces. It is comfortable to hold in the hand, and its readings are reliable because of the direct reading index. It is not rendered inaccurate by a strong magnetic field, as are so many of the other speed counters now on the market. Where it is desirable to use a counter in connection with electrical machinery the rubber tip shown is provided, which effectually insulates the counter from the machinery.

The Planche Air Cooled Motor.

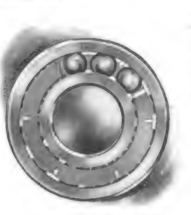
The Motor Car Specialty Company, of Trenton, N. J., are bringing out the "Planche" four cylinder, air cooled motor for motorcycle or other service to which such a motor can be put. The motor consists of four individual gray iron cylinders, bolted to a two part cast iron crank case, each cylinder having the cooling ribs cast integral. The bore is 2⅛ and the stroke 2¼ inches, the horse power being 5¼, at 2,000 r. p. m. All valves are mechanically operated, the inlets being on one side and the exhausts on the other. The valves are made with nickel steel heads and carbon steel stems. The pistons are of gray iron and are fitted with three rings. Cam shafts are hardened throughout their length, the cams being fastened in place by means of set screws into the cam shaft. The crank shaft is made of .40 carbon steel, and is hardened and ground to size. Plain bearings are used on all shafts. Connecting rods are drop forged steel, with bronze bearings at both ends. Gears are all of .40 carbon steel, hardened and rectified. Valve lifters and other moving parts are also hardened. The crank case is fitted with four circular windows through which the oil level in the crank case may be seen. Ignition is by Bosch H. T. magneto, driven from the crank shaft, the distributor being driven from the inlet cam shaft. The flywheel shown is for motorcycle shaft drive. The motor complete without magneto weighs 54 pounds.

New Silent Type of F. & S. Bearings.

A new type of "silent" annular ball bearing, which is claimed to possess some special advantage over preceding types, is shown in the accompanying illustration. This new bearing is made by Fichtel & Sachs, of Schweinfurt, Germany, and it resembles former ball bearings made by that well known firm in respect to the method of introducing the balls. This method is to form angular entering grooves in the sides



Inlet Side and Distributor. Planche Motor. Exhaust Side.



F. & S. Silent Type Bearing.

of the inner and outer races, and after the bearing is half filled to introduce the remaining balls by way of these grooves. Contrary to a possibly common impression, these side grooves are not quite as deep as the races themselves, and therefore the balls are sprung in under some pressure. Once in they do not touch the side grooves, and even if they did the fact that the grooves are angular would prevent them from tending to escape. So far as the ball "knows" the side grooves are no longer there. This construction is claimed to present obvious advantages over that in which the races are so shallow that the balls may be sprung in from any point, since such races are usually too springy to endure material end loads, whereas bearings constructed in the manner above described will carry end loads from one-tenth to one-quarter of their radial load capacity. It also permits a larger number of balls to be used than when, as in bearings without side grooves, only half the races are filled with balls.

In the new type of bearing the distinctive feature is the separator, which is so formed as to permit almost the entire space to be filled with balls. This separator is die cast of a special alloy, and requires almost no machinery. It is split in the central plane of the balls, and the two halves are united by brass wires of dovetail section, which are inserted in dovetail shaped grooves, and have their ends clinched over into notches in the sides of the separator. From the illustration it is seen that the loss, as compared with the "full" type, is only one ball.

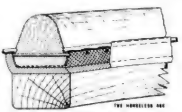
The makers of this bearing lay special stress on the high quality of the materials used, and on the extreme accuracy of workmanship and sizing. It is obvious that a bearing, such as the one described, having more than the usual number of balls, should distribute its load among several balls instead of concentrating it on three or two or even on a single ball, as in some types of bearing. To realize this advantage in practice extreme accuracy in both balls and races, as well as perfect uniformity in size of balls, is evidently necessary. Fichtel & Sachs claim to have made this degree of accuracy a matter of commercial practice. These bearings are imported into this country by J. S. Bretz Company, Times Building, New York.

The Diamond Motor Buggy Tires.

The Diamond Rubber Company, of Akron, Ohio, is marketing a solid rubber side wired tire especially adapted for high wheel motor buggy service. The tire was given a series of elaborate road tests before being put on the market, these tests starting about a year ago. The cut shows the construction and method of fastening. The protective fabric "stocking" around the tire base and retained by the through rods is designed to prevent chafing and "creeping." The regular sizes for this service are stocked.

New One Piece Timken Live Axle.

The Timken Roller Bearing Axle Company, of Canton, Ohio, have recently put out a one piece pressed steel axle, made of special basic open hearth high static resistance steel, and shaped to give better than truss resistance to load, thrust and breaking strains, and eliminate the vibration common to cast or forged axles of the built up type. Advantage is taken of the great strength in globular and tubular forms, and resistance is distributed proportionally to stress by graduating the thickness of the metal, which is heaviest at the hubs and spring seats, and lightest at the central part. From the hubs inward, as the thickness of the metal decreases, the circumference of the tube increases and finally merges into the globe of the central case by a graduated flare, thus avoiding sharp angles or changes of direction, which ordinarily add leverage and concentrate shocks and stresses at the points of least resistance.



Diamond Motor Buggy Tire.

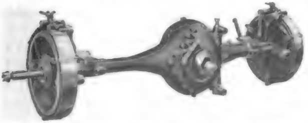
The entire load bearing and gear encasing member is a single unit, clear and smooth, without angles or protruding parts, supports or braces, and easy to clean. This axle is designed for use on cars weighing up to 3,000 pounds empty and of 45 horse power or less. Exhaustive tests of the axle have been made, and the company expects to have it ready for the market in a very short time.

In addition to this new axle, the Timken Company have about completed a new differential gear carrier, a new torque bar arrangement, and an improved brake equipment.

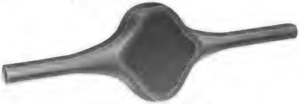
Anniversary Celebration at Kokomo.

A celebration in honor of the fifteenth anniversary of the completion of the first gasoline automobile by Elwood Haynes was held under the auspices of the Kokomo Automobile Club at Kokomo, Ind., on September 2. A crowd estimated at 10,000 persons witnessed the program of events. During the afternoon there was a parade in which about 100 automobiles participated. An egg race, obstacle race and fancy driving contests were held during the forenoon, with race sprints on a half mile asphalt stretch following the parade.

The summary of events was as follows: Egg race, Mrs. Harry Davis, in an Apperson, driven by Edgar Apperson; obstacle race, Frank Sweigert, driving a Buick; ladies' fancy driving contest, Miss Ruth Newby, Indianapolis, driving an Oldsmobile; ladies' sprint race, Miss Agnes Davis, Kokomo, driving a Haynes; gentlemen's fancy driving contest, Frank Sweigert, driving a Buick; half mile race for four cylinder cars under 30 horse power, Nelson McLain, Apperson, 38½ seconds; half mile for Haynes owners, Paul Smith, Indianapolis, 40¾ seconds; half mile for four cylinder cars above 30 horse power, Edgar Apperson, Apperson, 29½ seconds; free for all, Nelson McLain, Apperson, 30 seconds.



Front View of Timken Pressed Steel Rear Axle, Showing Gear Carrier, Spring Bases and Brakes.



Pressed Steel Axle Housing of New Timken Axle.

Selling a Car to a Salesman.

By S. A. S. Agent.

Did it ever occur to you that this is a little different from selling a car to the ordinary business or professional man?

If you have only thought of this aspect of the situation since you started reading this, you have probably come to the conclusion that selling a salesman a car is rather trying, and that in most cases you do not sell a salesman an automobile but rather he buys one from you.

I think this conclusion a wrong one. It is not a case of Greek meeting Greek; for a salesman is pre-eminently a *salesman* and not a *buyer*. I am using these terms in their technical commercial sense.

While he could stand by and criticise the way you tried to sell a car to someone, yet when he comes into the market himself, and the agent is demonstrating to him, his mind is on the automobile and his critical faculties are not so wide awake.

Do not get nervous when selling to a salesman, trying to make the sale in a manner reflecting credit on yourself. When it is over he will not remember how you sold it to him. You, of course, have not made use of the usual line of "smooth talk" which you are tempted to use with some people because they seem to want it, actually fishing for it.

While the critical faculties are not wide awake in your salesman customer, they are not asleep. Anything really crude in *your* salesmanship may wake his criticism, and then his mind will get off the car and attend to you.

Keep his attention on the car. Would you not rather make a sale and have him go away saying, "That certainly is a great automobile," never even thinking of you, than for him to say, "B—— certainly is a good man, but I don't care so much for the car he is selling."

Never assume that your salesman customer is not well informed about competing automobiles. It is instinctive in him to be informed about his own line, and when he begins thinking about automobiles he will naturally get well posted.

There are five reasons for cars being easy on tires, which he has heard before you talk to him. Don't repeat them. They are: A's car is easy on tires because most of the weight is on the rear axle, and hence these tires do not slip or skid. In B's design the greater weight is on the front axle and so rear tires only have to withstand the driving strains. C's car has an even distribution of weight, fore and aft, and so tires wear equally. D's car is so light that the tires are lightly loaded, and so last a long time. F's claim is that the weight of his strongly built solid car keeps the tires always in contact with the ground, and there being no slipping or sliding, tires wear very well

Take a new point. Say that the foregoing all has more or less truth in it, but that the reason you car is easy on tires is the clutch. Explain that the sudden jerk when speeds are changed produces enormous strains in the fabric of the tire, to say nothing of the tendency to tear the rubber off the tread. Shocks to the tires at every gear change exert a great deteriorating effect, even though the passengers do not feel them much.

Do not spend much time talking about the economies resulting from the use of an automobile in his business. He has already made calculations as to how much more quickly he can cover his present route, and how to spend the time gained. Perhaps he has decided he wishes to enjoy the fun of making his trips in an automobile, and does not care much for the economy.

Remember a salesman is supposed to be buying a car for business use. While sometimes he has a pleasure use of car in mind as a side line, he would rather not say so. Keep your talk on the business use of your car.

From conversations with many salesmen owning cars, with agents and in selling cars myself, I have found a certain few talking points stand out above the others as being the most effective in making sales to salesmen. I have been careful to eliminate from consideration anything that savored of being a good point discovered by the *use* of the car.

What I wanted and I think I have gotten are the things that being said and demonstrated have helped most to sell cars to salesmen and incidentally to the professional man, contractor, etc.

SINGLE CYLINDER CARS.

When selling single cylinder cars emphasize the fact that this one cylinder has plenty of power by tagging on behind some two cylinder car and staying there. If you are a good demonstrator you can do this.

Explain that on the average real hill a two cylinder has to drop into its low gear, and that while the single cylinder must do this a bit sooner, yet the actual extra time required to mount the hill is not so great after all.

TWO CYLINDER CARS.

Point out the great value of the duplex power plant.

If a cylinder gives out remove its spark plug, open its pet cock and come home on the other cylinder. Show that the two cylinder motor, being well balanced, may be run at high speeds without undue vibration. Vibration is antagonistic to long life of motor bearings and other adjustments about the car.

FOUR CYLINDER CARS.

While traveling at ordinary speeds the explosion in each of the four cylinders is a small one, so the pressures on bearings are light, giving long life. The four cylinder motor is the only one of fair power which is vertical. This means cleaner cylinders; ability to go slower in streets in combination with speed in open country.

SIX CYLINDER CARS.

A salesman, etc., wanting a six cylinder car knows what he is after—its ability. Tie the lever in the direct drive with an impressive piece of rope. Have your demonstrating car with its carburetor adjusted to pull well at low speeds and not to pop back at high speeds. Do not think of economy. Climb every hill in sight and go fast on the level stretches. Stop on some very slight down grade to look at one of your tires and then start up again by coaxing the clutch.

AIR COOLED CARS.

See that your demonstrating car does not smoke.

PLANETARY GEARED CARS.

Show how the reverse may be used as a brake; demonstrate it. Nearly all agents talk about it, but never demonstrate.

SLIDING GEARED CARS.

This car has a middle gear. Use it. Take your customer through a piece of very rough road on the direct drive fairly slow, and let him feel the bumps. Then turn back and go over it again, using the middle gear, and let him feel the comfort of the slower speed. Then as you turn again to continue the trip drop into low gear, and without hustling the engine let him observe the tedious slowness of it. Remind him that a two speed car would have to choose between two kinds of discomfort, either bump over the bumps or suffer the wearisome slowness. He will fall in love with the middle gear.

Take him into a crowded city street and show him how the middle gear increases the flexibility of the car's power plant. Show him how to crawl along and then shoot ahead again. In the open country after a stop start the car with the middle gear in mesh, and do not change to high, but speed up the motor till car is going at a good pace. Then call his attention to the fact that you were and still are on middle gear. When you are through it will be very hard to sell him a two speed car, and best of all he will unconsciously attribute the merits of the middle gear to *your* middle gear and *your* car.

THE LAST WORD.

A salesman wants to carry samples. You ought to have a sketch showing exactly how a trunk or suit cases may be attached to every model you sell. You ought to be ready with the exact cost and the name of the firms that will sell the trunks and do the fitting work. If any salesman has had one of your cars fitted with trunks get a photograph of it. The ability to come down pat with the exact way and cost of fitting a trunk and mentioning it before being asked has very often been one of the clincher arguments in making a sale.

Coming Events.

September 11—Hill Climb of Springfield (Mass.) A. C.

September 14—Annual Economy Run, Chicago Motor Club.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

COMMUNICATIONS

Two Cycle Engine Matters.

Editor Horseless Age:

Whatever appears in The Horseless Age concerning two cycle engines I read with much interest, and I now have a few comments to make on some articles which have appeared during July and August. The first was by Mr. Watts on page 111, "Why the Average Two Cycle Engine Does Not Give More Power." The reasons given by him are: First, power is lost in compressing the charge in the crank case; second, the inlet opening is insufficient to obtain a full charge at high speeds; third, the mixture is of poor quality. As he states, the power lost in precompression may vary from 2 to 15 per cent., and as a well designed engine not using excessive crank case compression should keep the figure near the lower limit this should not cut down the power much.

What Mr. Watts says about insufficient inlet opening I believe to be quite true, as my experience has shown a two cycle engine to require a larger carburetor than a four cycle engine of the same size.

The poor quality of the mixture is due, as Mr. Watts says, to faulty carburetor action or incomplete clearing out of the burned gases from the cylinder. The three port, two cycle engine is notoriously hard to supply with a good mixture, and at the same time seldom allows the crank case to fill at high speed; also, the clearance of the crank case is so great that it does not pump a quantity of mixture nearly equal to the piston displacement at each stroke. The volume of the cylinder at the time the exhaust port closes is equal to the cylinder clearance, plus that part of the piston displacement which has not already been swept by the piston on its up stroke. That a greater quantity of burned gas is left in the two cycle cylinder than in the four cycle engine is due to the fact that the crank case does not pump so large a quantity of new charge as does the four cycle cylinder. I believe that the two cycle engine of the future will be able to pump a greater quantity of gas than the four cycle, and the main problem is to find the simplest and most practical way to furnish this increased pumping capacity, together with a reasonably even draught upon the carburetor.

The address by Mr. Roberts, reported on page 131, was especially interesting, because of his long and well known connection with two cycle design. However, he seems to hold, in common with Hugh Dolnar, to the fallacy that throttling a two cycle engine reduces the cylinder compression. He says: "For low compression and weak mixture the period of inflammation is longer than for high compression and rich mixture. * * * Therefore, when running on low throttle, and consequently on low compression, it is necessary either to enrich the mixture or to advance the spark." It is true that the crank case compression and the quantity of new charge transferred to the cylinder are reduced by throttling, but the pressure in the cylinder when the exhaust port closes must be nearly equal to the atmospheric pressure, and will vary with the speed because of inertia effects in the exhaust pipe rather than with any change in the incoming charge, which is shut off before the exhaust port closes. The only result of the smaller new charge is a greater quantity of old burned gas, making the total amount compressed the same as when the charge is unthrottled, and as it is compressed in the same space the compression is the same.

Mr Huene proposes a novel form of bypass on page 189. This would hardly seem practical, as the explosion and expansion pressure would be against the side of the piston constantly. Any looseness of the piston would allow the burned gas to pass around and out of the inlet port, also in some position of the piston out of the exhaust port. The effect on lubrication can be imagined.

In the editorial, "Offset Cylinders of Two Cycle Engines," page 250, the following statement is made: "With the offset shaft the tendency is toward a slightly slower opening and a slower closing of both ports, which are uncovered at the lower dead centre, as well as a very slight reduction in the total time during which these ports are uncovered." This seems a peculiar statement, since in ordinary practice the total time during which these ports are open consists of the time of opening and the time of closing. To satisfy my own curiosity I laid out the port openings for three engines of 5 inch stroke, all having equal ports. The crank case inlet port was five-eighths inch in height, the transfer port one-half inch and the exhaust port seven-eighths inch. The first engine was provided with a 10 inch connecting rod, and was not offset, the second had also a 10 inch rod, but was offset one-half inch, while in the third the connecting rod was shortened to 9 inches, the offset being still one-half inch. I found that with equal connecting rods the two ports opened at the lower end of the stroke were each uncovered somewhat earlier and closed somewhat later in the offset engine, thus remaining open during a longer time. This seems an advantage, as it gives more time for the exhaust and transfer without sacrificing more of the stroke. As an offset construction permits the use of a shorter connecting rod without increasing the side pressure on the cylinder this was also tried in the third diagram, with the result of still longer port openings. With the crank case inlet port the result of offsetting was as stated by you, an almost imperceptible increase in the time of opening, while a shortened connecting rod decreased the time of opening in the third engine to less than that of the engine without offset.

A. C. Woodbury.

What Rate of Toll Can Motorists Afford to Pay?

Editor Horseless Age:

Would be pleased to have you give me some information on the following questions through your "Communications." Would also be pleased to have opinions from other parts of the country.

In preference to traveling over the ordinary country roads, what rate per mile can the average automobile afford to pay for the privilege of traveling over a comparatively straight and level macadamized road used only by automobiles?

Would a road built especially for automobiles along the route af an electric railway have a tendency to increase or decrease the amount of travel on the electric line?

J. A. L.

[Your questions are rather broad, and we have no information available to give a definite answer thereto. The good road would enable better average time to be made, and would therefore save the time of the motorist on business trips, which would be worth something. But it is hardly conceivable that a special autohmobile road would be of any great use to owners using their cars in their business, because of the fact that they cannot freely choose their roads. Such a special road would have to depend mainly on pleasure seeking motorists, and how much these would be willing to spend per mile for the use of the improved and exclusive road we are unable to say.

We do not see that a parallel automobile road can have much effect either one way or the other on the business of a trolley line. Some six or eight years ago it would have been a boon to the trolley line, but the average cars are now so reliable that motorists are seldom obliged to travel home by trolley.—Ed.]

Overhead Valve Gear versus T-Motors.

Editor Horseless Age:

Referring to the correspondence in your paper on the above subject, Mr. Napier has used the overhead inlet valve for a good many years; in fact, in 1903, when we first introduced it on our racing cars, and in 1905 on our regular output of six cylinder Napiers. We have discontinued it on touring cars, because it appeared to be more open to abuse; that is to say, the inexperienced person could so adjust the lift of the valve as to cause great damage to the cam shafts and levers for opening the inlet valve.

Another disadvantage was that it was a noisier form than the underneath type, owing to the extra joints, and then again the domes which were required to hold the valve down in position appeared to worry owners very much because sometimes they leaked a little, and then instead of setting them down carefully they endeavored to prevent the leakage by screwing the bolts down very hard and then breaking something.

There is no question about its advantage.

An engine with this form of valve gives more power, keeps cooler, or, rather, throws off less waste heat through the radiator; but is not so sastisfactory commercially, because it requires greater intelligence to use it.

On our latest cars, which were built for the Grand Prix, and on our fastest racing cars we use the overhead inlet valve.

S. F. EDGE.

Minor Cannot Obtain Driving License.

Editor HORSELESS AGE:

As I am a subscriber to your paper, will you please inform me through it whether or not a boy under eighteen years of age is permitted to have a motorcycle or automobile, and can get a license to run same on the public roads in the State of Pennsylvania? LUDWIG FLACH.

[The Pennsylvania automobile law does not permit the issuing of licenses unless the applicants are at least eighteen years old. There is nothing said in the law about motorcycles, but it is our opinion that the Highway Department at Harrisburg requires a license from those using motorcycles, and that the same age limit is held to apply. We do not believe that a motorcycle is a motor vehicle within the meaning of the Pennsylvania law, but if the Highway Department has considerd the law otherwise it will be necessary to comply with the regulations as promulgated by the department.—ED.]

The Price of Wood Alcohol.

Editor HORSELESS AGE:

In the article on page 453, "Wood Alcohol Cheaper," you intimate that wood alcohol can be bought for about 15 cents per gallon. I use a good deal of it, but have to pay 40 cents per gallon. Can you put me in the way of getting it cheaper? C. P. F.

[The information contained in the above mentioned article was taken from a report of the Department of Agriculture, and the prices mentioned are undoubtedly wholesale prices. Nevertheless, it would seem that the retail price should be less than 40 cents per gallon if the wholesale price is only 15 cents. We shall be pleased to hear from any reader who can supply wood alcohol at less than 40 cents per gallon retail.—ED.]

A Reply to Mr. Buse.

Editor HORSELESS AGE:

The writer has just had his attention called to an article in THE HORSELESS AGE of August 26, on the recent Glidden Tour, written by Mr. Gus Buse. I am at a loss to know why he should single me out for attack, as Mr. Buse and his sons were merely compelled to obey the rules of the tour, just as everyone else, and the combined family was not able to overawe any officer of the tour. I administered the duties of chief observer without fear or favor, and I believe that the consensus of opinion of the participants in the tour will verify this.

I have for many years found THE HORSELESS AGE fair in its treatment of both firms and individuals in the motor car world, and trust that you will repel this attack, which looks to me as if it was personal, pure and simple, and therefore of no interest whatever to the public.

Trusting that you will allow my friends to vindicate my conduct in the tour, and will give this the publicity which I think is due me, I am, Yours respectfully,

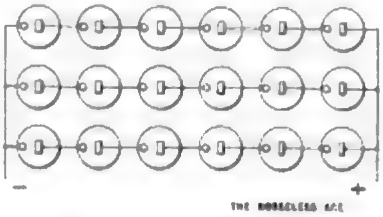
F. D. STIDHAM.

Ignition Queries.

Editor HORSELESS AGE:

I saw in the June 10 issue of THE HORSELESS AGE, on page 699, an article about using dry cells in multiple series. The arrangement described the style of connection shown by the accompanying sketch. Will you please tell me what amperage and voltage would be obtained at your zinc and carbon leads where the three series are effective? What voltage and amperage will an ordinary coil stand? What objections are there to a single coil for a four cylinder machine against four separate coils?

I have used a non-vibrating coil on a Knox for five years, and now am using a buzzer coil. Is one style any more economical to use than the other, considering current consumption?



Please put me down as a kicker on long valve stems on tubes, and believe me I appreciate your paper and the way it is gotten up, and last, but not least, the little thread to tear the wrapper off with.

J. F. HAYWARD.

[The method of connection is correctly shown by your diagram. The voltage on open circuit is exactly the same as for one series of six cells. On closed circuit the effective terminal voltage would be very slightly greater in the case of the series parallel arrangement, on account of the smaller voltage drop in the battery itself, due to the smaller internal resistance. But the difference would be not worth talking about. The current will be greater in the case of the series parallel arrangement on account of the smaller internal resistance. How much greater depends on the relative resistances of the coil primary, the cells and the connections. Coils are made either for four or six volts, and will stand any amperage that can be got through them at these voltages.

Up to recently it was urged against the single coil or synchronous system of four cylinder ignition that the high tension distributor required with it was at least a very delicate device, liable to give trouble from leakage. But it seems that the difficulties involved in its construction have been overcome, as this system has recently come into quite extensive use. Its advantages are lower first cost, greater ease of adjustment and synchronism of ignition in all of the cylinders. The non-vibrator coil should be more economical of current than the vibrator coil, though it is not necessarily so. It all depends on the length of contact at the contact maker or timer.—ED.]

Relative Efficiency of Gear and Double Chain Drive.

Editor HORSELESS AGE:

Kindly give me through your columns the opinion of automobile engineers as to the following problem:

Given two cars of the same weight, wheels and wheel base, with the same engine located under the hood, and the same transmission, one driven by a propeller shaft to the differential on the live rear axle, the other with jack shaft and side chain drive, which will deliver the most tractive power to the rear wheels?

I am considering the qualities of two cars representing the above problem, and in this country power is the essential on account of poor roads. JAMES H. WROTH.

[It stands to reason and we believe it is generally admitted that the percentage of power loss is greater when the power is transmitted successively through a pair of bevel wheels and a pair of chains and sprockets than when it is transmitted directly through a bevel pinion and gear. This holds as long as all the driving members are in good order. If the rear axle should be too light for its service and become distorted, and the axle shafts should thereby become bound in their bearings or the mesh of the gears greatly disturbed, the efficiency of the bevel gear drive might fall below that of the side chain drive, but this condition need not occur.—ED.]

Preventing Rust on Rims.

Editor HORSELESS AGE:

Some time ago I had occasion to remove all my tires and found not only the metal rims (q. d. type) but the bead on the outer clincher casing badly rusted. I removed this from the metallic parts by the use of a stiff wire brush and sandpaper, and then rapidly applied a thin coat of quick drying shellac varnish, to which some flake graphite (Dixon's) was added. This dried hard and firm overnight, and the tires and rings were put on the next day with the greatest ease. They have been on for some time now, and show no signs of rust or wear. In fact it is a good preparation to use on any iron work of the car liable to rust. M. D. HOGE, JR., M. D.

LEGISLATIVE and LEGAL

The Critical Legal Period of Automobiling.

By Xenophon P. Huddy, LL. B.

This, it may be said, is the critical legal period, so far as automobiling is concerned. The history of legislation controlling automobile driving shows us that the regulation of automobiling started with few restrictions, and has gradually increased, until there are now many and numerous regulations in various States. We have arrived at the point where there must be a turn in the tide, either in one way or the other, calling forth either an increase or a decrease in the control over the subject. Particularly unfortunate is it that at this critical period the industry and automobilists should be face to face with many examples of reckless driving, disregard for the public safety, and a disposition of even automobilists themselves to incite the speed mania.

With one notorious automobilist about to be expelled from motoring organizations, in which he has been more or less a prominent member, and another motorist under indictment for manslaughter in the city of New York, and having heretofore gained a reputation as a successful automobile racing enthusiast, what may be expected from the hands of the law makers? The daily newspapers are editorially advocating further restrictions. The railroads are devising means and ways of protecting automobilists against their own recklessness, and the Government officials in some sections have ordered the motor vehicle departments to enforce the provisions of the automobile laws with more severity and strictness. Facing this situation, would it seem possible that representative automobile organizations would at this time be advocating the holding of another big automobile race on the public highways?

The automobile associations have manifested a desire and over-eagerness to stop reckless driving and to comply with the spirit of the automobile laws. Meetings have been held between representatives of these organizations and county officials to devise ways and means for preventing disastrous and reckless driving. Committees of public safety have been appointed by certain clubs and statements have been issued to the public asserting the position which the automobilists take against speeding. All this has had a tendency to some extent to restore confidence in the public; but actions speak louder than words. Nothing material has been accomplished, and today a more critical situation has never faced automobiledom and the public.

It is utterly impossible to legislate evil out of existence. Accidents cannot be prevented by laws, neither can evil conduct. Conduct may, to a more or less extent, be regulated by statutory control, if the penalties are severe enough to provoke respect in the minds of those who would disobey the law. Various men throughout the country have suggested ways and means for doing away with evils connected with automobiling. Very comprehensive laws have been enacted, notably the one in the State of New Jersey, which, it must be confessed, is as good a law as any for all concerned, with the exception, perhaps, of its revenue features. The courts have in one or two rare instances given a jail sentence to drivers who have been guilty of speeding under aggravating circumstances, but it must be noted that there has been no decrease in the evil.

The time has come for automobilists themselves to take active steps in order to protect automobiling. Instead of asking special favors, for more lenient regulations and for the privilege of holding illegal speed contests on the public highways, they should be spending their time devising a method to regain the respect which they should have in the minds of the public, and to protect themselves against the evils which are now known to exist. Automobilists should be just as eager to have a violator of the law prosecuted and punished as the public officials are, and it would seem that the proper method to get at this is for automobilists themselves to maintain a prosecuting department which will be energetic and active.

Not all the fault can be laid at the door of the chauffeur. He is to blame for much of the evil, but we now have on record the first case of an owner indicted for killing a human being and not stopping at the time. Surely the chauffeur will not be compelled to bear the stigma which is now placed upon the owner, which owner, it so happens, is an advocate of racing upon the public highways. Surely this case will be made an example, and if automobilists generally would take sound and wise advice they would from now on be as much against the holding of all speed contests on the public highways as they have been in favor of it in the past. So long as these contests are held just so long will the speed mania be perpetuated, and more drastic legislation, public indignation and deplorable accidents may be expected to increase.

Maryland Grand Jury Recommends Motor Car Commission.

The Maryland grand jury has recommended to Governor Crothers that the appointment be made of a paid commission of examiners for motor cars, similar to the State Board of Licensing Engineers. The report submitted goes on to say that "it should be the duty of such examiners to require every driver of a motor car to stand a practical examination to prove his ability to run such a machine, and to require a visit in person to the examiners at periods designated for renewal. Such an applicant should present credentials of sobriety, good character, carefulness and the indorsements of reputable citizens. A fee should be charged for the permit, a fine imposed for allowing its use by others than the owner, and both fine and imprisonment for driving a motor car without a license."

The recommendation is a step in the right direction, according to Maryland motorists, and is well thought of by the public in general.

Effect of the Anti-Smoke Ordinance.

The effect of the recent anti-smoke ordinance of the New York city Park Board has evidently been more far reaching than the average person would imagine. As the parks and parkways of New York, and especially Central Park, are favorite places for afternoon and evening drives, the operators of automobiles who wish to follow these routes must take care that no smoke issues from the muffler of their cars. Even business men on their way home like to take a spin through the park, especially if they have friends with them. The result of this ordinance has been most noticeable in respect to taxicabs, however. Before the passing of this ordinance one make of cab in particular was very objectionable in this regard. At the central station and at the stands where these cabs were stationed it was the rule rather than the exception to see them belching forth volumes of smoke, much to the discomfiture of pedestrians and others. Recently this has been changed to a marked extent, and it is seldom that one sees this condition. At the central station recently the writer observed only one cab that was giving forth an objectionable quantity of smoke, and this was a new one, which perhaps accounted for the fact.

Legal Notes.

The Thomas B. Jeffery Company, Kenosha, Wis., will bring suit against the city of Racine, Wis., for damages to one of their machines, which was partly wrecked while entering a drawbridge that was opening. It is claimed that no warning signal was given.

The Massachusetts Highway Commission has revoked the chauffeur's license of Thomas Cooney, of 17 Grand street, Dorchester, who has been held under a charge of manslaughter committed while driving his employer's car without the latter's consent.

Governor J. Frank Hanly has called a special session of the Indiana Legislature, to convene September 18. While special matters will be looked after principally, it is probable that automobile interests will try to get some needed reforms in the way of signboards, etc.

Commercial Applications.

Special German Motor Car for Dead or Injured Animals.

In large cities horses or other animals often meet with an accident and fall helpless to the ground. Either dead or injured they are obstacles to traffic; besides, they present an ugly, pitiable sight. Therefore the municipalities try to remove them as quickly as possible, which is usually done by teams sent by animal hospitals or the fire department. In this respect the automobile is indeed the ideal vehicle, and Germany is the first country to take up the idea and put it into effect. It is well known that German municipal authorities are very progressive with respect to sanitary improvements.

The vehicle here shown was ordered by the Berlin council and has just been completed. To remove animals affected with contagious disease the motor car is certainly the best medium. Team owners can seldom be induced to accept an order for removing such beasts, as they fear that their own horses may be infected.

The car is kept in the municipal meat destroying institute and called to any place by telephone. A large firm which chiefly makes motor trucks has used such a chassis of 1,500 kilograms capacity for this car. Inside the body is room enough for the largest corpse, the inner length being 2.75 metres, the width 1.4 metres and the height 1.75 metres. Of course solid tires are used, single for the front wheels, double for the rear. The rear door serves also as an incline on which living animals can mount the vehicle. But as cattle can scarcely be forced to leave a vehicle backward, a side door is also provided just behind the driver's seat which when lifted up is fastened by bolts. The inner side of these is nailed with narrow wooden strips to give the hoofs some foothold. If the car is to be loaded with a dead animal a strong platform, consisting of three parts hinged together, is pulled out and slides down the rear door, which has also to be lowered. The connections are covered with strong leather to save the skin of the animal sliding across it. Each of these parts runs on four small wheels and a guiding pulley is provided at each corner.

After the body has been fastened to the platform the latter is wound up by chains over the inclined rear door by means of a windlass, the latter being placed in the empty space beneath the driver's seat. The windlass has a ratchet device to prevent slipping down the slope. The engine develops 32 horse power and the speed is of course much higher than with the usual horse teams. At present one such car is in use, but it is probable that additional vehicles will be introduced and in other German cities as well.

A New Automobile Livery Service.

The Elite Motor Service Company, of New York city, have recently been formed, with a paid in capital of $100,000, to conduct an automobile livery service on lines which the company claim will make it the finest service of its kind in existence. The headquarters will be located at 587 Park avenue, and they propose to start with about twenty-five Delahaye and Pilain cars. The cars will be equipped with motors of 25-30 horse power, and fitted with special touring and limousine bodies. William H. Barnard, 54 Howard street, is one of the officers of the new company.

State Normal School Wants Motor Bus Line.

Officers of the Kansas State Normal School, located at Hays, Kan., are looking about for the necessary capital to establish a motor bus service between Hays and Larned, a distance of 60 miles. There are 500 students at the school, but the railroad facilities are very poor, Larned being the nearest railroad centre and running only occasional accommodation trains. Consequently, the school is usually reached by driving, a full day being needed for the trip, provided the horses are good. In addition to carrying students and others between the towns, the small settlements along the route would contribute to the travel, as the section is a fine wheat land. The roads are level, and there is little rainfall, so that the service could be conducted economically. A number of local dealers have been approached, but they seem unwilling to make the venture. A member of the faculty will shortly come East to talk over the proposition.

J. N. Eastwood, Herscher, Ill., will put in a line of machinery for doing all kinds of automobile repairing.

Commercial Notes.

The board of fire commissioners of New Haven, Conn., have purchased a 30 horse power Continental runabout for the use of Fire Chief R. R. Fancher.

An automobile stage service is to be started in October from Quogue to Riverhead, L. I., by W. H. Robertson, a Brooklyn contractor. Fifteen and twenty passenger stages are to be used.

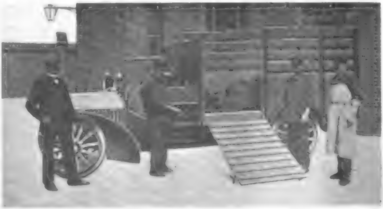
James Atkinson, a rural mail carrier at East Troy, Wis., is now using a motor buggy. It is said that with the horse he was only able to make two trips, while with the motor buggy he makes three.

A passenger automobile service has been established between Tacoma and Bismarck, Wash. At present only one sixteen passenger car is in service, but others will be added as the service increases.

The Springfield, Ohio, postal authorities are seriously considering the adoption of motor cars for collection from boxes. The vehicles required should be light and fairly speedy, in addition to the usual commercial requirements, according to the views of the authorities.

A motor propelled fire engine of the Webb type was tried out at Wheeling, W. Va., on August 22 last. The machine was tested for speed over both short and long distances, for flexibility in traffic and for hill climbing ability. A 150 foot stream was thrown from a 1¼ inch nozzle, using the river for suction, and with connection to the street plugs a stream 190 feet high was thrown, 200 pound pressure being used on both tests. The city will shortly put the machine into regular service.

The board of fire commissioners of New Haven, Conn., have purchased a 30 horse power Continental runabout for Fire Chief Rufus R. Fancher after a cautious two year consideration of the value of the motor vehicle in fire department work. The machine is a New Haven product, and was sold to the city at $1,000 below its catalogue price. Mr. Moeller, the manufacturer, also offers to supply the police department with



Special Motor Car for Removing Animals in Berlin.

a car under the same conditions, and the proposition is now being considered.

Walter Benz, of the Benz Auto Company, Minneapolis, Minn., has established an automobile service between Minneapolis and Robbinsdale.

The Taximotor Cab Company, of Boston, which now has thirty-five cabs in service, is reported to have placed orders for forty more cabs, including six special cabs for the three clubs at which the company now has stands.

J. F. Levy is said to be contemplating the introduction of a taxicab service in Atlanta, Ga., placing five cabs in service on October 1, five more on November 1 and five more every thirty days until a total of twenty-five are in operation.

C. B. Ulrich, of Hancock, Mich., is reported to have organized a company, with a capitalization of $50,000, to operate an automobile service between Houghton and Hancock, on the same plan as the Calumet-Laurium service, now conducted in that vicinity.

General Reduction in Tire Prices.

A practically general reduction in the catalogue prices of pneumatic tires took effect September 1. We have before us announcements of price reductions from the G & J Tire Company, the Michelin Tire Company and the Ajax-Grieb Rubber Company. Elaborate attempts are being made to give plausible explanations of the reductions, such as increased production and consequent reduction in the pro rata overhead expenses, reduction in expenses for free replacements, etc. The true cause is undoubtedly that the former catalogue prices were inflated, as were the commissions offered to dealers, which resulted in obnoxious price cutting. Although the recent conferences between representatives of the tire makers seemed at first to have led to no direct result, it is really these meetings which brought about the general price reductions, for, as stated in these columns, this was the only remedy proposed at the meetings to do away with price cutting by dealers.

A. L. A. M. Board of Managers Meeting.

The board of managers of the A. L. A. M. held an all day session at New York headquarters on September 3. The principal business of the meeting was in connection with the Madison Square Garden Show, to be held January 16 to 23 next. A scheme of decoration was decided on among other matters, and the space allotment for exhibitors was made. The licensed agency clause, prohibiting dealers from handling unlicensed cars, was retained in force for the next year. A full attendance was reported.

The Anderson Engine Company, Shelbyville, Ill., manufacturers of automobile engines, will equip a factory and engage in the manufacture of automobiles.

OUR FOREIGN EXCHANGES

Motoring Goggles and How to Test Them.

Most people who suffer from defective eyesight and who have had to betake themselves to expert spectacle makers and sight testers are, of course, well aware that a proper spectacle lens is a very highly finished product, that its surfaces must be accurate curves, and that the required degree of accuracy can only be obtained by careful grinding followed by subsequent polishing. Lenses merely cast to the required shape and not subsequently trued by these processes are almost, without exception, worse than useless.

The ordinary motorist, however, whose sight is not defective, and who does not require in ordinary life the assistance of spectacles to go about his business, is too likely to think that almost any sort of glass, provided it be properly transparent and not noticeably crooked or bent, is good enough. No greater mistake can be made. The plain glass of a goggle should be just as carefully finished as a spectacle lens. It is not like a window glass through which objects are viewed from some distance, but it is employed close up to the eye, and if there is any irregularity in either of its surfaces there will be distortion in the image formed on the eye, which the eye is perpetually striving to correct, and so subjecting itself to a perpetual and usually irregular strain, which is likely if prolonged to lead to astigmatism and all sorts of eye troubles. People with perfect sight will have noticed that continuous use of a motoring goggle often upsets their eyesight, or at least gives a tired feeling to the eyes.

Goggle glasses are of two classes, those which are intended to replace spectacles and those which simply form a shield or screen. The former are not very numerous, and as practically everybody who uses them will have had sufficient experience to insure his providing himself with specially made glasses, the dangers encountered are comparatively trifling. Those of the other class are of two patterns, the curved and the flat, of which the former are more usually met with. In them, of course, the two surfaces are supposed to be parallel or concentric, the outer surface being convex and the inner surface having an exactly corresponding degree of concavity. It will be quite clear that any irregularities in either surface will produce distortion and danger to the eyesight, and the same is practically true of the flat glasses in which the two surfaces should be exactly parallel with one another. There are little lens testing machines of wonderful ingenuity and delicacy, which enable imperfections to be ascertained with great accuracy, but for the ordinary user it is sufficient to take the goggle and test each of the glasses by turning them so that their surface reflects a distant lamp, and by then moving them about so that the reflection passes all over the surface. If the glass is true and properly ground no distortion of the reflection of the distant lamp will be observable. If it is not true the reflection will be distorted, probably at a number of different places. It is a simple test to apply, and may save many a buyer from incurring the danger of permanently injuring his eyes.—*Automotor Journal.*

Metal or Wooden Panels for Motorcabs.

Concerning the above, a correspondent of the *Commercial Motor* writes as follows:

"There is a considerable difference of opinion as to the relative advantages that accrue from the employment of wooden and metal panels for motorcab bodies. There is very little doubt that wooden panels are the only suitable fitting for private service vehicles, but, without exception, it has been found that, for public service, pressed steel leaded panels are the only really sound form of construction. The great objection, from the user's point of view, is the drumming hollow sound which is emitted by all metal panels, and this is largely due to the fact that a metal panel has to be rigidly encased in the framing of the body which forms the 'quarters' and the back. For metal panels to be a good job, they have to be beaten into a more or less concave shape, and this undoubtedly accentuates the drumming capacity of the metal. One leading manufacturer is now having all metal panels fixed with special screws on the outside of the body framing, and this has been found to give quite good results from the point of view of the elimination of noise; it has also been found to be of advantage in the matter of repairs. In the case of accident, the damaged panel can be removed, and a new one may be fitted without disturbance to any other part of the bady. There is no question but that a wooden panel will take a very much better paint surface than a metal one, and it certainly reduces vibration of the body work to a minimium, especially if it be well covered with canvas. If wooden panels are employed considerable care should be taken to insure that the grain of the wood runs in the right direction.

"It may be remembered that many coach builders, at first, had considerable trouble with regard to the drumming effect of the wooden domed roofs of horsed broughams. An attempt was made to lessen this effect, by the building of a false or second roof on the inside of the body; this secured the passage of a free current of air between the two skins, but it was eventually found that a great deal of the noise arose from the fact that the roof boards were usually arranged so that the grain ran longitudinally in the direction in which the vehicle was traveling. The difficulty was ultimately overcome by the employment of three-ply built-up wood, with the grain, wherever possible, running laterally across the vehicle. If wood be employed for cab bodies, it will, therefore, be very much better to arrange for the grain to run transversely, and not from the back to the front of the vehicle."

Denmark's New Automobile Law.

The new automobile law of Denmark, to which strong exception was taken, especially by owners of motor cabs, went into effect on August 20, although the taxicab drivers of Copenhagen went on strike on account of this law six weeks previously. A mistake had been made by the Government in neglecting to publish the law in the official publication, whereby its going into effect was delayed. One of the first results of the new law was that every driver of an automobile had to be photographed and his picture sent to the police authorities. All automobiles in the country also had to be reregistered previous to August 20, mainly to give the police a chance to ascertain whether the new requirements with respect to number, plates, lamps, etc., had been complied with.

The minimum fine under the new law is 50 crowns (about $13), but the chief of police of Copenhagen has already let it be known that he considers the measure rather too drastic, and that he will be lenient in its enforcement. It is expected that the recent change of Ministers in Denmark will be greatly to the advantage of motorists, the new Minister of Justice, Hogsbro, having shown himself to be very favorably inclined toward automobilists, which could not be said of his predecessor Alberti, who has just been indicted for having wrecked a bank by speculating in American stocks. He made use of the privilege conveyed by the law, according to which the decision of special questions rests with the Minister, in order to place restrictions of all kinds on the use of automobiles. Thus, for instance, he prohibited automobile traffic on the shore road between Copenhagen and its suburbs, so that the automobile owners living in the suburbs could not make use of their cars, and it was also impossible to deliver goods by automobile to these points. It is now hoped that this prohibition will soon be raised.

New Proposed Rating Formula.

A special sub-committee of the (British) Society of Motor Manufacturers and Traders, appointed for the purpose, has evolved the following horse power formula for gasoline engines, viz.,

$$\text{H. P.} = K \times D\,(D-1) \times (R+2) \times N,$$

where K is a constant varying between .197 and .333; D, the cylinder bore in inches; R, the ratio of stroke to bore, and N, the number of cylinders. This formula, which is intended for use in connection with hill climbs and similar trials, takes into account the fact that it is not possible to obtain as high mean pressures in large as in small engines (by the factor $D-1$) and also the ratio of bore to stroke, both of which elements are neglected in the simple rating formula of the Royal A. C.

Important Exhibition to Be Held at Bourges, France.

The International Exposition of Agricultural Applications of Motor Cars and Industrial Uses of Alcohol is to be shortly held in Bourges, France. This is the first exhibition of the kind held in France, and perhaps in the world. It will include everything pertaining to stationary and portable motors, agricultural motor cars, automobile fire engines, special departments for agricultural machines driven by motors, tires, fuels and alcohol for industrial purposes. The date of opening is not yet announced, but it is said to be about the middle of September.

Road Congress to Be Held in Paris in October.

An International Road Congress will be held in Paris in October for the study of roads, in which everything pertaining to the building, improvement and maintenance of roads will be discussed. Experts and authorities are expected to either deliver lectures or submit papers upon the subject. Great French roads will be examined, excursions being made for the purpose from Paris. The Congress will be formally opened in the Sorbonne on October 11. M. Hende, chief engineer of roads and bridges at Mehen (Seine et Marne), is to be applied to for full particulars, etc.

Foreign Notes.

The city of Karlsruhe, Germany, intends to purchase a motor propelled fire wagon for carrying hooks and ladders and a centrifugal fire pump. The sum of 35,000 marks has been set aside for the purpose by the municipal council.

The Daimler Motor Company, of Stuttgart, Germany, has declared 6 per cent. dividends on its capital stock, the same as last year, although the net earnings this year were only 477,437 marks, as compared with 1,505,840 marks last year.

In Sweden plans are at present being considered for connecting the railroad leading through the Province Bohuslehn, on the Cattegat, with a number of smaller towns along the coast, and it has been suggested by Consul W. Lundgren to establish automobile services to these towns. An investigation of the practicability of such services in other countries is at present being made.

The Motor Cab Company of Great Britain, recently organized to operate a service of Napier cabs in London, has acquired the Coupé and Dunlop Brougham Company, Limited, and increased its capital to £100,000 by the creation of £50,000 additional shares of £1 each, and changed its title to the Coupé Company and Motor Cab Company of Great Britain, Limited.

Emperor Francis Joseph of Austria took his first automobile ride on the occasion of the recent visit of King Edward of England to the Austrian capital. He occupied a seat in the 70 horse power Mercedes car of Prince Leopold of Bavaria, his son-in-law, and after a trip into the country and back he expressed himself as very much pleased with his experience.

During 1906 patents for 663 automobile inventions were issued in France, and in 1907 patent applications for 1,750 such inventions were filed. A notable fact in this connection is that latterly a great proportion of these inventions relate to wheels and tires.

If oil cans are placed in the tool box the latter will soon become greasy and dirty, which is objectionable to most motorists. The best plan is to have a special compartment for each object in the tool box, and a French contemporary recommends a zinc lining for the tool box on the running board, so arranged that it can be readily taken out and cleaned.

The French automobile exports for the first seven months of 1908 amounted in value to 77,694,000 francs, as compared with 89,645,000 francs for the same period in 1907. The exports to Russia and Algiers increased during the year, those to Russia being about three times as great as in 1907, while the exports to every other country decreased.

Following the lead of several American railroads, the Paris-Lyons-Mediterranean road is now also having built a number of special freight cars for automobiles. These cars are provided with doors, both at the sides and the ends, and equipped with means for securely fastening the vehicles in the cars. An order for eighty of these special cars has been placed.

The Swedish Post Office has made trials with motor mail wagons on three different lines, but on two of these lines the results were so unsatisfactory that the use of the vehicles was discontinued in short order. In Gotland, on the other hand, there has been an uninterrupted service since the beginning of the present year, and the vehicles appear to give complete satisfaction.

As in practically all cities where drivers of taxicabs are being paid a percentage of the receipts, taxicabs are being driven at unduly high speeds in Munich, Germany, and the local automobile club has recently addressed a circular to the owners of these cabs calling their attention to this fact, and also to the fact that the cabs are often being driven with the muffler cut out. Numerous accidents caused by taxicabs have recently been reported in Munich, and the club warns the owners that unless steps are taken by them to prevent undue speed the club will take legal proceedings in the mattter.

W. K. Vanderbilt, Jr., announces that he is through with automobiling, except possibly for a ride in a taxicab. We think that both Mr. Vanderbilt and the automobile industry are to be congratulated on this decision.

MINOR MENTION

The Forest City Motor Car Company, Massillon, Ohio, announce that they will build 100 1909 touring cars.

The Wisconsin Auto Supply Company, Two Rivers, Wis., has decided to enter the manufacturing business. The company recently built two trucks as an experiment.

The Breeze Carburetor Company, 276 Halsey street, Newark, N. J., have adapted their latest model to the Ford cars, so it can be put on without further machining.

The Belden Motor Car Company, of Pittsburg, Pa., state that they have perfected their car, and expect to build 100 next year. They will exhibit at the New York Show in January.

There are said to be about 300 automobiles in Mobile, Ala., of which about 100 are driven by hired chauffeurs, and about fifty men are said to be employed at the garages in the city.

The Middleby Auto Company, which recently took over the plant of the Duryea Power Company, on River street, Reading Pa., will shortly engage in the manufacture of low priced four cylinder runabouts.

Hopewell Brothers, of Cambridge, Mass., announce that their tire casings will be hereafter fitted with a spiral japanned piano wire spring in place of the wire cord formerly used. The new construction is said to bind the tire closely, and renders access to the tire easier than before.

"Al" Poole, who was to drive an Isotta car in the Lowell races on Labor Day, was injured and his car smashed during practice on the course on August 29. Poole had his collarbone broken, while his mechanic escaped with bruises. The accident occurred in rounding a hairpin curve on the boulevard, where the car skidded into a ditch.

The Indiana system of automobile registration has started on its fourth round of the alphabet, there now being 7,902 automobiles and motorcycles registered with the Secretary of State. The last number issued on September 4 was B 2-2. About 2,700 registrations have been made since January 1, 1908, exceeding all previous records.

Building Commissioner Smith, of St. Louis, Mo., has decided on a rigid inspection of the garages in the city, and has sent inspectors out to all garages to see that the regulations recently passed by the municipal assembly are complied with. The regulations prohibit smoking in garages, state the care to be taken in the handling of gasoline and prohibit automobiles entering garages without first extinguishing all lights.

No less than three speed traps are said to be established on the 4 miles of road from Eagleville to Trappe, Pa., and the Norristown A. C. last Sunday had a squadron of scouts patrolling the road and warning motorists.

Club Notes.

The Britt Automobile Club, of Britt, Ia., which was recently organized, made its first annual run to Crystal Lake and return on August 28. Ten cars participated, and the members report the run to be a great success.

The Kokomo (Ind.) Automobile Club was incorporated at that city on August 29 last, the purpose of the club being to create interest in the public highways of Howard County. The directors are A. V. Conradt, G. L. Davis, H. C. Davis, J. A. Kautz and S. Tudor.

The Licking Automobile Club has been organized at Newark, Ohio, with J. I. Matthias as president, M. J. Reese secretary, and Carl Swisher treasurer. The organizing meeting was held at the Board of Trade on August 31, J. M. Maylone, secretary of the Board of Trade, occupying the chair.

The first formal meeting of the New Haven Auto Club took the form of a house warming at its new clubrooms in the Café Heidelberg on Saturday evening, September 5. A Dutch supper and smoker occupied the evening. The club purposes to hold a hill climb early in October, and is greatly in favor of road improvements.

The Kokomo Automobile Club, of Kokomo, Ind., has been incorporated, with 100 members, without capital stock. Among other things, the club will make an aggressive fight for good roads. Officers of the club have been elected as follows: Henry C. Davis, president; J. A. Kautz, vice president; Geo. L. Davis, secretary, and S. Tudor, treasurer.

The Licking Automobile Club was organized at a meeting of automobile owners in the Board of Trade rooms at Newark, Ohio, on August 31. All car owners in Licking County will be eligible to membership. The following officers were elected: J. I. Mathias, president; M. J. Reese, secretary; C. Swisher, treasurer. The club was to meet again on September 8.

The first formal meeting of the New Haven Auto Club took the form of a "house warming" at its new club rooms in the Café Heidelberg on Saturday evening, September 5. A Dutch supper and smoker was enjoyed by its seventy-five members, and by about 300 of the city's motorists invited to inspect the rooms. The club plans a hill climb early in October.

The Bureau of Tours of the Automobile Club of America has prepared an eleven days' itinerary from Chicago to Savannah, the route leading through Indiana to South Bend; from South Bend to Indianapolis; from Indianapolis to Louisville; from Louisville to Mammoth Cave; from Mammoth Cave to Nashville; from Nashville to Huntsville, Ala.; from Huntsville to Chattanooga; from Chattanooga to Atlanta; from Atlanta to Macon; from Macon to Swainsboro, and from Swainsboro to Savannah; in all, 1,274 miles.

An automobile club has been formed by twenty motorists of Red Bluff, Cal.

The Beloit (Wis.) A. C. held an automobile and motorcycle race on Labor Day.

Garage Notes.

The Stanton Garage has been opened on Johnson street, Appleton, Wis.

Joseph Saris will erect a three story garage at Beloit, Wis., at a cost of about $10,000.

The Ellis Motor Car Co., agents for Pierce cars in Newark, N. J., have removed to 124-126 Washington street.

Eugene Wusthoff, Milwaukee, Wis., is erecting a garage on Thirteenth street, between Grand avenue and Wells street.

The Chattanooga Automobile Co., Chattanooga, Tenn., will handle Franklin and Cadillac cars exclusively during the coming season.

The Stewart & Clark Manufacturer Company will shortly open a branch in New York city for the handling and repair of their speedometers.

The Curtin-Williams Automobile Co., agents at Columbus, Ohio, for the Peerless, Oldsmobile and Cadillac lines, declared a 10 per cent. dividend on September 1.

Smith & Lewis, who have been conducting the Anderson garage at the rear of 1060 Bedford avenue, Brooklyn, will move to 515 Putnam avenue during the next month.

The Minnesota Motor Sales Co., Minneapolis agents for E. M. F. cars, have secured a plot and will erect a $20,000 garage on the right hand side of Hennepin avenue, at Ninth street.

The Tarentum Auto Co., of Tarentum, Pa., have erected a brick garage on Mill street, where they will conduct a general storage and repair business in addition to handling the Buick cars.

H. W. Kakaska, of Stevens Point, Wis., has opened an automobile repair shop at the factory of the Krieger Tool and Manufacturing Co. on Seventh avenue South, Grand Rapids, Wis.

Emil Estberg, Milwaukee, Wis., agent for the Pope-Hartford, Pope-Waverley and Woods Electric, has moved into the garage erected by Dr. Lewis Sherman, at 450-460 Jackson avenue.

A 35x140 foot one story garage building is being erected for the Stoddard-Dayton agency in Minneapolis on Hennepin avenue, near Ninth street, white glazed brick being used for the front.

The garage located at 906 Union street and Park Plaza, Brooklyn, N. Y., will hereafter be known as the Montauk Garage. The business has been reorganized, E. M. Stratton now being manager.

The Miller Machine Co., Inc., Defiance, Ohio, have opened a garage at Perry and First streets. The building is constructed of brick and is two stories, 40x132 feet. A general garage business will be conducted.

Plans have been completed for a 40x30 foot addition to the garage of the Milford Auto Machine Co., on Main street, Worcester, Mass. This will increase the storage capacity of the garage to twenty-five machines.

G. S. Hill has sold his interest in the Hill Motor Car Co., located on Merrimack place, Haverhill, Mass., to Elmer C. Bassett, of Boston, who will take possession immediately and continue the business along similar lines.

The Smith-Clemens-Hopping Garage, of Dayton, Ohio, removed to their new quarters on South Main street, near Fifth. Alterations are under way at the new location, and when these are completed the garage will accommodate 200 cars.

A new garage is to be erected on West State street, Rockford, Ill., by Mr. and Mrs. Laverner Cole, of that city. The building will measure 48x60 feet, and is intended to be a garage only for machines procured from the Cole agency.

The Levy & Hipple Motor Co., Chicago, representatives of the Chalmers-Detroit, are erecting a three story building on Automobile Row. The building will be 42x162 feet, and will include a machine shop, storeroom and garage, as well as the exhibition rooms.

W. H. Shaw will establish a garage at Parkston, S. Dak.

H. E. Jacques has opened an automobile repair shop at 338 North Main street, Wichita, Kan. Mr. Jacques was long in the employ of the Missouri Pacific Railroad.

The Elmore Motor Co., of Los Angeles, Cal., have begun the erection of a new garage at 742 South Olive street, which is expected to be ready for occupancy October 1. The building will be 80x167 feet, and will be fitted up in thoroughly modern style.

The Rockaway Motor Co., Kane avenue and Jamaica Bay, Far Rockaway, N. Y., were dispossessed last week by John R. Murray, owner of the premises, and two days later workmen began tearing down the shop, leaving the machinery exposed to the weather.

Damages estimated at $200,000 were caused by a gasoline explosion in the basement of the Taylor-Palmer garage, 169-171 Huntington avenue, Boston, Mass., on September 6. The garage is a three story structure of brick and terra cotta, and the eighty automobiles which it contained were practically ruined by the explosion.

New Incorporations.

Cavicchi-McDonald Motor Car Co., Kittery, Me. —Capital, $25,000.

New London Automobile Co., New London, Wis.—Capital, $5,000.

Miles Auto Co., Louisville, Ky.—Capital, $10,000. Incorporators: L. L. Miles, W. H. Curtis, A. B. Harris.

International Autocab Co., Dover, Del.—Capital, $500,000. Incorporators: F. P. Jones, F. W. Mills, E. J. Forhan, No. 154 Nassau street, New York city.

Burk Auto Co., Chattanooga, Tenn.—Capital, $10,000. Incorporators: Anton Pyron, T. W. Fritts, S. B. Elmore, Albert Rogers and W. H. Burk.

Denver Automobile Service Co., Denver Col.—Incorporators: J. W. Smith, R. J. Bardwell, W. V. Elliott, R. C. Hecox, Chas. H. Smith, Jr., all of Denver.

Walter Christie Automobile Co. New York.—Capital, $400,000. Directors: Van S. Howard, 308 West Fifty-eighth street; C. Colgate Moore and G. W. Moore, 602 West Fifty-second street, New York.

Motor Car Sales Co., Indianapolis, Ind.—Capital, $25,000. Incorporators: B. W. Twyman, C. C. Hauger and C. O. Britton. The company has established headquarters at 330 North Illinois street, with the Willis-Haywood-Holcomb Co., and will supply Indiana agencies outside of Indianapolis with Studebaker and E-M-F cars. The Indianapolis trade will be handled by the Willis-Haywood-Holcomb Co.

Trade Personals.

Benjamin F. Adams, formerly connected with the White and Peerless agencies in Newark, N. J., has associated himself with the Ellis Motor Car Co., of the same city.

A. G. Southworth has succeeded H. J. Koehler in the management of the Buick Automobile Agency in New York city. Mr. Koehler will represent the E. M. F. product in New York and vicinity.

Henry Fenn, of the firm of Fenn Brothers, of Sioux Falls, S. Dak., will shortly leave for Seattle, Wash., where he will establish the agency for the Cadillac for the State of Washington. Mr. Fenn will represent Fenn Brothers in addition to the agency.

H. T. Clinton, in charge of the agency and publicity departments of the A. L. A. M., has resigned and will be succeeded by E. P. Chalfant, who will handle agency matters, and by Coker F. Clarkson, secretary of the mechanical branch, who will handle publicity matters.

Henry Cave, A. M. I. M. E., who has been connected with the engineering departments of the Electric Vehicle Co. and the American Locomotive Automobile Co., has severed his direct connection with the automobile industry and has formed a company, under the name of the "Autogenous Welding Equipment Company," to handle the Davis-Bournonville Co.'s oxy-acetylene welding and cutting apparatus in the New England States and northern New York. This company has installed a plant at 92 Hayden avenue, Springfield, Mass.

Trade Literature Received.

Overland Automobile Co., Indianapolis, Ind.—Circular of the Overland 1909 models.

Pneu l'Electric Co., 1610 Broadway, New York. —Catalogue of the G. & A. carburetor.

Peerless Specialty Co., 1876 Broadway, New York.—Circular of the Peerless speedometer.

The Overland Automobile Co., Indianapolis, Ind. —Circular of the 1909 model Overland cars.

The O'Neil Tire and Protector Co., Akron, Ohio. —Circular of the Akron-Williams repair vulcanizers.

Dayton Motor Car Co., Dayton, Ohio.—Preliminary announcement of Stoddard-Dayton 1909 models.

Billings & Spencer Co., Hartford, Conn.—Circular of rod and yoke ends according to A. L. A. M. standard.

The Billings & Spencer Co., Hartford, Conn.—Circular on rod and yoke ends, A. L. A. M. standard and regular B. & S.

Autogenous Welding Equipment Co., 92 Hayden avenue, Springfield, Mass.—Circular on autogenous welding by the oxy-acetylene process.

Autogenous Welding Equipment Co., Springfield, Mass.—Description of the autogenous welding process and the apparatus therefor.

New Agencies.

Chicago, Ill.—Webb Jay, Premier.

Jewell, Ohio.—Seiple & Owens, Buick.

Papineau, Ill.—Tegg Brothers, Jackson.

Wichita, Kan.—H. J. Donohue, 351 North Topeka avenue, Lambert.

Patents Issued September 1, 1908.

897,270. Running Gear for Vehicles.—William H. Chapin, Springfield, Mass. Filed December 11, 1905.

897,368. Automobile.—Henry K. Holsman, Chicago, Ill. Original application filed February 8, 1907. Divided and this application filed June 12, 1907.

897,421. Brake for Automobiles.—Gordon Stables, Philadelphia, Pa. Filed April 24, 1907.

897,466. Spark Plug Guard.—Robert S. Kearney, New York, N. Y. Filed April 9, 1907.

897,515. Friction Drive Chain.—Warren J. Belcher and William M. Butler, Hartford, Conn. Filed May 25, 1908.

897,574. Valve Mechanism for Fluid Motors.—Albert Becht, Paris, France. Filed March 31, 1904.

897,579. Bicycle Handle Bar.—James E. Brannan, Idagrove, Ia. Filed December 20, 1907.

897,591. Automobile Running Gear.—John W. Cooper, Boston, Mass. Filed July 2, 1907.

897,630. Detachable Rim.—Rudolf Kronenberg, Ohligs, Germany. Filed December 21, 1907.

897,664. Disappearing Luggage Carrier for Automobiles.—Edward T. Robinson, St. Louis, Mo. Filed February 11, 1908.

897,604. Spring Suspension.—William O. Worth, Evansville, Ind. Filed November 21, 1906.

897,701. Detachable Rim for Vehicle Wheel Tires.—Edwin A. Baker, New York, N. Y. Filed January 25, 1907.

Grand Central Show Committee Meeting.

At a two day meeting of the show committee for the Grand Central Palace Show, held in New York last week, a final selection was made of the posters to be used for the exhibition, while the plans for decorating were cut down to two designs. Of the two posters adopted one will be in seven colors and the other in five. Space applications and diagrams have been sent out from the office of the American Motor Car Manufacturers' Association.

Premier "Hundred Centuries" Run Ended.

The Premier "30" touring car, which started on June 1 to run 100 miles for 100 consecutive days, is reported to have reached Chicago Tuesday, after its 100th daily run. It is the intention of President H. O. Smith to have some Western automobile club appoint a technical committee to inspect the car and make a report upon its condition when it is hauled down. The car, it will be remembered, took part as a press car in the Glidden Tour, and later was driven to Washington, D. C. The driver has throughout the trial been accompanied by disinterested observers, we are informed.

Status of the Vanderbilt Race.

A meeting of the Vanderbilt Cup Commission of the A. A. A. was held Wednesday afternoon, September 9, upon the return of William K. Vanderbilt from Europe. Contrary to expectations, Mr. Vanderbilt did not bring with him any European entries for the race. It was unanimously decided by the commission, however, to run the Vanderbilt race even if no more than the present number of entries, seven, are received. The entries thus far are a Mora, Acme, Thomas, Chadwick, Mercedes and two Knox. It was announced that the preliminary closing date for entries would be extended from September 1 to October 1, entries being received up to the latter date at the single fee of $1,000. Several other cars, including two Locomobiles and a Frayer-Miller, are said to have been promised. It is thought doubtful whether the Mora car will take part, because of difficulty in getting it ready in time, and it is further reported that Robert Graves, instead of racing the winning Grand Prix Mercedes, on which he holds an option, has decided to run his 1905 Mercedes car. Two additional entries of foreign cars, both privately owned, are expected. One is a Hotchkiss car that took part in the last Vanderbilt Cup race, and the other an Isotta stock car. It is thus apparent that the ban of the recognized national automobile clubs on the Vanderbilt race is quite effective so far as the foreign industries are concerned.

State Secretary Schmahl, of Minnesota, strongly recommends the enactment of a law to provide for a uniform system of licensing and numbering automobiles throughout the State. He says that the present system whereby each municipality or township organization issues licenses of its own has resulted in great confusion, and suggests that the license fee need not be more than $1.50 or $2 a year to bring the State a good revenue from its 10,000 automobiles.

The Horseless Age

First Automobile Journal in the English Language

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The Design of Frame Brackets, Attachments and Components.

By Warren Noble.

If the reader will mechanically recapitulate the features of chasses that he knows intimately and compare the one of his greatest admiration with any other, I am sure he will find that the whole difference lies in such things as details of frame construction, engine, radiator and transmission support, tank hanging, spring brackets, etc. It is upon such details that I propose to touch in the following article, not delving further into attendant theories than absolutely necessary to explain the elements encountered in our progress from the forward dumbirons to the rearward ones. By starting thus at the extreme forward end of the frame and taking in all the attachments at frame level, we shall touch on many vital questions (particularly vital after the experiences of the Glidden Tour), such as radiator support, engine suspension, etc.

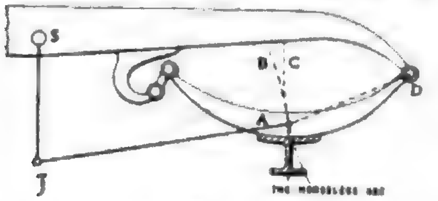

Fig. 1.

In considering the most efficient mode of supporting the forward end of the front spring, it is necessary to know certain other features of the construction of the chassis, notably the position of the steering fore and aft rod. Examine Figs. 1 and 2. In both I have depicted a diagrammatic representation of the conventional running gear forward suspension.

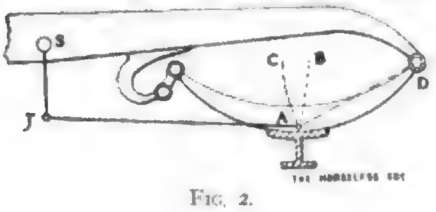

Fig. 2.

In both S J represents the steering arm, J A the fore and aft rod and D the forward spring eye. Examination will show the difference in the two cases to be in the length of S J. In Fig. 1 a long steering arm is shown; in Fig. 2 a short one. Considering all other conditions identical, trace the arcs of the point A first with J and then with D as the centre. The arcs A C indicate very approximately the path traveled by a point such as A (which we will think of as the front joint of the fore and aft rod). In such a construction as shown, the forward half of the front spring acts as a radius rod, hence the arc A C is nearly the path that would be described in practice by the core of the forward steering rod joint on the wheel passing a jolt. Now in Fig. 1, J A is lowest at J, while in Fig. 2 it is lowest at A. It will be seen that in Fig. 1 the arcs A B and A C are almost coincident, whereas in Fig. 2 they are distinctly divergent.

In practice the effect of such an arrangement as shown in the latter diagram is to cause unsteadiness of the steering when traveling on a rough road, whereas with the arrangement of Fig. 1 a larger motion may be dealt with, with much less deflection from this cause.

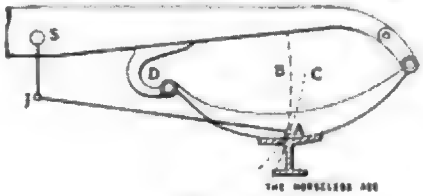

Fig. 3.

Now, the reason I have digressed so widely from my theme is to indicate the necessity of considering the layout as a whole, if general efficiency is desired. Thus the arrangement in Fig. 1 is undoubtedly superior from every viewpoint to that in Fig. 2, but the steering gear being designed or made of unalterable ratio and fixedly located, it is impossible to secure its advantage and still use the same shackling.

In Fig. 3 an alternative method is indicated. The same letters are used, the only difference being that the shackling lies at the front end of the spring in place of the pivot, which now takes the place of shackle in Figs. 1 and 2. Here the arcs A B, A C are as nearly coincident as the corresponding arcs in Fig. 1. Some readers may remember the crude manner in which this idea was carried out on a now obsolete car, as shown in Fig. 4. The bracket pivoted to the spring eye slid on a circular bar projecting from the front of the frame.

Before passing on to the actual shop details of spring hanging, let us look at Fig. 5. This is entirely similar as regards the suspension to Figs. 1 and 2, but with the spring inclined from the horizontal. Supposing R to be a road obstacle, the wheel strikes it at a point forward of a vertical line through its centre, so that the direction of the shock is in some such direction as C D, slightly out of the vertical in a counter clockwise sense. By setting a spring with the line connecting its pivoted points A B a few degrees from the horizontal, not only is the spring more advantageously loaded but other beneficial results are obtained.

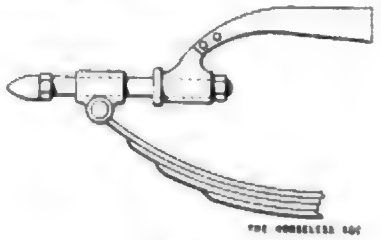

Fig. 4.

First, the steering points are thus forwardly inclined, which is most desirable, as steering wheels having their stubs so located will tend to automatically return to and maintain the straight ahead position. A spring so loaded will plunge less than a horizontal one. The inclination, in combination with the arrangement shown in Fig. 1, will render the arcs of the vibration under load so nearly coincident that the fluctuations of the steering wheel will be inappreciable.

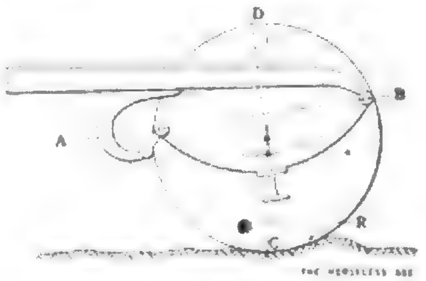

Fig. 5.

There is one point in frame construction which should be thoroughly impressed on every draughtsman who ever has anything to do with the subject, namely, that the under side of the frame bars must not be drilled except in cases of absolute necessity. In the shop it should be the assembling foreman's special care to see that this same under side

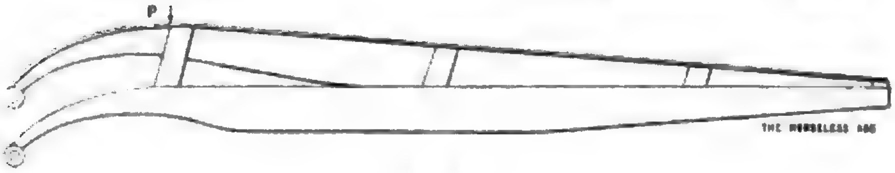

Fig. 6.

is not even deeply scratched in marking off. I think that all frame makers will bear me out in these statements and agree that where such drilling is performed reinforcement must be provided for. The reinforcement is always obtained where cross bars are secured to the side bars, as the lower side of the cross bar channel and the attached gusset provide the reinforcement required.

FLEXIBILITY ESSENTIAL.

While on the subject of the "sine qua non" factors in frame construction it is fitting that the greatest of these be mentioned, viz., flexibility. Sufficient stiffness to be useful for the permanent alignment of parts is impossible to obtain. A frame is a flexible support, and as such it must be treated in assembling the parts upon it. If an assembled frame be raised from the ground by one corner, say P, Fig. 6, it will be found that the rear cross bar remains in contact with the floor for its whole length, even if the point is raised, say, 6 inches.

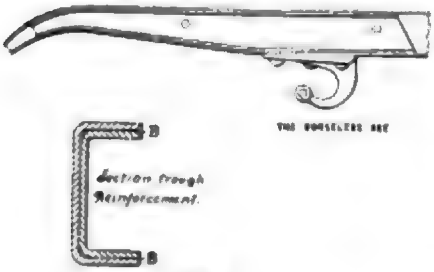

Fig. 7.

It may be held that here we have an abnormal condition of distortion. That the distortion is abnormal I agree, but not more so than that distortion which occurs in traversing an extraordinary road. This distortion effect can be observed even with frames built for stiffness, though less markedly, but if the frame weight alone will cause such distortion, how much greater deflections will be caused by the weight of the power plant, the body and the passengers? Owing to the missionary work done by frame makers during late years this feature of frame construction is fairly well understood, but even at the present day it is not uncommon to see a frame overloaded with cross stays with the idea of stiffening it, and so hinder its true function.

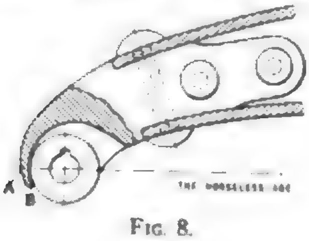

Fig. 8.

The weakest portion of any frame of conventional pattern is from the front cross bars to the spring eyes. By this statement I do not mean to say that the frame bar is excessively loaded between these points, considered purely as a beam. But particularly with a machine capable of high speed this is the portion of the frame that has imposed upon it the most trying work. It is subjected to more direct impact load than any other portion of the frame; it is without tie for a considerable distance, and the greater portion of the strains due to taking a turn come right on this portion of the frame. For these reasons, and also for the sake of lightness in the complete frame, I strongly recommend the use of a reinforcing channel, as shown in Fig. 7. This consists of a channel similar in form to, and a light pressing fit in, the forward end of the frame, running from the neck of the forward spring iron to a line aft of the rearward front spring hanger. This reinforcing channel should be firmly held into the main channel by rivets, or, better still, be autogenously welded along the edge at B B. Its large end should be cut diagonally as shown, and not straight across, the theory being the same as that demanding diagonal shaping of the inner end of liner tubes.

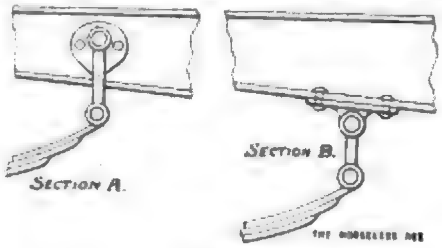

Fig. 9.

SPRING HANGERS.

Now let us consider spring hangers. Fig. 8 shows the usual type, which is excellent. The great difficulty with these front irons is that of securing neat appearance. It is the most prominent of all frame brackets, and the use of 2 inch wide springs has done much to render more difficult what was always an awkward detail to work out. Compactness is the feature most desired for appearance's sake—an avoidance of bulbous lines. One small point that should be marked is the line of ending of the shroud. The usual point to finish this is at A, but if the wall is continued to B a completely closed appearance will be secured when viewed from the front, greatly enhancing the neatness of the detail.

Practice is divided as regards the rearward spring hanger, owing chiefly, I believe, to economical considerations. The rear spring shackle may be above or below the spring eye. If above it is, of course, continuously in compression; if below, in tension, and must be mounted in conjunction with a hanger bracket. Where above the spring it should be mounted as at A, Fig. 9, and by no means as shown at B. In Fig. 10 we have an example of the underhung shackle bracket as very commonly applied, mounted with rivets and a reinforcing plate inside the frame member. I do not favor this mode of attachment for the bracket, since all the "rock" of the spring is taken up by bending in the lower flange of the frame, with the result that a crack will frequently appear (especially with nickel steel frame stock) along some lines, such as C, where the stock has already been subjected to heavy strain in the forming die.

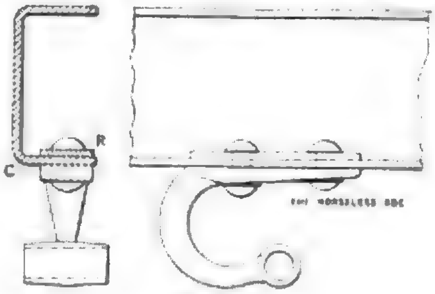

Fig. 10.

A much better scheme is to make such a bracket according to the design shown in Fig. 11, wherein the "rock" of the hanger is taken by the web of the channel rather than on the lower plate. Although no reinforcing plate is shown in the sketch, it is not good practice to leave it out, and it should by all means be included.

Theoretically the underhung shackle type of suspension is the better, and this theory is entirely borne out by results in practice. It will readily be seen that with an overhung type, if the spring is flattened under load, it will meet with considerable resistance in returning to its normal curvature, whereas with the underhung type the return is facilitated by all the tendencies of the mass of the machine. That this superiority is borne out in practice there is no manner of doubt. In my own experience, with facilities for observing great numbers of different cars in continual daily use, I

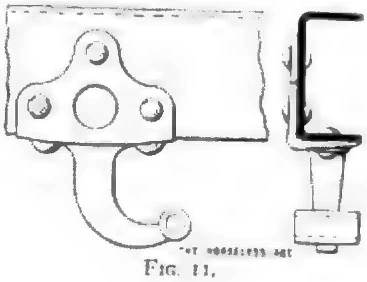

Fig. 11.

have found that broken front springs occur frequently in connection with the overhung shackle and very rarely with the underhung type. I remember in a conversation I had with the mechanic in charge of the A. C. A. garage this same point was raised, and he then said that at least 90 per cent. of the breakages of front springs occurred on cars fitted with overhung shackles. Inquiry in other entirely impartial quarters led to similar results.

FRONT CROSS BARS.

The pattern of front cross bars used depends, of course, on the scheme of engine suspension to be employed. The usual thing is to have the main front cross bar of similar section to the side bars, riveted into the frame. Many foreign manufacturers, however, are returning to that oldest of all schemes for cross material, viz., the tube, and are simply using floating tubes in flanged brackets riveted into the side bars (Fig. 12). All other considerations aside, this is excellent, since its adoption removes the necessity for drilling the under side of the frame, and indeed there would appear to be few objections to the system, inasmuch as it is fairly cheap (not as cheap in quantity as a pressed bar, but cheaper for small lots, since there is no tool cost), and easy of attachment to the engine base. The floating of the tubes in the supporting brackets provides for the flexibility of the frame in one direction at least, and the great ease with which a lateral movement of the engine can be made should recommend it strongly to the assembler.

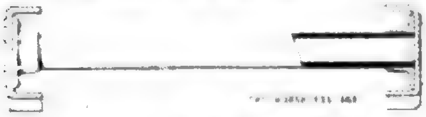

Fig. 12.

If the engine is secured to the side bar, the front cross bar may be behind, in front or beneath the radiator. Now, inasmuch as the front cross bar is subject to the hardest kind of strains, it is entirely desirable that a drop bar be avoided and a bar from straight stock be used. The question then becomes chiefly one of appearance. A bar in front of the radiator is not sightly, though a tube does not look badly; behind the radiator it is invisible, and the "nakedness" of the lower tank of the radiator offends the eye a little; beneath the radiator its width or depth, as the case may be, destroys the general effect of lightness—daintiness—that it is so necessary to attain. I have wrestled over this matter with critics who knew nothing of the problem except that they "liked" a certain outline. The problem then was to get the outline and a large enough radiator. Eventually the construction shown in Fig. 13 was determined on. A straight cross member is used. The radiator tank obscures this and is set not more than an eighth of an inch clear. A plate B is cut, so shaped as to match the tube head of the radiator accurately, and spaced about one-sixteenth of an inch from it. At either end it is turned back for attachment to the side bars by "through" bolts. The plate should have ears left in it at C C, so that it finishes flush with the frame top. The lower line of the plate offers opportunity to make the front elevation of the machine harmonious in angle lines or curves. In my own case I made the lower lines match the centre axle drop. If the plate is finished as shown by the dotted line D, an excellently neat and clean effect is arrived at which cannot be equaled by any other method that I know of. This "false cross bar" also provides a splendid seat for the forward end of the starting crank bracket, and solidity for this generally flimsily supported and neglected bracket is to be welcomed. By referring to the starting crank bracket in this way I do not wish it understood that I think this is the place for a starting crank bracket. The proper place for a starting crank is on the engine, and it should be carried in the end of the crank bearing hub. A starting crank is part and parcel of a gasoline engine, let it then become an integral part and not a neglected necessity.

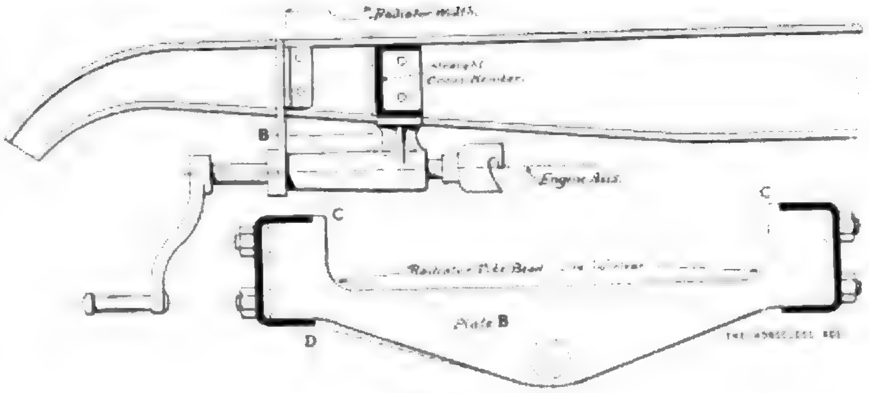

Fig. 13.

RADIATOR SUSPENSION.

That radiator suspension is one of the difficult matters is no secret. At first the makers of honeycomb radiators were led almost to despair by injury to their radiators from strains transmitted to them by the frame, until they made a stronger radiator. Every maker of radiators of the cellular type has been through the mill of this trouble, and even at the present time (vide the Glidden Tour reports) radiators leak from the same old cause of frame distortion that some designers have steadily ignored.

A radiator is affected by two adverse influences, viz., vibration and frame distortion. Engine vibration is, I fancy, a negligible quantity in later designs, since the very foolish practice of staying the radiator to the engine (to the dash is little better) is quite dead, or ought to be. All the stay that a radiator needs at the top is the connection hose from the motor, whether it is held on brackets or trunnions below. Fig. 14 shows an excellent trunion scheme which provides universal flexibility, insuring absolute freedom from frame distortion strains to the radiator body. It consists of a circular stub T projecting outward from the side brackets riveted to the radiator body. These brackets, it might be mentioned here, should be carried round beyond the lower corner radii to take the strain of support from the rivets. On the circular stub is mounted the spherical collar S, free to slide laterally in either direction. This is carried in the frame bracket B (being inserted by the slot method described by the writer in an article termed "Odds and Ends," in The Horseless Age of July 29). The bracket having a spherical seat, permits angular motion in any direction. The radiator being supported between two such brackets, a differentiation in level between the side bars carrying the brackets will cause the spherical collars to rock in their seats and also to move slightly upon the

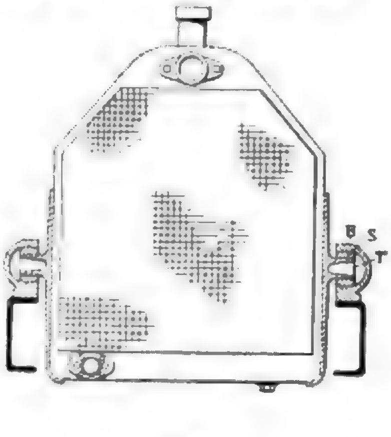

Fig. 14.

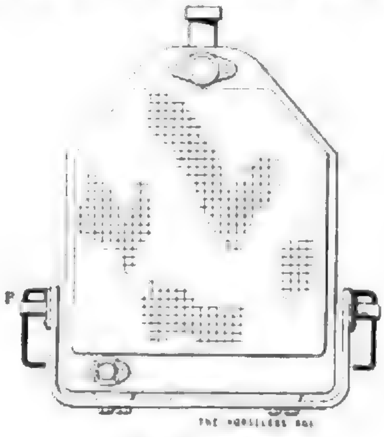

Fig. 15.

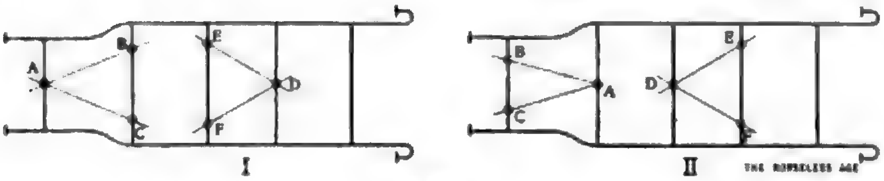

FIG. 16.

stubs that carry them, so permitting any distortion to take place without effect upon the radiator body.

Fig. 15 shows another means of suspending a radiator that is fairly good. It comprises a sheet steel strap or cradle attached to the base of the radiator by means of two short stubs. These stubs fit loosely (with about .01 inch clearance) in holes in the side bars, as at P. Distortion in the axis of the car is taken care of by these stubs, while the fact that they lie loosely in their very narrow seats, whose width is simply the thickness of the frame stock, permits adjustment to any and all distortions. In any case, distortion or binding of the stubs affects only the pendulous sides of the cradle and not the radiator body.

ENGINE SUSPENSION.

Four point suspension is most common, three point suspension provides an effective talking point, suspension by underframe is very well known, and freak suspensions on pivoted sub-frames are not without disciples. No one seems to be settled in mind as to the truly best system of suspension, even for given circumstance. Admitting the need of flexibility in frame construction, it is difficult to reconcile with its demands a four point suspension from the side bars. With an underframe subjected only to secondary or transmitted distortions the case is different, but where there are arms from the crank case to the side bars and the quadruple point suspension is used, it would certainly appear that a twist must be set up in the length of the crank case corresponding to the major distortion of the frame. This applies not only to the crank case, but to the transmission case as well, and with the object of analyzing the effect of frame distortion on such a suspension I have diagrammatically represented opposed three point systems in Fig. 16. In each case A B C are the points of engine suspension and D E R of the transmission. In construction I the apices of the triangles are opposite each other. The distortion in a frame is invariably greatest at the ends and extends between the end cross bars. Thus, if the right hand member, which is at the proper level at the rear cross bar, is forced up so that is is an inch or so above the plane of the left hand bar at the front, the rear spring hanger, if any is used, will be depressed similarly and lie below the corresponding series of planes of its mate.

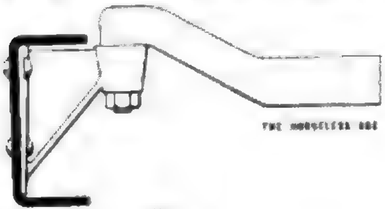

FIG. 17.

In passing over a rough road this alternation of the planes of the side bars continues, as front and rear wheels separately or consecutively pass over rough places. The greatest distortions occur when obstructions are met simultaneously by oppositely located front and rear wheels. In any case, distortions are greatest at the locations of the major cross bars, so that the distortion of the triangle would be least where the base was forward and the apex on the frame axis as in construction II. Setting an engine as in construction II is a bit troublesome from the designer's standpoint and has been neglected. The point against it which appeals most forcibly to me is that the torsion of the drive is transmitted through the length of the case to points B and C, whereas in the alternative setting, B and C are close to the point of power delivery and absorb the torsion before it reaches the side wall of the case.

The application of a similar analysis to the transmission support will indicate the most advantageous system. Personally, I invariably recommend the setting of a chain drive transmission, as in construction I, and a live axle transmission, as in construction II. The reasons will be obvious.

I mentioned just now that many foreign makers have readopted the formerly neglected tubular construction, particularly for cross bars. There is no better way of carrying an engine that I can immediately think of—though there are many less costly—and by the use of it the engine suspension system I, Fig. 16, becomes easily possible. The conventional scheme with the lipped arm to pack in place on the frame with a block of wood and held by a through bolt (sometimes two) at each point is well known as an assembler's great trouble, particularly where only one universal coupling is provided between engine and gear box. With this construction, too, long arms from the aluminum case are necessary, and where these are flawed or of light design the frame twist will soon fracture one of them. This, in fact, is one of the most difficult points that the maker of main frame suspension type of machines have to contend with. In Fig. 17 I show a system of suspension that in a slightly modified form is used by one of the successful makers of America. A steel bear spans the distance between brackets, which are riveted to the side frame members, and the engine is slung from two such bars. I have had a little experience with such suspension, not altogether satisfactory, but on reviewing the matter I am inclined to ascribe the gradual but recurrent loosening up of the engine found to other causes than the mode of suspension. It is an excellent system from an assembler's point of view.

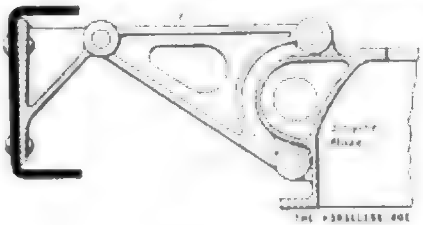

FIG. 18.

In Fig. 18 is illustrated a method of suspension that has many friends in Europe, especially in England. Lugs are left on the crank case at two or more points in its length, these being bored parallel with the motor axis to accommodate the forked attachment eyes of the suspending distance pieces. Round pins lock distance pieces and lugs flexibly together, and other similar pins connect the distance pieces with brackets bolted to the web of the side bars. This construction is probably the cheapest of any in the end. It may be made very neat and is very dependable, a quality singularly lacking in the aluminum arms of the usual main frame suspended crank case.

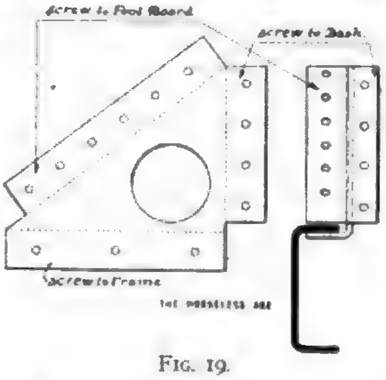

FIG. 19.

Suspension of the engine and gear upon trunnions, like the radiator suspension above described, I expect to see very shortly. Underframe constructions are excellent from the standpoint of minimum distortion, but are abominable from nearly every other point of view, particularly that of neatness. That they are almost a necessity with a long six cylinder engine is a matter for regret.

Passing rearward on the frame we get to the dash supporting brackets. There are all kinds of parts for holding these neatly, but I like the method shown in Fig. 19 as well as any. A one-eighth inch steel plate is cut, as shown in the development in Fig. 19, and folded to lie, as represented, in place on the frame. This makes a light, firm and cheap bracket, and just as neat a one as can be made.

In an article in THE HORSELESS AGE of July 29 I referred to the warp of the frame affecting the cross slide mechanism, and in Fig. 20 the illustration referred to is reproduced. This is an arrangement that is especially commendable, and one in which stick-

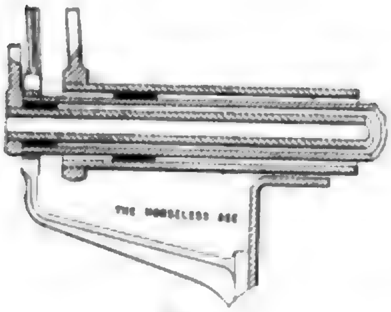

Fig. 20.

ing, binding or hard motion of any sort is unknown under any condition. The novel feature is the use of a third tube running between the attachment brackets, the brake shaft lying within and the cross slide without it. Provision is made to support the third tube so as to be immune from torsion. The arrangement is particularly handy in cars having the change gear striking mechanism forward in a separate case, as so many long wheel base machines (generally chain drive) do. Where such a construction is used the striking mechanism housing is affixed to the third tube and another active cause of binding on modern cars is removed.

Let me deal an instant with change lever and brake lever quadrant brackets. The only strain that such a bracket has to bear is that of setting the hand brake, but since effective braking can only be secured if the stationary members of the brake are firmly held, it is necessary that the bracket carrying the quadrant be stiff enough.

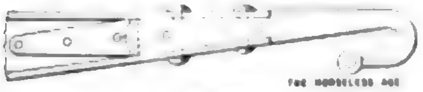

Fig. 22.

Many designers have ceased making outlying levers inclined from frame to handle, on account of the difficulty of laying out the quadrant gate and in machining the conical bosses for holding them. Now the closer the lateral stay of the bracket is to the frame the stiffer it becomes, and also the stiffer the levers are on their tubes, particularly the change gear lever. Also, they are more convenient for the driver's use. So, since the making of these brackets requires a fixture anyway, it is worth while putting in the additional work in the drawing room and make an "outset" arrangement. Another thing that is curious to me is the extraordinary amount of metal that some firms seem to consider necessary in the make up of a change quadrant. One often sees them with one-quarter inch and even five-sixteenth inch walls and separators. This is unnecessary and unsightly; one-eighth inch is ample in a good bronze.

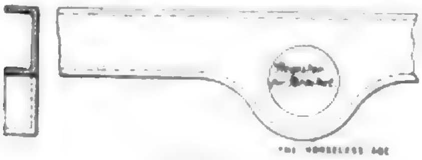

Fig. 21.

SPROCKET BRACKETS FOR CHAIN DRIVE.

One of the hardest of all frame brackets to make of neat form is a combination spring and sprocket bracket for a chain driven car. The ideal bracket requires a special form of frame illustrated in Fig. 21. This is a good—probably the best—way to attach a sprocket bracket, but it cuts too much into the frame stock to render it very commercial, consequently crescent shaped bases are very commonly employed, the sprocket shafts lying just below the frame lower section. The bracket can only be secured to the frame during the general assembling, as it is futile to attempt drilling frames in fixtures. The only thing that can be done is to locate the brackets from the transmission during the assembling process, drilling in place and then bolting or riveting. The best scheme of bearing mounting is to use a standard ball bearing located in a special housing, the centre of this lying in the chain line. This makes an excellent job, but a better one is to have the bearing manufacturer supply a specially ground outer case, if the order is large enough.

REAR SUSPENSION IRONS.

Unless a platform suspension is used, in which case the rear cross bar carries the bracket for the attachment of the third spring, I think the arrangement shown in Fig. 22 is the best for rear dumb irons. The side bar is extended for a matter of 8 to 12 inches aft of the rear cross bar, and the dumb iron is made so that it fits the channel along to the end of the frame and then takes the contour of the outside bar, continuing the taper to the suspension crook. Thus from the rear cross bar back the frame and iron look as if one piece, and if well caulked at the joint at J and draw filed, it is difficult to detect the joint. The dumb iron is supported well back, and neatness and the utmost strength are secured.

The Manufacture of Motor Truck Parts—The Rear Axle Components.

By Morris A. Hall.

In three previous articles on this same general subject the writer covered the work on the front axle, rear axle and front axle parts respectively. The present article on the rear axle parts will complete the whole running gear series.

It will be remembered that the truck was described as having a nominal load capacity of 5 tons, capable of sustaining an overload of one-third, weighing ready for the load, with all tanks filled, about 8,200 pounds, had double side chain drive to the rear wheels from a three speed and reverse transmission of the individual clutch type, and front wheel steering.

GROUPS OF PARTS.

The parts to be described may be grouped into two main groups, the hub parts and the brake parts. In the former or hub group are included the hubs, hub flanges, hub caps, hub bolts, brake drums, sprockets and sprocket bolts, two of each being registered per car, except in the case of the bolts, of which there are needed sixteen hub bolts and twenty-four sprocket bolts. In the latter or brake group are the brake bands, brake shoes and linings, brake anchors, studs, bolts, cams, cam levers and cam lever bolts, there being two of each, except in the cases of the first three, of which there are four each.

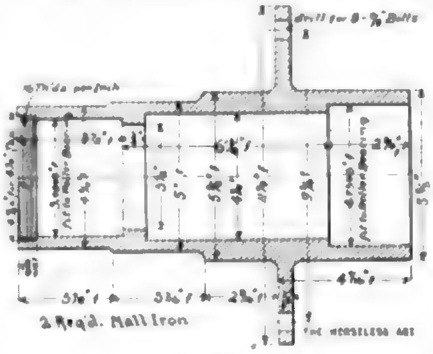

Fig. 1.

THE HUBS.

The hubs are of the taper roller bearing type, in two pieces, the design being quite an ordinary one, and requiring no comment. The hubs as shown in Fig. 1 are tough malleable iron castings. These are machined up in an ordinary 16 inch or 18 inch engine lathe, unless it so happens that the 21 inch Gisholt is not busy on more important or more necessary work. The former is a slower machine both as to time and methods, but also as to operator, because the more skillful and quicker mechanic is always assigned to the more valuable and quicker machine. On the other hand some of the saving is neutralized by thread cutting, which the latter cannot do well, except as regards external threads, when a self opening die may be used. So, when internal threads are required the work must go back to the screw cutting lathe to be finished. In this particular case these threads have been cut in the Gisholt using a tap, but they were not satisfactory, being inaccurate and usually crossed.

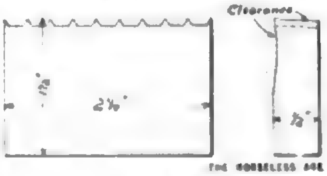

Fig. 2.

The hubs are first chucked, holding the smaller or outer end, while the inner end is faced, turned out and finished to size and depth; then the outside diameter of the flange is turned up. Next the hub is

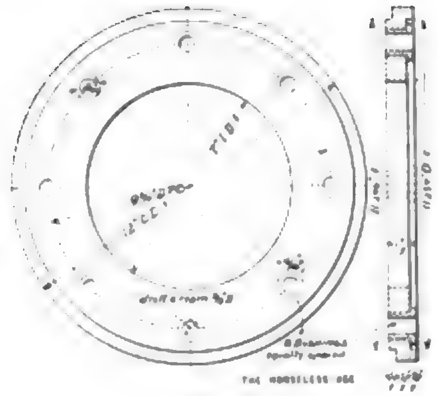

FIG. 3.

taken out of the chuck, turned end for end, and rechucked on the outside of the flange, thus holding the piece by its largest diameter.

The face of this flange and the larger diameter of the hub, which is the part the spokes of the wheel rest on, are now turned off, using an ordinary round nosed tool in the tool post. However, the face of the flange is grooved to hold the wheel more firmly, and this is done with a special flat blade tool with serrations or teeth somewhat resembling a saw. These are but one-sixteenth inch high, as shown in Fig. 2, and are fed into the hub the whole depth. These grooves were formerly cut in as a spiral, using a thread cutting tool, but the new method is quicker, cheaper and better.

The next smaller diameter is then turned and finished carefully to size, as the hub flange must be a tight sliding fit on this. Then the smallest diameter is turned, but is a not a very particular job, and on both of these last two the same flat blade cutter is used, with a radius on one corner. After this last operation the end is faced, bored, counterbored and finished to size. Then a thread cutting tool is substituted, the gears are set for sixteen threads, and the threads cut.

These go to the drill press and holes are drilled, eight in number, one-sixty-fourth inch large, for five-eighths inch diameter bolts. This work is done using the jig shown in Fig. 3, which is centred over the outside diameter of the flange, being simply a flat annular ring with a shallow counterbore in one side to fit the hub flange, and a similar groove of the same size is turned in the other side to allow the use of the jig on a female part. The bushings are all removable, so as to allow of transferring them to the opposite side when drilling a female part. Drilling these eight holes requires no special set up, and presents no particular difficulty; it completes the hubs.

THE HUB FLANGES

The hub flanges, Fig. 4, are very similar, except that less work is done upon them. They are chucked at the small end, the hole is bored out and finished, the flange faced off and the radius turned in; then the grooving tool is used to groove this face. The outside diameter is turned off, then the piece is taken out, turned over and chucked on the largest finished diameter. The end is faced off to length, then a very light scrape is taken over the face of the flange and hub. Drilling as before, with the same jig, completes the work. The extreme outside diameter is only finished to take the drill jig and for the sake of looks. The light cut over the other outside faces is taken to give a smooth surface so that the paint will lay flat. Formerly this was not done, and the castings were so rough and pebbly that a good job of painting was out of the question, no matter how much time was spent or how much filler was used. The extra cut actually saves enough in the painter's time and material to more than pay for itself.

HUB CAPS.

The hub caps shown in Fig. 5 are also made of malleable iron. These were formerly a very expensive piece to make, being finished all over. The outside part, after being assembled on the wheel, was painted a dead black, so that machining beyond filing was unnecessary. The first operation was to hold the small end in the chuck, and to turn the outside diameter of the beading and the surface of the top conical portion. This last is now omitted, as explained above. The cap was then taken out, turned over, chucked on the outer diameter, and the beading was finished on the inside, faced down as far as the small diameter; this latter portion was turned and the end faced. The gears being set for sixteen threads, the tools were changed and threads cut in. A light scrape was taken over the inside to insure plenty of clearance. As now done this finishes the piece, but as formerly finished the most expensive work remained to be done. In this condition they were sent to the milling machine, where they were set up in a chuck on the dividing head. The sides of the hexagon, as well as the flat sides opposite each face thereof, were milled one at a time, using a small diameter end mill. This work could not well be done with a straddle, so it was necessary to finish one face, index 60° and finish the next, and so on. This was not a very close job, yet it cost a lot of money, and the substitution of ten minutes' work by a laborer with a file for this milling and the previous lathe work, both by expensive men, was a big saving.

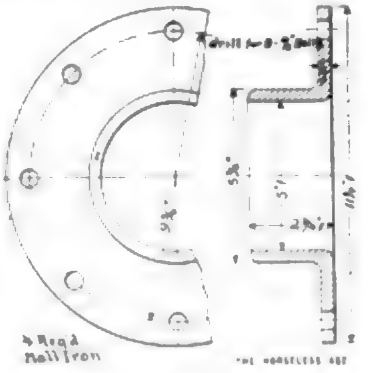

FIG. 4.

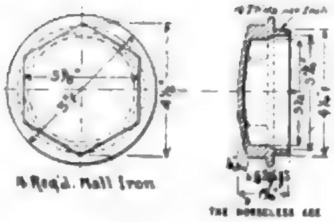

FIG. 5.

HUB BOLTS.

The bolts which held the flange, hub and brake drum together were ordinary carriage bolts of five-eighths inch diameter by 5 inches in length, with the usual square just under the round head filed off. Standard hexagon nuts are used with lock washers.

BRAKE DRUMS.

The brake drums, Fig. 6, were intended to be of steel, but the thin metal required on the sides, coupled with the shape, gave so much trouble in the foundry that malleable iron was tried instead. Proving satisfactory, it was adopted. These drums were handled in a 24 inch lathe, being just too large for the 18 inch machine. Here they were held in the chuck on the inside of the big or flanged end. The hole in the small end and the counterbore were turned first and finished accurately to gauge, as they must be a tight fit, almost a drive, on the hubs. The end was faced off and the extreme outside size of the flange, a micrometer fit in the sprocket, was the next operation. A very light cut, just sufficient to get under the scale, was taken down the back of this flange, and over the flat portion at the top of the drum proper. This was done to obtain a true surface and clearance for the bolt heads.

The second operation on this piece, after turning it over and chucking on the inside of the small end, was to face off the open end, turn and finish the braking surface on the inside and clean up the back of the inside where the holding on bolts come through. This provides a true surface for the nuts.

At the drill press the jig for the bolt holes in the hub and hub flange shown in Fig. 3 has the bushings transferred to the other side, and then fits in the counterbore in the small end of the drum. These holes are drilled, the jig is removed and the drum turned over. It takes a similar jig of larger diameter on the other end, where the sprocket bolt holes are drilled just to size.

These have been tried on the Gisholt, but the impossibility of using more than two tools at once and lack of opportunity for flat blade cutters combined to prevent a large enough saving to overcome the extra cost of the work on this tool.

SPROCKETS.

The sprockets, Fig. 7, are hard cast steel annular rings. One of these is held in a chuck on the outside diameter, while the inside diameter and the counterbore are turned and finished. These are nice fits on the brake drum, and call for close work.

Then the face is finished and the radius on the inside of the tooth portion.

The second operation calls for rechucking on the inside diameter, facing the outside face, the radius on the outside of the tooth portion and the extreme outside diameter. Thus it will be noticed that the blank is finished all over and presents no particular difficulty, at least none that is apparent. In reality these castings are so hard when they come from the foundry that a tool will not touch them. The writer had one batch of fifty upon which a solid week was wasted, in which time we succeeded in getting only eight finished, the ordinary time for which would be twenty to twenty-five hours. The rest, forty-two in number, we tried one after another, first on one side and then on the other, and we were finally obliged to return them to the foundry with a caution to avoid chilling any of those in the second order of fifty, or those sent to replace the ones returned. On those returned it was impossible to get a tool that would penetrate the scale. The writer tried successively all of the well known brands of tool steel, including Ark, Novo, Jessops, Burgess H. S. No. 3, Bethlehem XXX and others, without success.

The finished blanks went to the drill press where the holes for the bolts, twelve in number, were drilled, using the jig used on the brake drums. The blanks went to the gear shaper, a Fellows, where they were cut four at a time. Ordinarily eight of these thin blanks are cut at one time, but this material was so hard that the four blanks were close to the capacity of the machine.

The drilling was done before the teeth were cut, because one hole in each blank is necessary for a dowel pin to prevent them from turning, and also for relocating exactly in case it is necessary to take them off or loosen up the bolts for any reason whatever. Needing one hole in each it is easier and cheaper to drill all of them and mark one than to drill one before cutting and the other eleven after, meaning two set ups, handling the drill, jig and blanks twice, etc.

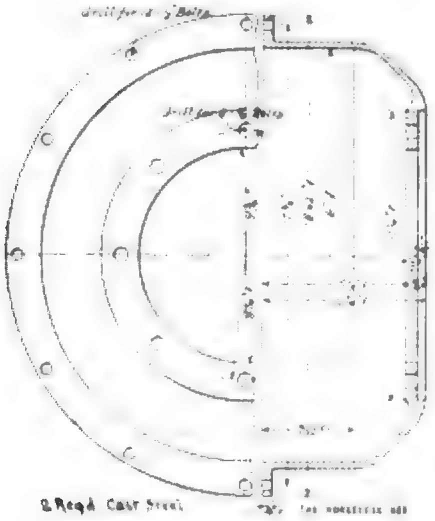

Fig. 6

After drilling the blanks are set up in the gear shaper, one hole on each is marked, a dowel pin put in, bolts are tightened up, and the machine is started. The machine now finishes them up automatically, the operator meanwhile doing other work. The cutting time on these sprockets varies from nine and one-half hours to eleven hours, but the average is ten. This finishes the sprockets.

SPROCKET BOLTS.

The sprocket bolts are three-eighths inch finished cap screws driven into the brake drum from the outside, where they are always left. This allows taking off or putting on a sprocket without disturbing the rest of the wheel, and is handy in case of repairs.

ASSEMBLING.

In assembling the hub group the wheels are first turned out, using a flat blade cutter in the radial drill press, with the wheel bolted flat on the table. In this work on wood the highest speed and a very heavy feed are used. Then the hub is driven in and the bolt holes are drilled, using the holes in the hub as a jig. The wheel is taken off the drill press table, and the hub flanges are driven on, but before either hub or flange is put on it is well smeared with white lead. This is done for two reasons: It prevents the parts rusting fast, which would prevent their removal, and it acts as a lubricant when driving them into place. The brake drum is now fitted on the hub, and the bolts are driven in, lock washers are put on, and the whole is bolted together very tightly. The bolts are cut exactly to length, and when assembled and tightened a centre punch is used to spread each bolt end just enough to prevent the nut working off; that is, entire dependence is not placed on the lock washer. Now the cups for the roller bearings are oiled and driven in, one in the inner and one in the outer end of each hub.

This latter operation is one that has puzzled the writer not a little. The original method was to drive them in with a sledge hammer, using a heavy steel block with a taper end to fit the cup, and a shoulder which rested against the end of the cup. These were made long enough to reach out past the end of the hub. This method seemed so crude, and as the constant blows of the sledge soon battered up the ends of the blocks, necessitating frequent returning, the writer sought another method. The arbor press could not be used on the hub in the wheel, owing to the large diameter of the latter, 36 inches, but it was tried on the hubs before they were put in the wheels. This was not a success.

Next, this difficulty was solved by making two new blocks to screw over a 2 inch diameter steel bar, with 4½ threads per inch, threaded right and left handed at opposite ends. One end of this bar was squared, and a long handled heavy wrench was made to fit it. This rigging was used by setting the cups in place, putting in one block with the bar in place, then the other block, which was screwed up as far as possible by hand, and then the wrench was fitted, and by turning it the blocks were drawn toward one another, drawing the cups into place.

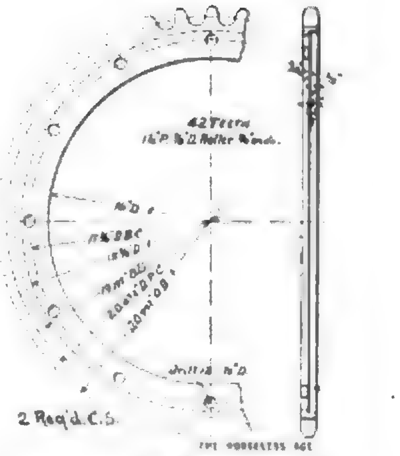

Fig. 7.

Although the coarse thread was supposed to draw the blocks together quickly, one full turn resulting in four-ninths inch approach, the blocks needed so much drawing that twelve or thirteen full turns were necessary. The smallest amount of slip added to this, so that the first time the screw was used it took two men, one holding the wheel and one turning the screw, fifty minutes to put the cups in one wheel as against the regular ten or fifteen minutes for one man with the sledge. Similar results followed until this screw method was abandoned for the old sledge and block way, which prevails today as the simplest and quickest.

After the cups were put in the sprockets were bolted on, and the hub caps screwed in temporarily. The wheels were then ready to put on the axles.

THE BRAKE GROUP.

The brakes had this feature unusual among motor truck brakes, that the brake band and shoe were separate, the latter carrying the brake lining. It could, being separate, be removed without disturbing anything else. This was very useful in relining a worn out brake, and was a big talking point in favor of the truck.

BRAKE BANDS.

The brake band was the worst piece to machine. It consisted of a semi-circular steel casting with a tee section, the metal in the top part of the tee exceeding that in the bar in the ratio of 2⅓ to 1. As a result the outer portion tended to draw out from the semi-circular form and approach a straight line. A dovetail in the middle of the side, necessitating considerable extra metal there, aided the straightening.

So after the castings had been received, and before they could be machined they went to the forge shop, where the smith heated them up and hammered the ends back to the shape of a sheet iron template,

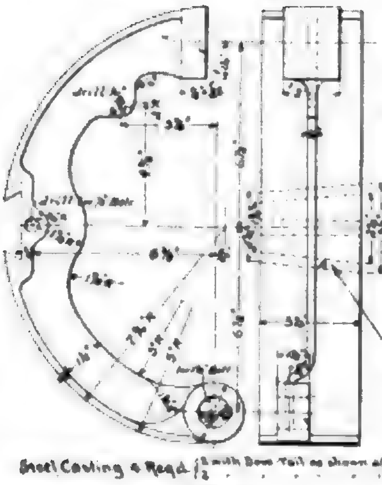

FIG. 8.

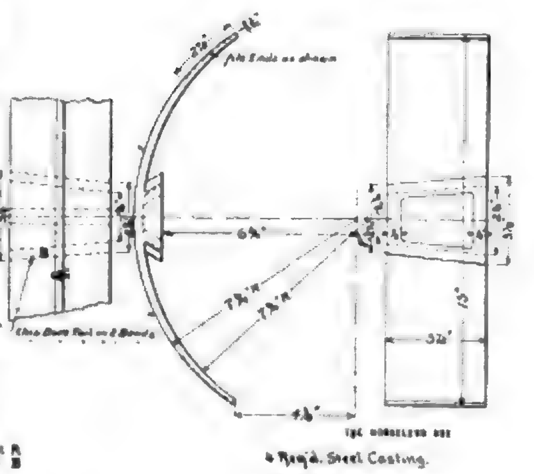

FIG. 9.

at the same time using a straight edge freely, and thus taking out as much of the twist as possible. This extra work saved castings, and lots of machine shop work as well, to say nothing of profanity. Even at that we took no chances on their being circular, but machined them on the outside.

First it was necessary to mill off the bosses, and before this could be done the bands had to be laid out. This was done as follows: A small hardwood block about 10¼ inches long by 1½ inches wide by 1 inch thick was wedged in between the two bosses. Then, using a pair of hermaphrodite calipers, the centre of the circular arc was found and marked on the wooden block, working from the average outside surface. Then the lower or circular boss was centred, and from this and the centre of the circle the vertical and horizontal centre lines were found and laid off, one on the block and the other on the casting. Now, working from these two centre lines the finished faces of the square boss at the top were scribed on; also the bolt hole at the dovetail and the hole for the spring. The band was now turned up on edge, and the centre line in that direction determined and scribed on, from which the finished faces of the two bosses in this direction were laid out.

Now the bands went to the milling machine, where they were set up on the broad part of the tee, the open and uppermost with the scribed vertical and horizontal centre lines set horizontally and vertically respectively, and the centre line at the back set parallel to the table, the band being gripped tightly in the vise.

In this position one side of both bosses and the top of the square boss were milled, using a small diameter end mill. Then the vise was turned through 180°, and the other side of both bosses milled. All five of the cuts were made to the scribed lines.

The bands went to the drill press, where all three holes were drilled at one setting, the one-quarter inch hole for the spring, one-half inch for the shoe retaining bolt, and 1 9-64 inch for the 1⅛ inch pivot bolt at the bottom. The next was a lathe operation, turning up the outside, for which a special face plate was used. This had a projecting stud 1⅛ inches in diameter, located at the correct distance from the centre, upon which a pair of bands were slipped, one being right hand and one left hand, forming a pair. A nut and washer prevented them from slipping off. At the upper end a flat cam separated the two bosses the required distance. Now an inspection of the drawing of the band, Fig. 8, and that of the shoe, Fig. 9, shows that the external diameters of the two differ, in that they are not concentric circles; in other words the same centre will not apply to both, so this separating cam was machined to the two different sizes about 2 inches wide at the centre line, and tapering for the band, and a perfectly straight three-quarters inch wide strip for the shoe. The former was used in turning up the band, which operation we are now describing. This simply separates the two and does not prevent them from further separation under the action of centrifugal force, so clamps are used to hold the two squares tightly to the flat cam. This being done the lightest possible cut is taken over the outside, simply for the purpose of truing up.

BRAKE SHOES.

Now the bands went to the bench in pairs, where the dovetails were filed out. Then a pair of shoes had their projecting ways filed to fit the dovetails in the bands. When they just slipped into place easily the bolts were put in, with a washer on each side overlapping the shoe, and thus holding it in place. The inside edge of the ends of the shoe was required to touch the outside trued up surface of the band. If they did not do so they were taken off and hammered until a good contact was assured. After this the bands and shoes together were sent back to the lathe, where, using the same special face plate with the flat cam turned the other way, that is to the shorter length, the outside diameter of the combined brake was turned to size under the same conditions as obtain in the car in actual service.

BRAKE LINING.

The brakes went back to the bench where they were dismantled, and the brake shoes were then drilled with four rows of small holes, three holes to a row. Then the braking surface of Scandinavian belting was riveted on. This had a thickness of one-quarter inch, and was very close to size, but was hammered down all over to make sure of the brakes entering the brake drums readily. The brakes were now reassembled.

BRAKE ANCHORS.

Fig. 10 shows the brake anchor, a steel casting with a boss at each end, one round and one flat, connected by an I section. These were laid out, which was a simple job, requiring only four centre lines. The first work done upon them was to machine the two sides of the square and the two diagonal faces. This operation the writer has tried in several machines. First this was tried on a planer, setting the anchors up vertically and planing the square first, and then the diagonal. This was found to be too expensive, as the planer hand was a high priced man and the pieces were hard to set up, this setting up taking more time than the actual work. Then, too, not over eight or ten could be done at a time, so that this method was not satisfactory. Next they were tried on the milling machine. Here they were also set up vertically, but in a vise one at a time. The milling machine operator was a cheaper man than the planer hand; besides milling saved an additional set up, as the sides of the square were also milled, but these pieces still cost too much, principally because only one could be finished at a time. So the final solution was shaping them off.

By doing them this way we were able to do three or four at one time, and the operator of the shaper was an apprentice boy at $3.50 a week, so this put the cost down to the limit. After shaping out the square and the diagonal holding the pieces in a vise, they went to the drill press, were laid flat and leveled up so that the centre line scribed on the side was exactly parallel to the table, the 1⅛ inch hole was drilled, then the drill was changed for a bar, and the surface of the boss counterbored down to within the proper distance from the centre line. The anchor was turned over, leveled up again, and the other face of the

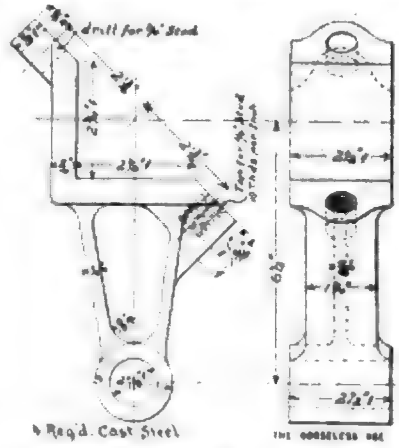

FIG. 10.

boss finished in the same manner, the bar being guided in the drilled hole.

A simple jig slipped over the top or diagonal part allowed of drilling the two holes in that face, after which the one hole was tapped out, finishing the job. Although a small, not very important and not very complicated part, a great deal of time and thought has been spent on this piece in the endeavor to cheapen the manufacturing cost without going into expensive special tools such as gang millers.

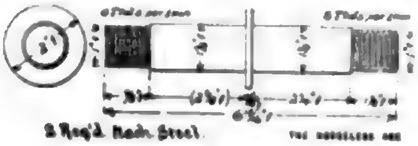

FIG. 11.

BRAKE ANCHOR STUDS.

The studs for the anchors are very simple. They are made of cold rolled steel three-quarter inch diameter by 3 inches long, 1¼ inches on each end being threaded with a standard thread. One of these is permanently screwed into each anchor. When assembled a lock washer and standard nut are used on each bolt.

ANCHOR BOLTS.

The anchor bolts shown in detail in Fig. 11 were finished in the lathe, the material being machine steel. These bars were cut to length in the hack saw, set up in the lathe with a dog, and the one end was rapidly roughed down, finished to size, and the smaller end threaded. The piece was turned over, the dog changed to the other end, and the operation repeated, the only difference being in the length. These parts are simple, and were finished very quickly, and by a $9 a week boy, so that they were not expensive, but an automatic machine would have cut the cost in half even with an operator at twice the pay. In assembling these bolts standard nuts were used and pinned in place with a three-sixteenth inch diameter pin.

CAMS.

The brake operating cam was another apparently simple piece, the cheapening of which took a great deal of time and study. As shown in Fig. 12 it is made from machine steel, round stock being cut in the saw to within one-quarter inch of the right length. Then in the lathe one end is roughed down as rapidly as possible, using a very heavy cut and a slight feed; then it is finished to size, using a very light cut and a quick feed. Next the projection is turned down and the end squared off. Then the dog is changed to the other end, the piece turned over and the large end just cleaned up. The limits of the cam portion are marked on with a fine pointed tool, and the large end is squared off to length. Next these go to the milling machine, where the cam is cut in. For this a small end mill is used, and the operation takes a great deal of time, as it is necessary to run around the cam surface, taking a light cut of not over three-thirty-second inch; then this circuit is repeated until the cam is cut down to size, after which the metal left in the centre is removed more rapidly.

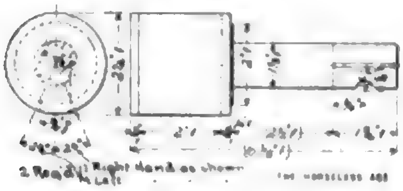

FIG. 12.

One side being finished, it is necessary to index 180°, then finish the other side in a similar manner. Then we index 24°, and finish one side of the square on the other end, index 90° and do another, repeating until the square has been completed. The cam is now finished, with the exception of the half round slot for the bolt, which is done later with the lever in place, drilling both at once. This makes an accurate job and saves one complete operation.

To return to reducing the cost on this piece, the first attempt was a 2 inch diameter end mill. Starting in with the one outside edge of this mill flush with one edge, say the lower edge of the cam, the mill was fed in to the required depth, then a single movement upward of about three-eighth inch finished the surface. This saved lots of work moving the table up and down, in and out. It was good, but not good enough, so a further saving was made as follows: In finishing the big end in the lathe a flat disc of the required thickness (one-quarter inch) was turned off and saved. Then the large end was finished one-quarter inch short. Now at the milling machine the blanks were set up vertically, four at a time, and the cams finished with a pair of straddle mills set three-quarter inch apart, thus finishing both faces at once. The lathe work was only increased by one parting cut. This way of milling required a second set up and a change of mills to square the small end. It also required the milling and countersinking of three small holes in the plate, and the tapping of three corresponding holes in the cam, but all this was covered by the milling work, and a big saving effected as well. It might be mentioned here that the straddle mills were old ones which we had for another job.

CAM LEVERS.

Fig. 13 shows the operating lever, a steel casting at first, but later changed to malleable iron. The rough castings were laid out with the centres of the three holes, the centre line of the small bolt hole being carried up the whole length of the casting. The hole in the upper end was drilled, and the face of the boss finished down to size with a counterbore; then the hole for the square was drilled, and this upper face finished, using the same counterbore as before. Then the casting was turned over, and the other face of the two bosses finished down to size in a similar manner.

The levers went to the key seater, where the holes were squared, and were then returned to the drill press. This time the cams went with them. A cam and lever were fitted together, and the half inch bolt hole drilled through both. Then the cam was withdrawn, and the upper face of the boss finished, lever turned over and lower face cleaned up. Next at the milling machine a vise was used to grip the smaller end of four of these with spacers in between, while a slitting saw mounted on the spindle cut the slot through to the square hole.

The bolt for use in this lever was ½x2½ inches hexagon head cap screwed with a lock washer and standard hexagon nut.

ASSEMBLING THE BRAKE GROUP.

This finishes the individual pieces of the brake group, which are assembled as follows: A dummy axle has on one end a pin of hubs fitted with a brake drum and roller bearings. The halves of the brake with shoes and lining being finished, a set of them are assembled on the proper end of the bolt shown in Fig. 11. Then the brake spring is hooked into one shoe and, the cam being not in place, the spring may be stretched and the shoes brought closer together when the other end of the spring may be hooked into the other shoe. Then the brake is pried open and a cam slipped into place, after which the brake is slid into place inside of the brake drum.

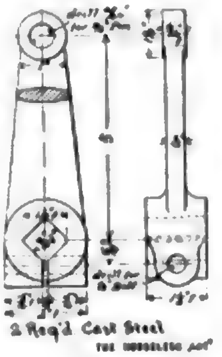

FIG. 13.

Next half of the brake anchor is slipped on the squared axle from below, and another half from above, the stud in each one passing through the drilled sole in the other, washers and nuts are put on, and the latter are pulled up loosely. Then the two anchors are moved along toward the brake until the bolt and cam slide into their respective bearings in the anchor. The nut at the bottom is put on and pinned; then the lever at the top is put in place and bolted. The nuts on the anchor are pulled up tight.

Now the brake is in a position exactly like the one it will assume in service. The brakes are tried by spinning the brake drums by hand, and when moving as rapidly as possible the brakes are thrown on, using only one's hand on the lever. They

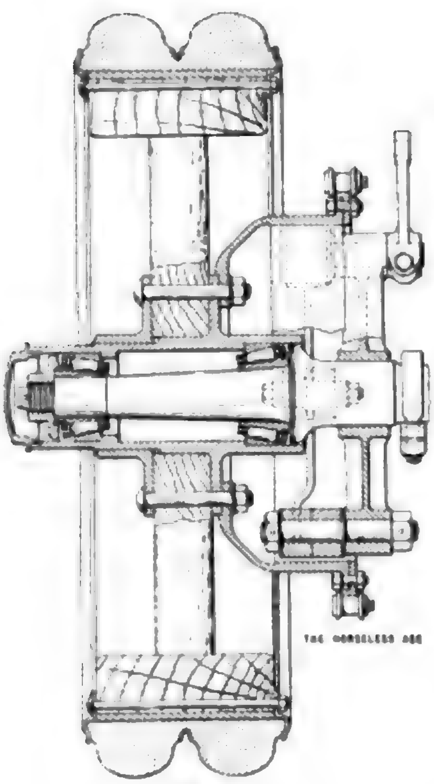

FIG. 14.

must be so fitted as to bring the heavy rotating mass to an immediate stop, although the force applied has a leverage of only 5 inches.

If this test is successful the nuts on the anchor are loosened and the whole brake is taken off the axle as a unit. It is then sent to the stock room and is ready for use. In putting these brakes on a car it is necessary to take down the anchor, necessitating taking off the lever at the top and the nut on the bolt at the bottom. While thus taken down a three-eighth inch diameter by one-half inch deep dowel pin hole is drilled in each half of the anchor to suit the dowel pin holes in the axle.

Then when reassembling the method is slightly different. The anchors are assembled on the axle with the dowel pins in place, and the nuts are pulled up nearly as far as they can go. Then the assembled brake is shored onto the anchors, reversing the previous method, the end of the cam slides into its bearing and similarly with the bolt. The cam lever is put on and bolted. The other nuts and washers are put on and bolted up tight, and finally the brake anchor nuts are pulled home, finishing the job. The assembled wheel, brake and axle are shown in Fig. 14.

The German Minister of Finance reports a deficit of $478,290 with regard to the revenues derived from the tax on automobiles for the year ending with March, 1908. The majority who voted for the taxes were warned by manufacturers and others that the tax would not produce the sum estimated in the budget, $875,000, and they contended that the industry would suffer from the tax.

Comfortable Gear Changing.

BY SIDNEY AYLMER-SMALL.

A few years ago I had a planetary geared automobile which had its direct drive and reverse controlled by the same lever. The slow speed was operated by a pedal. This was a very convenient control. When stopping the car a little further motion of the lever would tighten the reverse band enough to give a decided braking effect. Add to this that the lever was always at a convenient distance from the seat, and the result is a most comfortable control.

When I was ready to purchase the next car I had decided on a sliding gear. It soon became evident that comfort was not thought of very much when the designer decided upon the location for the levers. Even when I looked at the planetary geared cars I found many to be designed so that gear changes caused the driver to assume uncomfortable positions. A general criticism may be made that touches nearly all the automobiles in the market today, which is that the gear shifter lever in the direct drive position is too far from the seat.

Another criticism which is quite pertinent in respect to many cars is that you are expected to push on the service brake with your foot, and push on the emergency brake lever with your hand at the same time. The reason more people have not discovered the discomfort of this is the fact that the emergency brake is so little used. When you do use it, however, you want the arrangement of levers so that they are operated by natural movements. I have about concluded that a selective type transmission is the only one which makes gear shifting easy. Certainly thus combined with a "pull" emergency brake it makes things comfortable.

Three years ago selective transmissions were only fitted on cars too expensive for me to think about. I purchased, however, a three speed sliding geared car, whose gear shifting arrangement has proved comfortable and satisfactory throughout nearly three years' use. The first and most important feature is that the gear shifter in the direct drive position is up close to the seat. It is just far enough away so the hand clears the cushion when placed on the handle.

The comfort of its operation is apparent from this illustration. When approaching that part of a hill where the use of the intermediate gear becomes imperative drop the hand on the gear shifter and at the desired moment, perhaps ten seconds later, you make the change.

If my motor be pulling exceptionally well I may retain this position half a minute. There is no discomfort in this, as my body does not move at all. Later on I can repeat this trick, letting my hand rest comfortably upon the gear shifter in the intermediate position until the exact instant that the shift is required and then making it by a slight forward bend of the body.

The distances of the handle from the near edge of the seat are as follows:

	Inches.
Direct drive	0
Intermediate	5
Slow speed	11
Neutral point	14
Reverse	17

Two objections have been raised against this arrangement. The lever when in the neutral position hinders entrance to the driver's seat from the right hand side of the car. But the tool box, the generator and the spare tire constitute such effective hindrances that I always enter from the left side, there being room to cross the passengers' feet without touching them. The next objection given is that of the bending over when you are manipulating gears while turning in a narrow street. This is a nuisance, but as you change to intermediate ten times to turning in a narrow roadway once, I prefer the arrangement described.

Linoleum for Automobiles.

When the price of rubber went up the automobile manufacturer naturally looked for a substitute. The substitute was found in linoleum, which was, it was ascertained, excellent as a covering for the floor and steps of motor cars. The makers of one car used 5,000 yards in one season (1907) alone, and they were by no means the largest consumers for this purpose. The season of 1908 showed, says one large manufacturer of linoleum, an unexpectedly increased demand over preceding years.

Linoleum is, it is claimed, an ideal floor covering; no dust or disease germs can lodge in it, and it can be cleaned and purified in a few minutes with a damp cloth. It is by no means a crude fabric, as most beautiful effects, new art styles and small tracery designs can be purchased. Linseed oil is its largest and most expensive component, cork dust being added to fill out the jellylike linseed oil and give it body to stand mechanical wear.

Linoleum is unequaled for the floor covering of cars, being unaffected by gasoline, impervious to moisture, and resilient to the foot, and never becoming slippery with wear. A coating of linoleum cement applied once a week or at slightly longer intervals will insure its practical indestructibility. It costs something like 50 per cent. less than rubber, which it will gradually displace to a large extent.

The most popular color in this fabric is a neat shade of drab, which harmonizes with almost any color of body. Tans, terra cottas and black are also in favor. It may be had in various thicknesses up to half an inch.

At a recent meeting of the Fiat Automobile Company, of Turin, Italy, the old board of directors, which has been conducting the affairs of the company for the nine years that it has been in existence, was forced to resign, and an entirely new board was elected.

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Revival of the Detachable Tonneau.

Although there is room for considerable difference of opinion as to the merits of the detachable tonneau, there is every reason to believe that it or its equivalent is favorably regarded by quite a large class of prospective buyers of light cars. The double rumble seat, so far as passenger capacity is concerned, in a way meets this demand, but, as a rule, the rumble seats lack the comfort and security obtainable in the tonneau form of body. There is a pretty large class of owners who wish to use the same car for two passenger runabout service and for light touring with four or five persons, and who do not regard the rumble seat type of body as a fit form for even very restricted cross country service. On the other hand, they object to a fixed tonneau body upon a car which is to be used mainly for runabout purposes. This objection is perhaps mainly psychological rather than practical, as the extra weight of the unoccupied tonneau is not a serious factor, but there is a deep rooted objection in the minds of many against carrying about two or three empty seats during a large part of the time. There is something rather "cozy," too, in the removal of the tonneau and the use of the car for two passengers, with the substantial advantage of a large, convenient carrying space on the rear deck.

In the early history of the detachable tonneau manufacturers were somewhat chary of providing it, on account of the possibility of overloading their cars, but with the much more ably powered light cars of today this objection ceases to be serious. Most modern runabouts are capable of carrying a two or three passenger tonneau with excellent results, and of thus becoming light touring cars, if only a little alteration is made in the rear springs. Some of these cars, especially those carrying front mounted unit power plants, are decidedly light in the rear, and their behavior on the road might be actually improved by more passenger weight toward the rear.

The statement can safely be made that the detachable tonneau is likely to be demanded as a feature of the light family car of the future, which is to be used partly as a runabout, partly as a family conveyance and partly, perhaps, as a utility wagon for carrying dead loads. Comparatively few manufacturers are now offering the detachable tonneau, but certain ones have supplied it persistently for years and find a market for it. A few are offering it as a feature of their new models, and it is to be hoped that it may be extensively catalogued by manufacturers as an alternative to the double rumble seat type, which fails to appeal to many purchasers as being highly desirable from the standpoint of real utility and comfort.

The Magneto Triumphant.

It is becoming increasingly evident that the magneto is to hold a very much more important place in the ignition equipments of 1909 cars than ever before. For some years past a number of foreign makers have fitted their cars with the magneto alone, and have depended upon it to the exclusion of battery systems. The same tendency has begun to manifest itself in this country, as is evidenced by the recent announcement of an important manufacturer, who provides his cars with high tension magnetos without any auxiliary system. It is believed that the state of the magneto art is now so highly advanced that sole dependence upon a first class magneto is warranted. The only serious disadvantage resulting from discarding the battery system is that the motor cannot be started on the spark, but it is not impossible that this objection may yet be removed.

While hitherto magneto ignition has been regarded as a concomitant of the operation of the four and six cylinder engines of high priced cars, it is manifest that the coming season will witness its adoption upon some two cylinder cars and upon not a few four cylinder runabouts of low price. In a late announcement of one of the leading manufacturers of two cylinder runabouts a magneto is specified as a part of the regular equipment thereof, and others will doubtless rapidly follow suit now that moderate priced magnetos of good quality and adapted for any number of cylinders are on the market.

Great improvements in magneto generators have lately been made in the direction of simplicity, compactness and ability to give a spark at a low rotative speed, and manufacturing methods have improved as production upon the large scale has been inaugurated.

While the synchronized alternating current type has been and is still the prevailing one, it is no longer possible to disregard the non-synchronous direct current type, driven through a speed governor from the engine flywheel. These machines are in quite extensive use already, and will probably figure quite largely upon moderate priced cars in the future. They are merely substitutes for the battery and utilize a timer and coils of the regular type, being thus applicable to existing ignition systems. When well made and properly installed they furnish an unfailing supply of electrical energy, not only for running but for easy starting, and render the ignition system as truly independent of outside agencies as is the synchronized magneto system. Probably the only real advantage possessed by the synchronized system over this magneto actuated vibrator coil arrangement lies in the greater amount of spark lever manipulation which the latter entails.

Viewing the magneto situation in a broad way, it would seem that the use of the mechanical generator is in a fair way soon to become substantially universal upon all classes of cars, both low and high priced. It may be regarded as "manifest destiny" that the engines of motor cars shall generate their own ignition current and become independent of outside sources of current.

Inventive ingenuity and advanced manufacturing methods seem at last to have brought this ideal within early practical realization.

The Unencumbered Dashboard.

In the very earliest American built automobiles there was usually no apparatus mounted upon the dashboard. The coil was ordinarily placed under one of the seats, and the sight feed lubricator and speedometer had not been developed. With the introduction of multiple coils, force feed lubricators and speed recording instruments, and with the introduction of the pressure feed fuel system, the dashboard became the repository of the coil equipment, the sight feeds of the lubricating system, gauges for the gasoline and circulating water pressures, and often a voltmeter and ammeter, as well as for the speed and distance indicating apparatus. The dashes of some cars were greatly encumbered, and especially in the case of six cylinder cars, using multiple coil equipments, the space was utilized to the very fullest extent.

At the present time there seems to be a well defined tendency to relieve the dashboard of the congestion of apparatus which has characterized it.

The modern self contained lubricating system is so reliable that a visual indicator is hardly required, but, if it is desired, a single sight feed mounted upon the dash takes the place of the six or eight "telltales" often required with the separate pump oiling system. The adoption of the magneto as the main means of ignition has allowed the use of a single coil of compact proportions, operated in conjunction with a distributor, as the apparatus of the battery system instead of a four or six unit coil box of large size. With the complete elimination of the battery ignition system, and full dependence upon the magneto, which has already taken place to a certain extent, the dashboard is relieved of all coils and electrical indicating apparatus, and the only element of the ignition system which it carries is a simple switch. In the case of cars fitted with contact spark ignition, this has been true for some time past. Water circulation gauges have been discarded as methods of pump driving became reliable and no longer ornament the dashboard.

In fact, in the case of a car with gravity gasoline feed and magneto ignition alone, the only object necessarily mounted upon the dash is the switch. A telltale indicating the oil feed and a speedometer may, of course, be carried there, if desired. The banishing from the dashboard of so much apparatus leaves it much improved in appearance, and betters the looks of the whole car, removing the impression of complication which is, to present day taste, an objectionable feature. The removal of nearly all oil piping reduces the danger of leakage with its attendant uncleanliness.

Noise in Carburetor Operation.

So long as automobile engines and motor cars as a whole were noisy in operation very little importance was attached to some of the minor causes of noise which contributed to swell the total of buzz, rattle and pound. Now that cars extremely quiet in operation are in general use, the hitherto almost unnoticed sources of noise have become obtrusively salient factors in the relatively unimportant total of sound sent out by the modern car.

The carburetor is one of the parts of a car which has recently become a noticeable element in noise making, small in absolute volume as is the sound attributable to it. In addition to fulfilling its vaporizing and mixing function in a satisfactory degree, the carburetor must now do its work in almost perfect silence, and in the selection of a carburetor by the manufacturer its quietness of operation is a not unimportant qualification.

Carburetors vary very widely in regard to their quietness, and the same carburetor acts differently at different speeds and throttle openings. The sources of noise are either the mechanical operation of moving parts, such as poppet valves, or the action of the gaseous flow itself. The former cause of objectionable sound is removable by damping the motion of the parts and by facing the otherwise noisy parts with non-resonant material, but the latter source of sucking, gasping and hissing sounds is more difficult of elimination. Certain forms of carburetor, in which the air passages are formed so as to favor it, produce at particular gas speeds a very annoying hissing sound, often of a volume quite comparable with the other engine noises. Muffling the air intake has always been more or less resorted to for the purpose of stifling the sounds of gaseous origin, but is not entirely effective. A close study of the behavior of the entering air in the vaporizing passages, the confirmation of the passages themselves, and their sonorous qualities with regard to the conditions for the production of objectionable sound will have to enter into the problem of present day carburetor design, if silence at this point is to be secured.

Tendencies in Carburetor Design.

Carburetor designs for the coming season are already well advanced. Two general tendencies become apparent from their consideration. Strangely enough these tendencies are in opposite directions. On the one hand is apparent an adherence to the Venturi tube construction, while on the other is a multiplication of auxiliary air inlets. It appears therefore that to some the line of progress is represented by extreme simplicity, while others must think that increased complexity is desirable. Strange to say, each kind of carburetor gives good results, and thereby makes its designer sure that he is on the right track. Of course, as in former years, there will be carburetors of every conceivable kind, and the tendencies we have just mentioned are only those which appear to us to be the strongest. For instance, the type of carburetor in which the gasoline needle valve is opened with the throttle is still appearing in new forms, and this needle valve is sometimes combined with the bent tube or "bowl" type of mixing chamber.

In most carburetors it is apparent that considerable study is being made of accessibility and ease of adjustment. It is no longer usually necessary to take a carburetor all apart to change the level. And each adjustment is now generally so made that it can be changed without disturbing anything else, whereas formerly it was often necessary to go over the needle valve setting after the adjustment of the auxiliary valve was altered.

Some of the new carburetors have glass gauges, bullseyes, or, as in one instance, the barrel of the float chamber made of glass, so that the level of the fuel can be ascertained at a glance.

It is also very common to provide a butterfly valve or similar arrangement in the intake to the carburetor so as to shut off part of the air supply in starting, which makes the motor start much easier.

All in all, it may be said that carburetors are being very considerably improved, although no radical changes or important discoveries have been made.

That part of the old Albany post road between Fishkill Landing and Hughsonville has recently been treated with liquid asphalt.

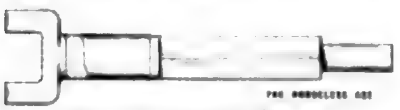
Maintenance and Repairs

Repair Wrinkles.

By H. P. Coleman.

The repair man at times has to resort to ways of doing jobs that at first sight seem like makeshifts or unmechanical means of obtaining the desired results, yet they make as neat and strong a job as is possible without incurring great expense, for a great many of the repair jobs are on cars of early date, parts for which cannot be obtained, or they are on cars of foreign make, the parts for which can only be had after vexatious delays, so the old parts must be repaired for the time being, or new ones made at the cost of extra expense and some delay.

The writer has had to repair several transmission shafts and some auxiliary shafts where the bearing in the gear box came through the box, more especially on the direct drive shaft, which, being squared for the shifting gear, is rather an expensive shaft to make. The shaft either had plain bearings which were worn, or it had ball bearings, and the cone had gone to pieces and cut the shaft. The shaft is turned down as little as possible, just enough to take off the cut surface, going down within, say, one-sixty-fourth inch of the worst cut place, but leaving it as large as possible so as not to weaken the shaft any more than is absolutely necessary, and at the same time getting it as near as possible to a standard size of seamless steel tubing inside measurements, which can be had in one-thirty-second inch sizes. The ends of the turned off portion of the shaft should be left with a nice ground corner or fillet for strength. The piece of tubing, which is to be sawed through lengthwise of the tube on one side, is cut off just the length of the turned part of the shafts, and the inside ends are rounded so as to fit the fillet on the shaft. The tube is chosen of such gauge that it will fill the turned off part on the shaft and stand above the old diameter at least one-thirty-second inch. The tube must be bright and clean inside. Now wedge a screwdriver or chisel into the sawed slot in the tube to open it, telescope it over the shaft and fit into place where it can be coupled, or, rather, clamped together, so the edges of the sawed tube will butt together or within one-sixty-fourth inch, and fit the shaft. Wind the tube with soft iron wire of about No. 14 gauge, twisting the ends together and pounding down close against the shaft, so they will not loosen with the heat, as the joint must be brazed, filling up the cracks with brass. The shaft can now be turned off to its original size, and if the job has been done well only a fine brass line can be seen where the parts are joined, and a neat job is the result.



Repairing a Cut Shaft.

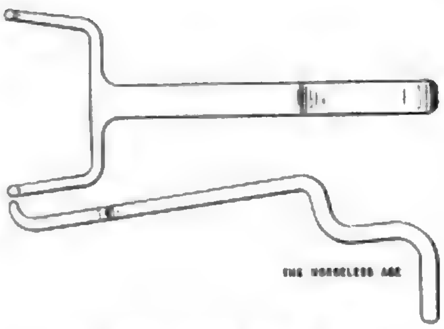
A Valve Stem Tire Tool.

By H. P. Coleman.

I have noticed several articles about long valve stems in some of the recent issues of The Horseless Age, and would say that in my own personal experience of eight years I have had more trouble in getting the screws in the old single tube tire lugs to line up with the holes in the rims, and the screws in, than from anything else.

I think the secret of getting the inner tube with a long valve stem into place is to go at it in the right way. In some cases where the wooden felloe of the wheel was deep I have found the stem so short that it was hard work to get the protecting cap on, while on other wheels, such as the wire wheel, it sticks through too much. Of course, the manufacturer of the tube does not know what kind of a wheel the tube will be used on, so he must strike a length that will work both on deep and shallow rims or felloes.

My experience is that with a valve stem tire tool the tube is very easily and quickly put into the tire shoe, but without this tool it is a mean job. In 1904 I saw one of these tools in use for the first time in Paris, and made a sketch of same with measurements, and when I returned home I had two of them made. It was a year or so later before they were to be found on the market in this country, and I think that even at the present time they are not commonly used.



A Valve Stem Tire Tool.

Emergency Methods of Fastening Nuts.

By G. S. G.

On cheaper cars the nuts are, as a general rule, not castellated. Instead they are usually furnished with a teat, as shown in Fig. 1, allowing a space A between the nut and cotter pin. The only object of the cotter pin in this case is to prevent the nut being lost, as the bolt itself loosens up in a very short time. The writer has tried various schemes to prevent the nut from loosening at all. In Fig. 2 two washers (or more) are placed under the nut, so that the cotter pint is driven through its hole. This method is not very good, as several threads of the nut are useless for holding the bolt tight. In Fig. 3 a washer is placed over the teat, and the cotter pin driven in. If washers are not handy a wire nail may be used, the head of the nail being large enough to touch the top of the nut securely. None of these methods are elegant, but what is the motorist to do when the makers of cars do not try to eliminate the "cussing"?

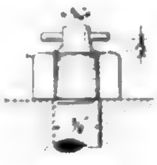


Fig. 1

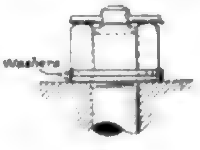


Fig. 2

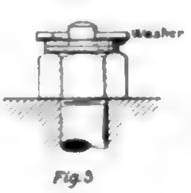


Fig. 3

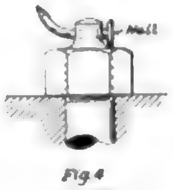


Fig. 4

THE HORSELESS AGE

Lubrication of Springs.

Comparatively few owners and even drivers seem to realize the necessity of oiling not only the spring shackles but the leaves themselves. There is more motion between the leaves of a spring than the average person imagines. It should be lubricated, if for no other reason than eliminating the annoying squeak that accompanies a dry spring. The best lubricant for this purpose is a mixture of ordinary oil and graphite or the regular graphite grease that is on the market. To facilitate the injection of the grease between the leaves, jack up the frame until the axle partially hangs by the springs. This will open the leaves, and with the aid of a thin stick the grease can be spread easily. A screwdriver or similar tool can be used without harm to further spread the leaves if necessary. It is best to be liberal in the application of this grease to insure its being squeezed over the whole surface when the frame is let down. The surplus can be wiped off, and with this treatment the leaves will not require attention for another season.

Connecting Batteries.

By H. P. Coleman.

The writer has seen several articles on the subject of connecting up batteries, but has seen no reference to one quite important point, a cause from which cars have been stalled twice within his experience.

I was lately called on the 'phone to locate ignition trouble on a car of well known make. The batteries on this machine are carried in a metal box on the running board, a storage battery being used ordinarily, and two sets of dry batteries held in reserve. A thin wooden panel was fitted into the bottom of the metal battery box, which had become soaked with either water or electrolyte solution from the storage battery. The moisture had penetrated the pasteboard covers of the dry batteries, which were grounded on the carbon pole of the battery, so they were so short circuited that they would not work. Had the zinc ploe been grounded instead of the carbon no trouble would have occurred.

A Bearing Wrinkle for New Motors.

The bronze bearings on new motors, particularly those running at high speeds, are apt to run hot, particularly if the motor has not been "run in" thoroughly previous to its purchase. This can be prevented and the bronzes and shaft rendered smooth by filling the oil cups with a mixture of washing soda and water and allowing the mixture to flow all over, while the motor is running without load, i. e., declutched. The mixture will become black and should be washed out with clean water.

The Wilbraham (Mass.) Hill Climb.

Cars of local manufacture largely shared in the honors of the hill climb held on Wilbraham Hill by the A. C. of Springfield (Mass.) on Friday last, September 11. There were more than seventy entries in the twenty-one events scheduled, and the attendance was very large. People lined the course up the hill from top to bottom, and in some instances crowded on to the course so as to invite disaster. One rather serious accident actually occurred, but it is to be ascribed rather to the fact that the car concerned was too fast for the hill, rather than to untoward behavior of the crowds. One of the Stevens-Duryea entries, driven by Peter Robinson, when about half way up the hill and while proceeding at a speed close to a mile a minute, hit a wood pile on one side of the road and got beyond the control of the driver; it zigzagged across the road a number of times and then turned over into the ditch, throwing the driver over the stone wall at the side. The car turned a complete somersault, and pointed with the forward end down hill when it came to rest; it was badly wrecked. The driver's right leg was broken and he received injuries over his right eye, on his right forearm, etc.

The course is about a mile in length, and has an average grade close onto 9 per cent., the maximum being 23 per cent. The scene of the climb is only a short distance out of Springfield, which accounts in part for the large attendance. The roads had been specially prepared for the event, and treated with oil to lay the dust. Fred Wagner, of New York, acted as starter.

Stevens-Duryea cars won seven firsts and one third, while Knox cars won four firsts, six seconds, a third and a fifth, and also won the trophy offered for the best time of the meeting. First prizes were also won by a Buick and a Jackson car.

There were two events for motorcycles, in addition to the time trials by J. De Rosier on a 9 horse power Indian motorcycle. On the first attempt he made the distance in 1 minute 11 3-5 seconds and his second trial was made in two-fifths of a second better time. The very best time of the day was made by Stanley Kellogg, of the Springfield Motorcycle Club, who on an Indian motorcycle ascended the hill in 1:03 4-5.

Following are the summaries:

Event 2, 40.1 to 60 h. p.—Won by 56 h. p. Stevens-Duryea, driver, Robinson; time, 1:10 1-5.

Event 3, 24.1 to 40 h. p.—Won by 36 h. p. Stevens-Duryea, driver, Hancock; time, 1:22 3-5.

Event 4, 15.1 to 24 h. p.—Won by 16 h. p. Buick, driver, R. Burman; time, 2:14 3-5.

Event 6, $850 and Under—Won by 16 h. p. Cameron, driver, Cameron; time, 2:24 3-5.

Event 7, $851 to $1,250—Won by 22 h. p. Buick, driver, R. Burman; time, 2:12 4-5.

Event 8, $1,251 to $2,000—Won by 24 h. p. Jackson, driver, E. P. Blake; time, 2:01 4-5.

Event 9, $2,000 to $3,000—Won by 38 h. p. Knox, driver, Bourque; time, 1:26 3-5.

Event 10, $3,001 to $4,000—Won by 36 h. p. Stevens-Duryea, driver, Hancock; time, 1:23 2-5.

Event 11, $4,000 and Over—Won by 54 h. p. Stevens-Duryea, driver, Robinson; time, 1:40.

Event 12, Cars With Piston Area of 50 Square Inches—Won by 34 h. p. Atlas, driver, Ruggles; time, 2:34 3-5.

Cars With Piston Area of 50 to 65 Square Inches—Won by 30 h. p. Knox, driver, Dennison; time, 1:40.

Cars With Piston Area of 65 to 90 Square Inches—Won by 36 h. p. Stevens-Duryea, driver, Hancock; time, 1:18 3-5.

Cars With Piston Area of 90 Square Inches and Over—Won by 54 h. p. Stevens-Duryea, driver, Robinson; time, 1:09 4-5.

Free-For-All, Gasoline Cars—Won by 48 h. p. Knox, driver, Basle; time, 1:08.

Free-For-All, Gasoline Stock Cars—Won by 36 h. p. Stevens-Duryea, driver, Hancock; time, 1:22.

Club Championship—Won by 30 h. p. Stanley, driver, Knuuson; time, 1:23 4-5.

Free-For-All, Record Trials—Won by 30 h. p. Knox, driver, Dennison; time, 1:09 3-5.

Motorcycles, 30.5 Cubic Inches and Under—Won by 4 h. p. Indian, Gustavson; time, 1:24 1-5.

Motorcycles, 61 Cubic Inches and Under—Won by 4 h. p. Indian, Kellogg; time, 1:03 4-5.

Motorcycle, Record Trials—9 h. p. Indian, De Rosier; time, 1:07 1-5 and 1:11 1-5.

START OF SPRINGFIELD HILL CLIMB ON WILBRAHAM HILL.

The Long Island Mechanical Efficiency Run.

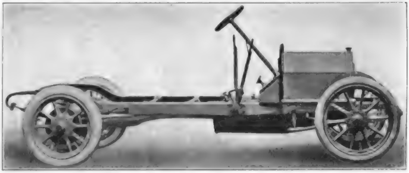
The two days' mechanical efficiency run of the New York dealers is to be held on Wednesday and Thursday of this week, over a course leading from New York city to Montauk Point, L. I., and back. The start will take place at Columbus Circle on Wednesday morning. During the outward run there will be controls at Bay Ridge (where the official or timed part of the run will begin), Lynbrook, Bluepoint, Southampton, Amagansett and Montauk Point. The greater number of the tourists will find accommodation for the night on board the steamer Shinnecock at the dock at Fort Pond Bay. The night control and checking station will be located at the Montauk Inn. The return trip will be over a route along the north shore, and the noon stop will be made at the Suffolk County Fair in Riverhead. The following classes have been provided for by the rules:

Class A—Open to all cars selling for $850 or less.
Class B—Open to all cars selling for $851 to $1,250.
Class C—Open to all cars selling for $1,251 to $2,000.
Class D—Open to all cars selling for $2,001 to $3,000.
Class E—Open to all cars selling for $3,001 to $4,000.
Class F—Open to all cars selling for $4,001 and over.
Class G—Open to taxicabs carrying two passengers and driver.
Class H—All cars in the touring division.

NEW VEHICLES AND PARTS

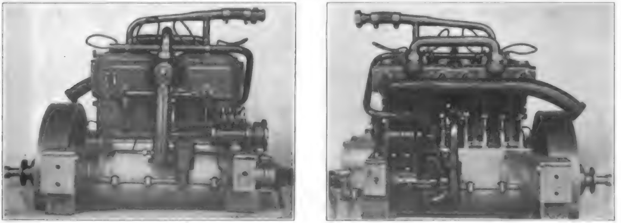
The Sixteen Horse Power Lancia Car.

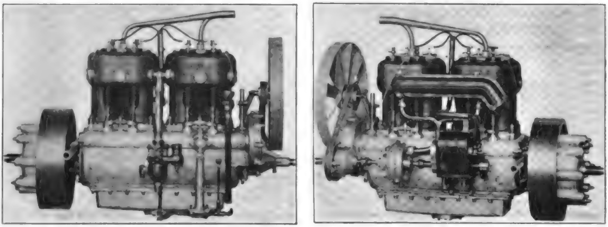
This car, which is designed for light touring or town service, is built by Lancia e Cia., of Turin, Italy. It recently made its appearance in this country, and is to be seen at the Hol-Tan Company's showrooms at 244 West Forty-ninth street, New York city


SIXTEEN HORSE POWER LANCIA CHASSIS.

The motor is of the four cylinder type, the cylinders being cast in pairs, with inlet and exhaust valves on opposite sides. The cylinders are 90x100 millimetres (3⅝x 3 63-64 inches), giving 16 horse power at normal speed. Both inlet and exhaust valves are mechanically operated from cam shafts fitted with integral cams, each cam being individually profiled according to the requirements of its cylinder, and not, as in ordinary practice, having all the inlet cams cut alike and the same with all the exhaust cams. All motor and cam shaft bearings, push rods and gears are thoroughly lubricated, the distribution casing being isolated from the crank case. Pump and magneto drive bearings are lubricated by compression grease cups. A rotary oil pump is driven from the distribution gearing, this pump taking its oil from a reservoir on the dash. On the same shaft is fitted a rotary distributor, which is hollow and provided with radial ports, which successively communicate with ports on the distributor casing as the distributor rotates. These ports have leads to the crank shaft bearings and to the cylinders, and lubrication is thus assured as long as the motor runs. Splash is used for the crank and conecting rod bearings. The crank case is of aluminum alloy, and is of the two part type, the supporting arms being on the upper part. The crank shaft is a solid forging and is supported on three long bearings, so that frequent renewal is unnecessary. All shafts and cams are hardened and ground. The connecting rods are drop forgings of I beam construction, with adjustable big end bearings. Oil tightness is secured by a grinding fit between the two parts of the crank case, and washers are fitted wherever shafts project from the casing. The carburetor is of the company's special manufacture, it being provided with two jets, one for low and the other for medium and high speeds, the change over being accomplished automatically. Each jet is provided with its own regulator, the main throttle being situated at the head of a long "heater chamber" through which the mixture passes. This chamber consists of a jacket surrounding the cylindrical tube, which has the jets within it, and water from the cylinder water jackets is obtained for heating by means of small pipes leading to the "heater chamber" jacket. The inlet manifold passes over the top of the cylinders and branches out to "barbettes" cast upon the cylinders and communicating with the chamber below the inlet valves, two cylinders having a common chamber as in ordinary practice with cylinders cast in pairs. The throttle is controlled by either a thumb wheel or one of the steering wheel spokes or by an accelerator pedal placed on the footboards. The water pump is of the centrifugal type, and is driven by a short shaft from the cam gearing. The pump is fitted with a stuffing box, whose cap is kept from loosening by a rigid blade attached to the pump body fitting in a slot on the cap. No fan is provided, the spokes of the flywheel creating sufficient draught. A honeycomb radiator is fitted, and its connections, like all other pipe connections on the car, are coned unions.

Ignition is by Bosch high tension magneto, with automatic spark advance. The leads from the magneto are taken through an armored conduit to the heads of the cylinders, and emerge to their respective sparking plugs through orifices fitted with fibre collars, the construction protecting the high tension leads from moisture, etc. The magneto is driven from a short shaft on the exhaust side of the motor. The clutch is of the disc type and is housed in the flywheel. The normal position of the clutch is in contact, but the operating mechanism is clear, when the clutch is in, declutching being obtained by pushing forward a flanged collar communicating with the positive plates when the clutch pedal is operated. The clutch shaft is connected to the line shaft of the change gear by means of a readily removable coupling. A novel feature of the car is the motor group, which enables the removal of the motor or change speed without disturbing the other parts, or the removal of both together. The rear arms of the motor case are broadened and provided with a deep flange. To this flange is bolted a like flange on the forwardly projecting arms of the change gear box. The rear suspension of this latter is by


INLET SIDE. LANCIA MOTOR. EXHAUST SIDE.



INLET SIDE. MARMON MOTOR. EXHAUST SIDE.

means of an ordinary aluminum alloy cross member. The removal can thus be effected by taking out the connecting and suspension bolts only.

The change gear is of the selective type, giving four speeds forward and one reverse, with direct drive on the fourth speed. The selectors, slider rods and the greater portions of the shifter tubes are encased within the gear box and are consequently protected from dirt, etc. A removable top is fitted to the box, wing nuts being fitted to retain it in place and enable it to be readily removed. The line shaft projects through the gear box and is fitted with a combined brake drum and universal joint, the latter allowing for slip. The final drive is by solid shaft to the bevel gearing on the rear axle. The differential is of the bevel type, and with the drive gears is housed in a pressed casing, to which are brazed the axle tubes. The axle ends comprise the spring saddles and brake drum face plates, which latter also support the internal expanding brakes. The half axles run on ball bearings, but the load is taken by the axle casings.

Struts are fitted to the axle to give strength with lighter weight. A triangular torque and distance rod is fitted, being attached to the differential casing at the rear and to a spring bracket on the frame at the front end. The front axle is channel section pressed steel, with spring saddles integral. Reversed Elliot type pivots are used, and the drag link is fitted behind the axle. Each bearing or connection in the steering gear has its own compression grease cup. The steering is by worm and sector, the steering hand wheel being bare except for the thumb wheel previously mentioned. The front springs are 36 inch semi-elliptic and the rear springs 45 inch three-quarter elliptics.

The frame is of channel section pressed steel, the upper flanges being deeper toward the gear box. A sweep is given to the frame just back of the dash to allow of turning in a small circle. The wheels are of the artillery type with hand finished spokes, according to Italian wheelwright practice, the front wheels being fitted with 810x110 millimetre tires and the rear wheels with 820x120 millimetre tires. The wheel base is 112 inches and the tread 52 inches. The foot brake acts on the drum at the rear of the gear box and is of the contracting type, the bands being drawn together by cams when the brake is applied. A spring separates them when the pedal is released. The clutch is operated by a pedal at the left of the steering pillar, this pedal being fixed to a tube working in bearings on the forward arms of the gear box and fitted with a fork with roller ends bearing against the clutch flange only when the clutch pedal is operated. Between the clutch and brake pedals is the smaller accelerator pedal, which, like the others, is of the push type. A pull-back lever operates the internal expanding hub brakes. Gasoline is carried in a large tank under the driver's seat for gravity feed, or at the rear of the frame for pressure feed. Splash and mud guards are fitted, as is also a mud apron for protection of the body and passengers.

Marmon 32, 1909, Light Touring Car.

The Nordyke & Marmon Company, Indianapolis, Ind., are preparing a light touring car of approximately 35 horse power to compete in the 1909 market. The accompanying photographs depict the engine from either side.

The first photograph shows the engine from the carburetor side, and in it the means of supporting the engine by means of a cross tube immediately in front of the flywheel and the force feed oiling system connections can be easily seen. This lubrication system enables the Nordyke & Marmon Company to adopt an inclined position for their engines, and so secures a straight line drive with road clearances impossible to attain with ordinary lubrication systems. The oil is forced from a pump driven from the cam shaft to the main bearings of the crank shaft. The crank shaft is hollow and the oil is conducted through the webs of the crank pins, whence it reaches the piston pins through the medium of tubes carried by the connecting rods.

The second photograph, showing the exhaust side of the motor, gives a good idea of the neatness of the design, the arrangement of the pump and the double system Remy magneto.

The American Simplex Touring Roadster.

The Simplex Motor Car Company, Incorporated, of Mishawaka, Ind., having recently completed their new factory, are taking up on an increased scale the manufacture of their Simplex two cycle cars, with both touring and roadster bodies. We show herewith a photograph of the touring roadster with straight line body carrying two, three or four passengers. The engine is of the two cycle valveless type, of 5 inches bore and 5 inches stroke, the four cylinders developing 50 horse power at 900 r. p. m. Two completely independent ignition systems are fitted, one consisting of a Bosch high tension magneto and the other of a storage battery and coil. A special automatic carburetor is fitted, and the control of the car is by a hand throttle and spark lever on the steering wheel, while there is also a foot accelerator. An automatic force feed oiler supplies oil to all bearings and wearing surfaces of the motor.

The change speed gear is of the selective sliding pinion type, the gears being made of nickel-chrome steel. The gear box is integral with the rear axle. Three forward and one reverse speeds are provided. All bearings on the car, except the motor bearings, are of the D. W. F. ball type. The frame is of pressed nickel steel. The car has a wheel base of 110 inches and is fitted with 36 inch wheels, equipped with 4 inch front and 4½ inch rear tires. The gasoline capacity is 20 to 30 gallons. The straight line body is made from pressed sheet aluminum. Both the service brakes and the emergency brakes are of the internal expanding type, located on the rear wheel hubs, are equalized and contain composition to metal friction surfaces. The equipment furnished with this car consists of two side oil lamps, one rear oil lamp, one gas tank, two gas headlights, speedometer, clock, horn, tire irons and tool equipment.

Lozier Car Wins Twenty-four Hour Race.

A 50 horse power, six cylinder Lozier car, driven by Mulford, won the twenty-four hour race at Brighton Beach on Friday and Saturday last, September 11 and 12, having covered a distance of 1,107 miles during the twenty-four hours. A four cylinder car of the same make, driven by Michener, was second, with 1,092 miles to its credit, and a Fiat, driven by Parker, was third, having covered 1,074 miles.

The race was to have been started at 7:30 p. m. on Friday, September 10, but the actual start was made at 8:30, when eleven cars were sent off. At 9:55 Sartori, on the Renault, attempted to pass Juhasz on the S. P. O. close to the pole on the three-quarter turn, but misjudged the distance and struck the fence. As the Renault swung out it collided with the S. P. O., and Sartori and his mechanic were thrown out and injured, the Renault going through the fence and turning over. Juhasz and his mechanic were thrown out, the driver being only cut slightly and the mechanic escaping injury. The Renault was badly damaged and was withdrawn. The steering gear of the S. P. O. was injured, and it was out of the race for several hours.

The Simplex car held the lead gained early in the race until after 1 o'clock a. m. when two cylinders were cracked through the mechanic throwing water on them, putting the car out for several hours. The Allen-Kingston and the six cylinder Lozier then fought for first place, which the Lozier finally took and held until the end of the race. The Lozier at one time was nearly 50 miles ahead, but valuable time was lost in adjusting lamp brackets for the rear red lights, as the electric arrangements which were fitted laid down late on Saturday afternoon. The car returned to the track with the lead much reduced, but kept well ahead thereafter.

About noon on Saturday the race was halted so that the track could be rolled and sprayed. During this period a short race in three heats was run off between a B. L. M. 80 horse power car and the Fiat Cyclone, the former going through the fence, but returning to the track and finishing. At 2:30 the twenty-four hour race was continued, with all but the Garford running, this latter suffering from ignition troubles throughout the remainder of the race. The S. P. O. car, which was of only 16 horse power, kept consistently on, making the circuits at an average of 37½ miles per hour regularly up to the finish. The Simplex, coming on the track after replacing the damaged cylinders, was driven furiously to regain its lead, but it had been out too long and took fifth place, with 1,029 miles, the Stearns finishing ahead of it with 1,050 miles. The race finished at 11 o'clock on Saturday night. The Morris Park record made by the Renault for twenty-four hours of 1,079 miles was broken by both the Lozier entries.

Previous to the start of the twenty-four hour event a number of short races were held. The first of these was a 5 mile race open to gasoline cars selling for less than $3,000. There were but two entries, a Palmer & Singer "60" and a Moon "35." The latter withdrew at the end of the first mile, and the "race" was adjudged to the Palmer & Singer. The second was an attempt to lower the 1 mile record of 54 seconds for the Brighton Beach track made by Walter Christie last year. The Fiat Cyclone made two attempts, the first in 55 1-5 and the second in 54, thus tieing Christie's record.

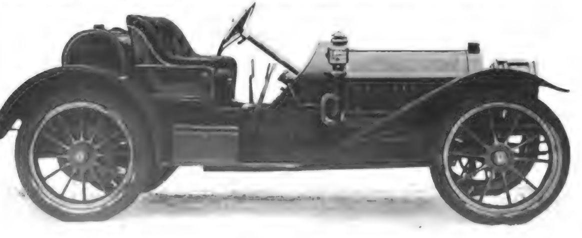
The third race was for 10 miles, open to gasoline cars selling for $4,000 or more. This event was won by a 60 horse power Stearns, driven by J. P. Marquis, in 10:51 2-5. In the 50 mile race which followed the Stearns again won, the time being 51 minutes 8 seconds. These events were scanty and excited little interest.

The following is the final score for the twenty-four hour race:

No. Cylinders.	Car.	Drivers.	Miles.
6	50 H. P. Lozier	Mulford and Cobe	1,107
4	45 H. P. Lozier	Michener and Lynch	1,092
4	40 H. P. Fiat	Parker and Copra	1,074
4	60 H. P. Stearns	Laurent and Marquis	1,050
4	50 H. P. Simplex	Robertson and Lescault	1,029
4	45 H. P. Allen-Kingston	Rippingill and Crane	1,007
6	50 H. P. Acme	Strang and Rodgers	976
6	40 H. P. Thomas	Roberts and Martin	955
4	16 H. P. S. P. O.	Juhasz and Kjeldsen	635

Wisconsin A. A. Annual Meeting.

The Wisconsin State Automobile Association went on record at the annual meeting in Milwaukee on September 9 as being in favor of a national license law for automobiles. Individually, members of the club have long urged the passage of such a law, and since the indorsement by the A. A. A. the first opportunity for such action was the annual meeting. The following directors were elected: Neal Brown, Wausau; James T. Drought, Milwaukee; C. O. Josslyn, Oshkosh; M. C. Moore, Milwaukee; George A. West, Milwaukee; Frank P. Hixon, La Crosse; A. R. Barker, Portage; F. H. Blodgett, Janesville; C. Roy McCanna, Burlington; H. L. Halvorsen, Whitewater; Senator James A. Wright, Merrill; Henry N. Boehm, La Crosse; A. J. Horlick, Racine; F. A. Chadbourne, Columbus. Two new clubs were admitted, viz., those of La Crosse and Monroe.



American Simplex.

COMMUNICATIONS

Trackless Trolley Lines in Europe.

Editor Horseless Age:

I am a subscriber to your paper and would like to ask you a favor, and if you can give me the information I ask I would be very much obliged to you.

I have read some years ago and several times since in your paper about trackless trolley lines operated in Europe. Could you give me some data in regard to same, and can you name the towns where they are operated, or can you send me the papers in which the accounts are, and if those lines still are in operation, and if they are practical? Joseph Ledwinka.

[Comparatively little on such lines has appeared in the automobile and electrical press recently. There are a number of different systems which have been exploited for a number of years, and trackless trolley lines are in apparently successful operation in Germany, Italy and France. The *Electrical World* of September 8, 1906, publishes an article on the Charbonnieres-les-Bains trackless trolley line near Lyons, France, which is 7 kilometres long, and is operated by the Societé de Transports et d'Eclairage Electrique de Charbonnieres-les-Bains. The equipment consists of six motor cars, with a seating capacity of thirty-eight people each, and standing room for ten. These cars weigh 3,400 kilogrammes, and are equipped with a single electric motor of 15 horse power, geared to the wheels by double reduction gearing, designed for a normal speed of 15 kilometres per hour. The cost of the power required during three and one-half months of the winter is said to have been about 40 cents per car per day, with an operation of 75 kilometres. The service is said to be very satisfactory.

In Germany there exist the Gesellschaft fuer Gleislose Bahnen Max Schieman & Co. in Warzen, who make a specialty of installing such lines. One of the lines built by them is the Neuenahr-Ahrweiler-Walphorzheim line, in Rhenish Prussia, which was started in May, 1906. It is about 2 miles long, and the total cost was $35,000. A track trolley line of equal length would cost, it is estimated, $87,500. Power is supplied at a rate of 3.25 cents per kilometre hour, making the cost of operation of the trackless trolley 1.4 cents per car-kilometre. The equipment consist of three motor cars, two being used regularly, with one in reserve. These motor cars weight 3,400 kilogrammes, and haul trailers weighing 1,640 kilogrammes, at a speed of about 22 kilometres per hour. With an operation of 275 car kilometres, 1,052 people were carried, the income being $51.84. The fare charged is 7.5 cents for the trip.

Several other lines built by this company are as follows: The line at Bielatal, opened in 1901; the Muhlenbahm Grosbauchlitz, opened in June, 1905; the Vieschedetalbahn, opened in June, 1904; the Monheim-Langenfeld, opened in May, 1904.

Considerable attention has been given in Italy to the subject of trackless trolley lines, and at the automobile congress, held in Milan some two years ago a paper on the commercial aspect of the system was read. A detailed description of a line in operation at Milan and an illustration of the car and trolley appeared in The Horseless Age of April 15, 1908.—Ed.]

The Spare Wheel.

Editor Horseless Age:

There is a feature accompanying the use of the spare wheel of that type which is attached to the rim of the regular wheel, such as the Stepney, Burrows, etc., which is not as yet generally recognized, but is of decided importance.

The use of the spare wheel will under certain conditions affect the safety of the wheel bearings very considerably, even to the extent of positively endangering them.

Fig. 1 is a rough diagram indicating the centre line of the tread of the regular wheel with reference to the usual arrangement of the ball bearings in the average hub. As the plane of the tread passes between the bearings the load sustained by the wheel is divided between the two bearings proportionately to the distances A and B. The bearings are selected for corresponding carrying capacities.

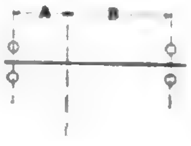


Fig. 1.

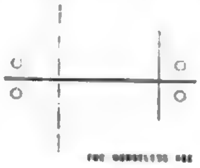


Fig. 2.

The use of a spare wheel changes the conditions as roughly indicated on Fig. 2; the dotted line is the plane of the regular wheel as before, but as that wheel does not carry, this does not come into consideration. The full vertical line represents the plane of the spare wheel tread; depending upon the size of the tire and the relative location of the bearings, this line may fall within the outer bearing, in line with that or beyond it. In every case this carriage of the load on the spare results in imposing a far greater load than contemplated on the outer ball bearing, in all likelihood sufficiently greater to seriously endanger that bearing.

If a spare of this type is to be used, then such use should be restricted to the unavoidable minimum for getting home, and even then cautious driving to avoid all sudden strains is imperative. Henry Hess.

Magnet Steel.

Editor Horseless Age:

Kindly answer the following questions in regard to magnetos in your valued paper: 1. What is the chemical composition of magneto steel and what is the usual heat treatment? 2. What is the flux density that can be expected from the best steel, and is there an appreciable decrease of the flux density with age or from the vibration of the car? 3. Does a high tension magneto necessarily require a higher flux density than a low tension, as usually designed?

H. R. Francis.

[It is generally understood that manganese steel makes the best permanent magnets. There are only very few manufacturers of magnet steel for such exacting service as in electrical measuring instruments and ignition magnetos, and they keep their formulæ and processes secret. It is not well to work the magnets at too high a flux density, as they are then more liable to lose their strength with age. The best French magnet steel is said to be capable of permanent magnetization to 20,000 lines per square inch, while an English manufacturer, Jowitt, claims only 12,700 lines. That the magnets of ignition magnetos fitted to automobiles will gradually lose some of their strength from vibration and other causes is undeniable. A high tension magneto does not require a higher flux density than a low tension magneto.—Ed.]

Weakening Effect of Lateral Offset in Side Frames.

Editor Horseless Age:

I have read with considerable interest the article on "Automobile Frames" in your August 26 number, by Asher Golden, and quite agree with the author that too little attention has been paid to the design of automobile frames.

I think there is one point, however, which your readers would appreciate more specific treatment of, and that is the weakening effect of the horizontal offset so common to the automobile frame of today. I should like to see this handled in a technical manner, and I believe that a great many other engineers, as well as the laymen among your readers, would appreciate a discussion of this point comprehensively handled in this way.

B. D. Gray.

An Automobile Funeral.

Hart, Mich., September 10, 1908.

Editor Horseless Age:

P. E. Thomas, one of our pioneer automobilists, died September 1 from Bright's disease. He had often expressed the wish that when he died he would like to be taken away in an auto. So September 3 sixteen touring cars gathered at his country residence, 6 miles out of town, and after the funeral services they formed an escort to his body from his late home to the local undertaking rooms, from whence the body was shipped to Chicago for cremation.

The machine carried the immediate family and friends, the casket (which was of a beautiful mahogany red) was strapped on in place of the rumble seat of a runabout. The procession covered the 6 miles in thirty minutes.

Mr. Thomas was a very enthusiastic automobilist, and a reader of The Horseless Age, which he considered the sanest and safest automobile paper published.

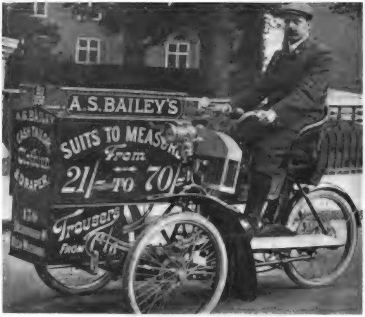
L. P. M.

Commercial Applications.

British Light Delivery Vehicles.

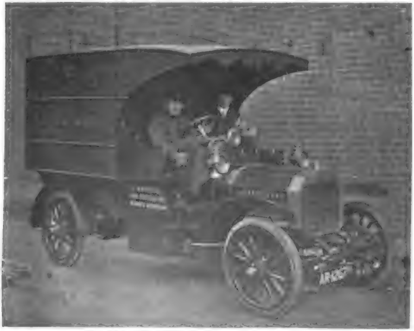
By Roy Lindsay.

Strange as it may read, it is nevertheless a fact that the application of the runabout chassis to business purposes is quite a recent introduction in England, dating back in time three years at the outside. In the early days of the industry, about 1897, many such machines were sold to unwary purchasers, with results that can be traced on the debit side of the owners' profit and loss accounts. The story of this dark page in automobile annals has already been told in these pages—how the conglomeration misnamed motor vans were put on the streets only to reach the scrap heap in a few weeks—and the baneful effect was so far reaching that it remained as a standing object lesson to all business men. Happily for those most concerned, viz., the manufacturers, some few of the journalists writing for the British technical press so persistently published their views respecting the suicidal policy as to gradually impress their thoughts on the minds of too greedy profit makers. Likes voices crying in the wilderness, the men who wrote have at last turned contempt into serious respect, and although none of them are ever likely to realize a single cent of personal gain, they have the satisfaction of knowing that their patriotic efforts have established this particular branch of the industry on a sound footing. The progress made in the employment of the light delivery car, capable of carrying 10 to 15 cwt. of goods, has been phenomenal, not only in London and other large towns, but even in the remotest districts, little places having but 2,000 inhabitants being perhaps quicker to realize their advantages than the big cities.



Tricar.

In England four wheeled machines, horse drawn or mechanically propelled, up to about 30 cwt. capacity, are invariably called "vans," and beyond that weight are "wagons"; a two wheeled vehicle is always described as a "cart." Originally evolved from the pleasure chassis, the business vehicle has developed into so distinct a type that while engine, transmission and frame possess the same general lines, the machines themselves are today as far apart as the north and south poles. In the one we have a high speed engine, refinements of construction, and wheels shod with pneumatic tires; in the other, the characteristics are a slow running engine, elimination of all redundant parts and fittings, and the essential necessity of solid rubber tired wheels. More and more have the types diverged, until those makers who started with the idea of cultivating both classes of business have been compelled to devote entire attention to one or the other, and there is now but one factory in the whole of Great Britain endeavoring to cultivate business and pleasure vehicles, and so small is the annual turnover for the latter that there is every likelihood of the van and wagon becoming its only line at the end of this year.



British Motor Mail Wagon, Fourteen Horse Power.

The tricar, an evolution from the motor bicycle, was very popular for a couple of years as a very cheap machine to carry driver and one passenger, but the placing of the latter tandemwise in front has killed it off, and now hardly one can be seen on the roads. The substitution of a box for light goods, instead of the passenger, has made it a convenient means of delivery for those tradesmen who cannot afford the running expenses of even the smallest four wheeled machine. With a gasoline consumption averaging only a gallon to every 60 miles, and expenses for lubricating oil, pneumatic tires, etc., in proportion, it is just the thing wanted. The British Post Office owns quite a number, mainly employed for transferring goods sent through the parcels post, from the chief office to the various sorting depots in London and the larger provincial towns. Several evening newspapers find them more convenient than any other method of distribution, the drivers being able to nip in and out among traffic far more quickly than can a bigger machine, while when it comes to turning back on their tracks in a narrow street, the driver of the tricar can jump off, lift the back wheel and swing the whole machine bodily around before the "bigger fellow" can find an opportunity for reversing. The machine has its limitations, bad road surfaces quickly shaking it to pieces, and its use is therefore confined to the well paved thoroughfares with which London and other cities are favored.

The Post Office also uses quite a considerable number of four wheeled machines, both light and heavy, the former in particular rapidly supplanting horses in all towns. Hitherto it has been the invariable practice, where the mails were carried by horsed vehicles, to put such work out to contract; but the success attending every service where motor vehicles have been tried has induced the Postmaster General to alter the policy and purchase machines outright. Not many are yet so owned, at least 250 being at present employed by time contract, but it is rumored that in the forthcoming year at least $200,000 will be spent on purchases of motor mail wagons up to 12 horse power or size. In other directions small tradesmen, once they have experimented, are finding motor delivery indispensable, and to attempt to enumerate trades would mean simply taking pages out of a directory.

M. O'CONNOR
TIRE REPAIRER
WEST

Aster Tricar Used by Tire Repairer.

A Commercial Application of the Tricar.

The tricar, as understood in this country, is a three wheeled vehicle for the carriage of passengers or goods, the rear wheel being the driver and the two front, or properly speaking, side wheels being used for steering. The vehicle is usually built upon motorcycle lines, although a great number of tricars in Europe are built as miniature cars, with wheel steering, sliding change gears, etc. The carrying arrangements are invariably the same, the driver, sitting at the rear and the passenger or goods occupying the front. The wheel base rarely exceeds 70 inches, 56 being the average, and the tread is generally 36 inches. A description of the tricar for passenger service will be found in The Horseless Age for December 18, 1907.

Parcel Runabout in Oxford Street, London.

The demand for commercial vehicles is today great, and will probably continue to be so for an indefinite time. The demand, it is true, is chiefly for trucks and for delivery wagons, but there are a still larger class than that which demands delivery wagons, who either keep a horse and wagon, or whose custom is of such size that the use of a horse and wagon would be uneconomical, but who yet cannot give the required service with boys and baskets. To such users the tricar may prove an efficient carrier, being small, inexpensive in upkeep and having a carrying capacity of from 300 to 500 pounds. Its first cost, it is true, is rather high compared with that of a good horse and wagon, being from $300 to $480, as against $200 to $350 for the horse outfit, but the cost per mile in service of the two methods of transport is decidedly in favor of the tricar. A case in point is that of a New York butcher who purchased a 4½ horse power Aster tricar in 1905. The tricar has a two speed gear, and is provided with a delivery box, with a full load capacity of 500 pounds. The owner personally drove the tricar to the markets every morning and returned, carrying on an average 485 pounds of meats, vegetables, etc., the trip out being light and the load being carried on the return. The distance covered was 12⅙ miles per day. In addition, delivery trips amounting to an average of 10¼ miles were made daily. The following table shows a month's expenses taken at random, and also the expense of keeping a horse and wagon in New York city for the same period:

Tricar.

Fuel, 16½ gallons, at 20 cents	$4.20
Oil, 3 gallons, at 75 cents	2.25
Storage and washing	Nothing
Tires	$0.35
Estimated depreciation	4.00
	$10.80

HORSE AND WAGON.

Feed	$14.00
Bedding	2.00
Stabling	14.00
Shoeing	3.00
Repairs to harness	1.50
Repairs to wagon	1.20
Veterinary (estimated)	2.00
Depreciation of wagon (estimated)	3.00
	$40.70

The difference in cost is most marked between the two. The advantage is all in favor of the tricar. In the case in point the butcher kept the tricar in the cellar, and had it washed by the store boy, who did not receive any extra wages for the service, consequently the cost for storage and washing was nil. The tricar is the one type of vehicle which can be stored in this manner, its width being such that it can be taken through an ordinary shop door, a prime consideration in this era of constricted passages.

The tricar covered 634.2 miles during the month in question. Giving the horse and wagon an equal mileage, we have the cost per mile, $0.017 for the tricar and $0.064 for the horse and wagon. But it has been found that the average horse in delivery service cannot travel 634 miles in a month without breaking down, needing extra shoeing or otherwise increasing the expense. The mean of three cases of horse delivery, closely approximating the mileage covered by the tricar, was 516⅓ miles. The cost per mile would increase, then, from $0.064 to $0.078.

Another condition enters here, viz., the relative capacity of the bodies of the two vehicles. The tricar can only accommodate six baskets of goods in the box, while the wagon can accommodate twenty, so that the latter can deliver three and one-third times as much per trip as the tricar. During the test cases mentioned above, the average delivery speed was 4.24 miles per hour, while the tricar delivery speed was 8.4 miles per hour. Let us now suppose that there are eighty baskets to be delivered per day, over the same route of 6 miles, a condition frequently met in New York city. The wagon will deliver these in four trips at 4.24 miles per hour, and the tricar in fourteen trips at 8.4 miles per hour. For the 6 miles, the wagon running time would be 5 hours 39 2-5 minutes, and the tricar's 11 hours 25 2-5 minutes. The cost of the trip will then be $0.384 and $0.102 respectively, and the cost per useful hour for the horse and wagon $0.068 and for the tricar $0.089, a difference of $0.021 in favor of the horse and wagon.

It is evident that if the tricar can raise its delivery speed it can operate at the same or lower cost than that of the horse and wagon. Of its ability to do so there is no doubt, the car in question averaging 10.8 mile per hour with a load of 250 pounds on the trial of one month before its sale. If the delivery speed of the tricar be raised above 10.8 miles per hour the cost per useful mile will be less than that of the horse and wagon in the case under consideration. To compete with the tricar on the basis of speed the horse would have to be driven quite rapidly, resulting in a shortening of the animal's useful life and laying him up in a short time.

It is unfortunate that there are no yearly figures extant on tricar service in this country. The owner referred to only recently began to itemize his delivery expenses, having previously "lumped" the expenses in a general manner with his other accounts, under the head of "Car." Figures from France, or other parts of Europe are of little value, owing to the difference in costs, in road surfaces, fuel, etc., and can only be used as proportionate approximations. The tricar was never taken up in this country to any extent, there being but five water cooled tricars in the whole of the United States to date, four of which are used in cities for commercial service. These, with the exception of the one referred to in this article, have either been in service only a few months, or their owners have kept no close account of the costs. The air cooled tricar has been tried out in Europe and abandoned, owing to its tendencies to overheating, despite its lower cost. The figures given in the table are quite high proportionately to those given in Paris for tricars in similar service, so that it may be inferred that the figures are not unusual. No figures as to country service are obtainable at all. The illustration shows a tricar of the Aster type in use by a tire repairer at one of the New Jersey summer resorts, it being exactly like the machine referred to.

New Style Taxicab for New York.

The New York Taxicab Company are placing in operation new models of their regular Darracq taxicabs. These new cabs do not differ materially from former models, the changes being the substitution of thermo-siphon circulation for the pump system heretofore used with the radiator mounted on the dash, "Renault" style, with a sloping hood. A belt driven fan within the radiator forces a current of air through it. The seat beside the driver has been eliminated, and the space thus occupied is now used for the carrying of trunks and packages. This trunk carrying feature is not new with this particular model, some of the regular models being so constructed. These two changes are all that constitute the differences between the old and new models, but they will undoubtedly be of advantage, as some trouble has heretofore been encountered with the pump circulation.

A. L. A. M. to Sue Members in Arrears for Dues.

At the meeting of the board of managers of the A. L. A. M., held in New York city on September 3, it was decided to take action against members of the association who are in arrears for royalties for a year or so. The defection or threatened defection of a number of members is said to be responsible for this decision.

It is well known that at least four members of the association are in arrears for a year's or at least nine months' dues. To meet the objections of these members to the terms of royalty payment a new agreement was drawn up some time ago, and the receivers of the Electric Vehicle Company, owner of the Selden patent, were authorized by the courts to adopt this agreement. This provided for a reduction in the rate of royalty payments. Other terms of the agreement were not satisfactory to the four members, however, and they persisted in refusing to pay their dues, and now the association is reported to be about to bring suit against two members, the Olds Motor Works and the Buick Motor Company. For a period of nine months efforts were made to settle the matter out of court, but they proved unsuccessful, and now the suits for the collection of the dues are to be instituted through the Electric Vehicle Company. In the case of the Olds Motor Works suit is also to be brought to compel them to show cause why their license should not be revoked, while the Buick Company's license is to all appearances to be continued.

In addition to the decision to bring suits, the A. L. A. M. has adopted a resolution that members in arrears on royalty payments shall not be allowed space at its Madison Square Garden Show, it being hoped that this would bring those in arears to time. It seems, however, that the move will not prove effective in the case of the four members above referred to, one of whom is reported to have asked for space at the Independent Show to be held in the Grand Central Palace.

Another and perhaps the chief cause of dissatisfaction on the part of members of the association is the continuance of the A. L. A. M. policy of having agents handling licensed cars agree to handle no others. This did not affect the manufacturers directly, but it affected them through their agents, who in a number of cases can find sales for "independent" cars, as well as the "licensed" product. As the agreement forbids handling both kinds the agents often refuse to handle "licensed" cars, and the manufacturer is obliged to get other agencies or lose that proportion of his sales. Consequently the feeling of dissatisfaction is strong. The admission of new members to the association was also objected to in several quarters, it is said, as the association thereby brings competition within the camp in addition to that which is outside.

The Olds Motor Works was one of the charter members of the A. L. A. M., and has been very active in the past in its work, F. L. Smith, the general manager of the Olds Company, having been at one time president of the association. The Buick Motor Company, on the other hand, has never taken any great part in the affairs of the association, and is one of those who are satisfied with the agency policy.

LEGISLATIVE and LEGAL

Illegal Police Methods.

By Xenophon P. Huddy, LL. B.

Notwithstanding the fact that the law is violated frequently by automobilists, there is no excuse for illegal depredations upon personal security and private property on the part of police officials who arrest persons for violating the speed limits. The use of ropes stretched across the public highways, the erection of hummocks and other obstructions in the path of travel, and the display of firearms on the part of the policemen and constables are unauthorized, unless there are extremely aggravating circumstances connected with an arrest. General obstructions placed on the road are never sanctioned under any circumstances connected with automobiling.

No more force can be used by an officer of the law in arresting a person who has committed a misdemeanor than is absolutely necessary for making the arrest. This legal requirement should be known and understood by every peace officer. Physical violence is prohibited, and the use of dangerous weapons renders a police officer liable for assault, if it is unauthorized. It must be borne in mind that violators of the automobile laws are guilty of misdemeanors merely, and are not to be dealt with harshly, especially where violations are only technical. Most automobilists are respectable, law abiding citizens, generally speaking, and are persons of business standing and integrity. Ignorant officials have no right to violate the personal security of these citizens, and if they do they should be taught a lesson in respecting personal rights.

For example, if an automobilist is arrested and he submits to arrest, indicating no disposition to escape, there is absolutely no warrant for poking a pistol in his face and threatening him with being filled with lead. Of course, if one who is arrested attempts to get away or escapes from an officer, then force may be employed to capture the offender. But if too much force is used the officer makes himself guilty of illegal conduct. A glaring instance of official oppression occurred at Scarsdale, N. Y., on September 3, 1908.

On the day in question an automobilist left Greenwich, Conn., for New York city, with two ladies with him in the car. While driving from White Plains to Scarsdale at a moderate rate of speed he suddenly heard a motorcycle coming up from behind, and when the motorcycle was abreast of him he was commanded by the rider to stop, and was informed that he had violated the speed limit. The automobilist asked the officer the rate of speed at which he was alleged to have gone.

The officer, looking at his speedometer on the motorcycle, said, "Thirty miles an hour." The maximum hand showed 30 miles.

The automobilist replied, "Your maximum hand shows 30 miles, which you had to do in order to overtake me, but do you mean to say that I was going that fast?"

The officer demanded of the automobilist his name and address, and handed him a receipt for $25. The automobilist, not knowing what the paper was, carefully folded it and placed it in his pocket, and politely asked the officer what time he wanted to see him again.

The officer demanded, "Where is your money?"

The automobilist replied, "What money?"

"The $25," the officer said.

"Have you not got it?" the automobilist retorted.

The officer said, "No."

"Well, I have not got it," the automobilist replied.

Then the officer said, "I gave you a receipt."

The automobilist replied, "If you gave me a receipt for $25 you must have the money," and he further remarked that the officer had better take him before a justice of the peace or a court.

The officer replied that there was no justice of the peace nearby, and that no court would sit before 7:30 that evening. It was then about 3 o'clock p. m.

The automobilist replied, "Then lock me up, if you wish."

The officer said, "You will have to pay me the money," whereupon he pulled a revolver and pointed the muzzle of it in the automobilist's face, saying, "I will make you pay me."

The automobilist immediately wanted to know if he was in Oklahoma or Indian Territory. He requested the officer to inform him if he wanted him to hold up his hands while the officer could go through his pockets. The officer replied, "I will fill you full of lead if you don't pay me."

Finally, after much wrangling over the payment of money, the two went before a justice of the peace at the automobilist's suggestion. They found the justice digging a ditch in his backyard. The coupon on a National Surety Company's bail bond was given as bail, which was accepted without objection, although this should have been sent to the company's office and the power of attorney left with the justice. The case was set down for trial on September 10, at the Scarsdale Town Hall.

Trial of the case was had at the appointed time, and the case was decided in favor of the automobilist, solely on the police officer's testimony. The officer stated under oath that he traveled 900 feet at a distance of 12 feet behind the car, and during that time his maximum speedometer hand registered 30 miles an hour. He then stated positively that the speedometer did not at any time register over 30 miles, whereupon he was promptly asked what his speedometer registered when he spurted the intervening 12 feet in order to catch the automobilist. His answer was that his speedometer did not register any higher. This the court could not swallow and gave the decision to the defendant.

Legal Notes.

A new automobile ordinance is being considered by the Council of Butte, Mont., which restricts the speed of automobiles to 9 miles per hour in general and to 4 miles in turning corners, or crossing intersecting streets. Local motorists are reported to be strongly opposed to the new measure.

A London alderman, Sir James Ritchie, recently declined to convict a motor cab company under a bylaw of the city prohibiting the casting of filth on a public roadway. The matter in question was a deposit of thick, black lubricating oil, shed by the motor cab on a street. The alderman held that filth means something detrimental to the public health and does not include lubricating oil.

New Jersey Club to Expel Thomas.

At a meeting of the New Jersey Automobile and Motor Club, held at Newark on Monday night, the trustees of the club took up the case of E. R. Thomas, a member, and ordered him to show cause why his membership should not be revoked. This was the first meeting of the trustees since the accident in which Thomas figured occurred. They denounced reckless driving as detrimental to the cause of automobiling generally, and passed the following resolution:

"Whereas, Reports have been received by the trustees of the New Jersey Automobile and Motor Club to the effect that E. R. Thomas, one of its members, was, on the night of August 14, 1908, recklessly and unlawfully driving an automobile through the public streets of Long Branch; and whereas, it is the opinion of this board that such an occurrence as it is understood took place on the above mentioned date is not only detrimental to all users of the highway, but if left unnoticed would tend to bring automobilists in general into disrepute, and whereas this club has placed itself on record as being strongly opposed to such actions, be it resolved that charges be, and they hereby are, preferred against Mr. Thomas, and that he be requested to appear before this board on the evening of October 5, 1908, to show cause why he should not be expelled from membership in the New Jersey Automobile and Motor Club."

Coming Events.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

OUR FOREIGN EXCHANGES

Steering Gear Matters.

As every road shock tends to deflect the wheels, it is necessary to provide some mechanism which will resist such deflection without throwing the strain on the arm of the driver, and this is most easily accomplished by the use of the customary worm and sector gear.

This gear is not really irreversible, though it is usually described as being so, and, as a matter of fact, if a really irreversible gear is fitted, the steering is very uncomfortable.

It would be perhaps naturally anticipated that a truly irreversible mechanism which did not allow any motion to be transmitted from road wheels to hand wheel would absorb all shocks, and therefore be extremely comfortable, but, as a matter of fact, though the shocks are absorbed, the rigidity of the gear renders it impossible to "feel" the road, and after turning a corner or swinging out to pass another vehicle the return to the straight course cannot be obtained by the same natural and easy motion possible with a gear that is not quite irreversible.

But the worm and sector, though no doubt the best mechanism to use, is never made strong enough for the work it is called upon to perform. Owing to the vast majority of steering motions only taking place over a small portion of the total lock, any gear will wear more rapidly at the centre of its motion than at the extremes, and therefore it is almost impossible to provide a positive adjustment which will take up wear at the centre without making the gear stiff on the locks, yet knowing this designers still continue to make gears of the same size and pattern year after year.

Why should not the worm and sector be made double or treble the size that they usually are?

There is plenty of room in most chassis for a very much larger steering box, and even if there were not it would be well worth while to alter the rest of the mechanism to permit of one being fitted.

Every manufacturer must know that his cars will be steered improperly in garages and carriage shops, and yet even in the light of this knowledge he does not design his gear to stand the ill treatment it is certain to receive. Not only are gears never made strong enough, but they are very seldom made accurately. If a worm drive for a back axle was being produced the worms and worm wheels would be most carefully cut, ground and hardened, but the steering gear which is continually absorbing shocks, even if it is not in constant motion, very rarely has correctly shaped teeth, let alone hardened or accurately fitting ones. The gear is usually more or less slack even when new. A worm gear will bind unless the teeth are correctly in mesh, and though a gear may move with perfect ease when there is no strain on it, as soon as any pressure is applied the gear will stick. Thus a gear which appears to be perfect when the wheels are jacked up, may be either always tight, always loose, or tight and loose in alternate positions when in actual use.

The worm and nut or screw gear suffers from exactly the same defects, and possesses the additional disadvantage of requiring another joint to conect the nut itself with the steering lever.

The New Orleans cars are fitted with a clever arrangement, which is vastly superior to the majority of worm gears, but which possess the disadvantage of not being in any sense irreversible. On the end of the steering column is a bevel pinion which meshes with a large bevel sector keyed to the steering arm itself; behind the pinion is a strong spring which keeps it in close contact with the sector, and thus all wear, however uneven, is automatically taken up, and the steering remains always free from backlash.

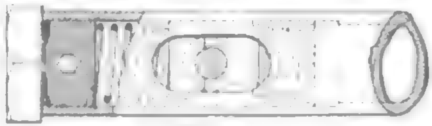


Fig. 1

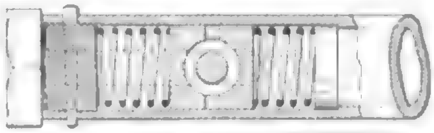


Fig. 2

There seems to be no valid reason why the fundamental idea of the spring adjustments should not be applied to a more irreversible form of gear, but if manufacturers would only consent to make their steering mechanism much larger there would be much less need for any adjustment at all.

Also, if the same care was taken over the machining and assembling of the gear as is taken over other parts, looseness or stiffness would never occur. Also it may be added, the worm should be properly supported and provided with adjustable thrust bearings. In quite a number of gears the only bearings are at the extreme ends of the steering column, and when this is the case the spring in the tube of which the column is made will allow the worm to spring partly out of mesh with the sector, and when there is no adjustment to the thrust, as soon as a little wear has taken place not only will there be lost motion but the worm will be able to move up and down slightly, causing rattling in the box accompanied by snatching at the wheel.

IMPORTANT DETAILS.

Even assuming that the gear itself is incapable of improvement, there still remain quite a number of details which are usually so badly designed as to be absolutely dangerous.

Firstly, the joint pins of the tie rod are seldom large enough, also the forks at the ends of the rod are frequently weak, and it is only in very rare instances that any adjustment or proper means of lubrication are provided.

Even though the actual motion about these pins is small, there is a continuous strain the whole time the car is running, which strain varies as the road shocks vary, and the constant blows on the pins are equivalent to quite a considerable amount of motion. It is hardly necessary to describe the methods by which these joints can be improved; it is simply a question of spending a little extra money in the first instance, but the amount is so small by comparison with the total cost of the car and the importance of the parts is so vital, that the wonder is manufacturers can afford to neglect them.

Most steering accidents have doubtless occurred through one or the other of the ball joints becoming detached, and there has recently been much discussion on this subject. It may be allowed that considerable improvements in this portion of the steering mechanism have recently been introduced, but some of them are unnecessarily complicated, and many cars are still fitted with the old fashioned joint in which, if the locking device fails and the cap unscrews, the ball is immediately freed and the car rendered unmanageable.

The advantages of the ball joint in comparison with the pin universal which was employed on the old Wolseley cars is that it is easy to make it so that the wear is automatically taken up by springs. The ball should most emphaticaly always be fitted on top of the stub axle arm and at the side of the steering lever, so that the steering rod will not easily drop off if the ball becomes loose in the cups. Assuming that the most convenient tubular ended rod is used, there are two ways of inserting the ball; the first is illustrated in Fig. 1, and may be called the old standard type. Here the tube is slotted so that the ball can be pushed in from the end together with the cups. There are numerous ways of locking the cap in position, but it can never be screwed up tight on account of the tube being split, and all locking arrangements are liable to failure. Even when a large split pin is put right through cup and tube as shown, the joint is not absolutely secure.

The other method is to make a hole in the side of the tube sufficiently large to admit the ball itself. One cup is put in from the end; the ball is then inserted and the other cup locked in place. This joint is better than the first described, because the cap can be firmly screwed up in the first instance, and if sufficiently powerful springs are placed behind the cups, even if the cap comes off together with the outside cup, the ball will be unable to escape from the tube, being nipped between the back cup and the side of the hole in the tube (see Fig. 2).

Of course with this joint breakage of the back spring, accompanied by the loss of the cap and outside cup, would render the joint useless, but, though there are several much more costly and complicated devices in use, scarcely any of them are more reliable than this type.

The security of all of them depends on something, and generally a small something; therefore it would be advantageous if a totally separate connection could be made between steering lever and stub axle arm—a connection which would only come into action when the ball jointed rod failed. It has been suggested before that the cable steering as used on the 8 horse power Rover cars might be used as a secondary system co-ordinate with the usual arrangements, but even if this is considered to be unduly complicated it should not be difficult to provide an emergency connecting rod.

All the minor faults of steering mechanism, such as wandering of the road wheels without movement of the hand wheel, spring in the connections, backlash, and consequent snatching at the wheel, are due simply and solely to the designers not realizing the immense strains to which every portion of the gear is subjected. Unfortunately, the weakness is not confined to the joints alone; the usual tubular connecting rods are none too strong, and breakage of the stub axle arm sometimes occurs, particularly where it is made to carry both the connecting rod and tie rod. Where springs are employed they are seldom of sufficient strength; tie rods, connecting rods, levers and the worm gear itself, each and all have a heavy load to carry, and they are rarely strong enough to carry it without a considerable amount of springing and bending, rendering the steering uncertain in action and very uncomfortable when running fast over rough surfaces. The trouble does not altogether lie in the design, for, as has already been mentioned, bad workmanship is frequently met with even on quite good cars.

UNEQUAL LOCK, FLAPPING AND WANDERING.

A typical example of careless fitting is the frequency with which cars will lock over further on one side than on the other; the stop which limits the motion may occur at any part of the gear, but it is usually in the worm box, and it is only necessary to set the sector properly to obtain equal lock.

Also if the steering lever is not vertical and if the stub axle arm is not at right angles to the connecting rod when the road wheels are in their middle or straight position, a definite motion of the steering wheel will give a different degree of lock, according to the direction in which it is made.

Another frequently observed effect is what is best described for want of a better term as flapping of the front wheels. With almost every car there is a particular speed at which this action will be most pronounced. If the wings are removed it will be seen that the wheel cans wobble from side to side to some considerable extent without in any way disturbing the hand wheel, and this even when there is no slack in the joints. It is partly caused by spring in the connections, but is also due to an entirely different action. As the rear springs give to a bump, the frame approaches nearer to the axle, and as it recovers its original position the ball end of the steering lever will move up and down in a vertical line. The ball end of the stub axle arm cannot move similarly, and so it is forced to move to and fro, and the wheels must, of course, move likewise, so that when a continual bouncing is going on the wheels will flap.

The shorter the connecting rod the more pronounced will this action become, and it need scarcely be added that such flapping tends to make the steering erratic. The fashionable large rake to the steering column necessitates a short connecting rod, and thus flapping is usually worse on new cars than on those of older pattern.

THE IDEAL STEERING OUTLINED.

Ideal steering would comprise the Renouf centre pivot axle with slightly raked pivots, combined with the Lavenir connecting links. Such a combination would not require an irreversible gear, as it does not require to be held forcibly against the resistance of every inequality in the road. All that would be required is a reduction gear, so that the ratio between the motion of the hand wheel and the road wheels should be comfortable in use.

The reduction gear and all joints in the connections should be adjustable, and, if possible, automatically so. The same precautions would have to be observed in the design of the ball joints as should be the case with the usual steering system, and the same precautions would have to be taken to prevent flapping; but none of the parts would be subjected to anything like the same strains as are entailed by the ordinary axle, and would be amply strong if made of about the same dimensions as at present.—*The Autocar.*

Test of Rubber for Purity.

India rubber lends itself very well to adulteration, and as the uses of this material are widespread and the price is high, it is perhaps only natural that adulterated and impure mixtures are to be found on the market. The following tests, which can be carried through quickly and without any special apparatus, are recommended by a French contemporary:

(1) Rubber that contains no other material than sulphur can, after vulcanization, be stretched to seven times its normal size before breaking.

(2) Rubber that contains a greater proportion of foreign substances (especially metallic oxides) than of caoutchouc will break after vulcanization upon being stretched to five times its normal size.

(3) A well vulcanized rubber will not harden or crack when subjected to cold.

(4) Rubber will not stretch under pressure nor change its appearance under the action of certain reagents, as ether, absolute alcohol, benzine, chloroform, carbon disulphide and carbon tetrachloride.

Electric Vehicle Company Report for August.

Following is the financial statement for the month of August filed by the receivers of the Electric Vehicle Company with the clerk of the Superior Court at Hartford, Conn., on September 10:

Charges on account and cash sales...	$20,231.00
Purchases on account..................	6,866.66
Cash	459.40
	$7,326.06

CASH STATEMENT.

RECEIPTS.

Cash on hand August 1, 1908........	$242,770.23
Cash collected on E. V. account......	119.96
Cash collected on receivers' account..	20,866.87
Golden royalty.....................	143.71
	$263,900.77

DISBURSEMENTS.

Pay roll..............................	$12,663.47
Traveling expenses..................	125.00
Purchasing creditors................	3,619.39
Freight and expenses................	172.25
Petty cash..........................	450.40
Telegraph and telephone............	175.34
Storage	75.00
G. B. Selden........................	28,002.00
A. L. A. M..........................	50.36
Licenses	118.00
Pub. Exh. Exp.......................	33.00
	$45,483.21
Cash receipts.......................	$263,900.71
Cash disbursements..................	45,483.21
Balance on hand September 1....	$218,417.56

Pope Manufacturing Company Report.

Following is an extract from the report of Receivers Albert L. Pope and George A. Yule for the Pope Manufacturing Company in Connecticut for August:

Balance in bank and cash in office July 31..........................	$326,363.20
Cash receipts for August...........	54,043.66
	$381,306.91
Cash disbursements for August......	$66,776.30
Balance in bank and cash in office....	314,530.65
Accrued liability of receivers.........	20,658.65
Balance due, accounts receivable, etc.	$112,704.34
Less cash collections and deposits credited to accounts................	57,531.88
Balance August 31..............	$55,172.46
Balances due from receivers of Pope Manufacturing Company in other districts, and receivers of Pope Motor Car Company for transfer of merchandise and supplies, and advances for expenses......	$4,423.41

The Argentinian Motor Club has recently held a number of contests for second hand cars. The first event of this kind took place early in August, and consisted of a 3 mile race on a straight, level stretch, which proved quite a success.

MINOR MENTION

Hackett & Witham, machinists at Skowhegan, Me., will enlarge their garage next season.

E. D. Etnyre, a wagon builder of Oregon, Ill., has perfected an automobile and begun its manufacture at his plant.

The Meteor Motor Car Company, of Bettendorf, Ia., inform us that they began deliveries of 1000 cars thirty days ago.

The Abendroth & Root Manufacturing Company, Newburgh, N. Y., have opened a repair department in connection with their factory.

The Meteor Motor Car Company, Bettendorf, Ia., have opened a branch office and salesroom at 1233 Michigan avenue, Chicago.

The H. H. Franklin Company, Syracuse, N. Y., have recently moved into a new five story, concrete, fireproof building, 97x62 feet, which will be largely devoted to motor trucks and cabs.

A. F. Spawn, a St. Louis inventor, is bringing out a fire extinguisher for automobiles, which is claimed to be of such compact construction that it can readily be carried on the car.

The first car to be manufactured by the new Burdick Motor Car Company, of Eau Claire, Wis., for the general market will be ready on September 20. It is an 85 horse power "Burdick Greyhound."

Ground is being broken at the Rambler works in Kenosha, Wis., for a solid concrete building, 257 feet by 150 feet, making a total of 38,500 square feet of floor space to be added. The new building will be used by the final test department.

According to a report from Flint, Mich., the Buick Motor Company delivered 1,007 cars during the month of August. The total output for the year so far has been 9,100 machines, of which about 4,000 were of the No. 10 runabout model.

The Goshen Motor Works has been incorporated and will establish a plant immediately at Goshen, Ind., for the manufacture of motors, engines, boilers, motor boats and motor vehicles. O. L., L. G. and L. F. Ihrig hold the capital stock of $25,000.

Stewart & Clark, of Chicago, manufacturers of the Stewart and American speedometers, have opened a New York branch office in the Motor Mart, 1878 Broadway. A storeroom is located on the first floor, and there are basement facilities where instruments may be installed on cars.

Automobile manufacture is now the largest single industry in the city of Syracuse. During the past year the H. H. Franklin Manufacturing Company transacted business to the amount of approximately $4,000,000, and the automobile industry has now gained a lead of three-quarters of a million over the clothing industry, which formerly held a record in that city.

Application blanks and diagrams of the Chicago Automobile Show for 1909 have been issued. Applications, in order to be considered in the first allotment, must be received at the manager's office not later than Saturday, October 3, and the allotment will be made on October 7.

The Seidel Buggy Company, of Richmond, and the Anderson Carriage Company, of Anderson, are the two latest Indiana concerns to bring out models of high wheeled motor buggies, and will place them on the market next season. There are now sixteen concerns in Indiana manufacturing vehicles of this type.

It is announced that in the Pierce 1909 model the change gear lever, which on Pierce cars has so far always been carried on the steering post, just below the steering wheel, has been removed to the side of the seat, in conformity with the practice of the great majority of makers. All of the cars will be equipped with four speed gears.

Thomas F. Hart and Madison Maring, of Muncie, Ind., capitalists, are preparing to establish a large automobile factory in that city at an early date. Present plans include a factory building that will employ several hundred men. It is stated that the company is negotiating for the purchase of the patents of an established company, the name of which has not been divulged.

The Buggy Car Company, Incorporated, of Cincinnati, Ohio, has bought the assets of the defunct Postal Auto and Engine Company, of Bedford, Ind. N. N. Anderson is secretary and general manager. At present they are located in a small shop on West Fifteenth street, but they will move within thirty days to a three story 50x110 foot building on the corner of John and Armory streets.

The recently organized Commercial Motor Vehicle Company, of Indianapolis, has established temporary headquarters at 145 East Market street, and within the next two weeks expects to make a definite announcement of its plans. The company was organized several weeks ago with $10,000 capital to conduct a manufacturing business. It is understood that the company expects to devote its attention to motor trucks and other business vehicles.

The Constantine Motor Car Company has been formed at Constantine, Mich., to take over the business of the Crescent Motor Car Company, of Detroit, which is valued at $50,000. The parties behind the deal were formerly connected with the Hawley Auto Company, which was moved from Constantine to Mendon a few months ago. The new company will build a runabout designed by J. C. Forrester, of Detroit, who will be general manager of the plant.

Inmates of the Home for Friendless Women in Indianapolis were treated to an automobile ride by tradesmen of that city on September 3. Seven cars were donated for the purpose by the Gibson Auto Company, Premier Motor Car Company, National Motor Vehicle Company, Fisher Auto Company and the Buick-Losey Company. The ride included a trip through Irvington and Woodruff Place and north of the city, over the Michigan road. Refreshments were served in Woodruff Place.

Club Notes.

The Physicians' Automobile Club of the Oranges (N. J.), has named five delegates to the New Jersey Good Roads Convention to be held at Atlantic City September 25.

The Fulton County (Ga.) A. C. has made application for letters of incorporation, the incorporators being Floyd W. McRae, Asa G. Candler, Jr., E. H. Iman, Beaumont Davison and John S. Cohen.

The Automobile Club of Albert Lea, Minn., was organized at a meeting held on September 8, and the following officers were elected: President, Edward Olsen; vice president, Svend Svendson; secretary and treasurer, Dr. A. O. Watland. The club starts with a charter membership of twenty.

At the meeting of the Pennsylvania Motor Federation held at Germantown last week the following new clubs were admitted to membership: Munroe County A. A., Lawrence County A. A., Johnstown A. A., Scranton A. A., A. C. of Franklin, York County A. A., Pottstown A. C. and the Oil City A. C. President R. G. Hooper recommended the passage of a resolution condemning driving above the legal limit.

J. H. Weeks, president of the Good Roads Committee of the Pennsylvania Motor Federation, has worked out a bill to be presented to the Pennsylvania Legislature, which asks for an appropriation of $5,000,000 for the next two years, for the construction of new roads, and for $3,000,000 as State aid for road construction. The former amount would be used for roads built entirely with State funds, while the latter amount would be used to assist counties in building and maintaining roads.

Commercial Notes.

A new automobile line between Lima and Ada, Ohio, began operations on September 8. A single car is used and three round trips are made per day.

The Joseph Horne Company, dry goods merchants of Pittsburg, Pa., have placed three 1,200 pound Frayer-Miller delivery wagons in service for city delivery.

A Studebaker State agent for Texas is at present having demonstrations made with a 5 ton electric truck in Galveston, where it arrived from New York a short time ago.

Geo. E. Burwell, formerly connected with the Olds Motor Works and with the Lozier Motor Company, has been apppointed superintendent of the Oscar Lear Company, Springfield, Ohio.

The Cedarhurst Motor Livery Company, New York, have placed an order with the Oscar Lear Company, Springfield, Ohio, for ten taxicabs; they already have five of these cabs in service.

W. H. & J. W. Bruner & Co., of Kansas City, Mo., plan to establish a motor line between Clovis and Tucumcari, N. M., a distance of 75 miles. They are also establishing a machine shop at Clovis.

A movement is on foot in Maine with the object of placing a graduated tax of $2 per horse power on motor vehicles, the proceeds to be devoted to road improvement purposes. The project seems to have originated in Somerset County, and will be brought up for discussion at the next meeting of one of the granges in that county.

Garage Notes.

Detroit's automobile row on Woodward avenue, east of Jefferson street, is gradually breaking up, owing to the fact that the dealers located there are deciding one after another to build their own garages.

The Hokanson Automobile Co., of Madison, Wis., agents for the Buick, White Steamer and other cars, is building a $12,000 garage on East Doty street, Madison. It will be ready for occupancy December 1.

The Wilmington Auto Co., Franklin dealers in Wilmington, Del., have under construction a large garage building next to the New Avenue Theatre at Delaware avenue and Tatnall street. The building has a frontage of 83 feet in Delaware avenue and a depth of 114 feet.

The garage at Devil's Lake, N. Dak., was destroyed by fire, and $7,000 worth of damage was done as the result of a gasoline explosion on a car on which two mechanics were doing repair work, on September 3. There were twenty cars in the building, but all were run out before they were injured by the flames.

The Westcott Garage Co., Utica, N. Y., has purchased the garage and automobile business of Chas. H. Childs & Co., of that city, located at the corner of Cooper and Cornelia streets. The Westcott Garage Co. is a newly organized concern with Addison Westcott as president and William B. Westcott secretary and treasurer. Addison Westcott was formerly connected with the Childs Garage for two years.

Frank Staley, vice president and general manager of the H. T. Hearsey Vehicle Co., Indianapolis, has sold his interest in the business to Fred I. Willis, who has been with the company several years, and the name of the company will be changed to the Hearsey-Willis Co. The company was for many years engaged exclusively in the carriage business, but Staley saw the opportunity offered by automobiles. For several years the company has carried a large line of automobiles, this year having the State agency for the Marion, Pope-Waverley, Rambler and White Steamer. Staley has gone to the Pacific Coast for a rest and will probably engage in the automobile business when he returns. He is president of the Indianapolis Automobile Trade Association.

New Incorporations.

Corsicana Motor Co., Corsicana, Tex.—Capital, $6,000. Incorporators, T. P. Kerr, J. Clarence Thomas and S. E. Kerr.

Coit Automobile Co., Omaha, Neb.—Capital, $10,000. Incorporators, J. Clarke Coit, J. T. Stewart and Ella M. Brown.

The New London Auto Co., New London, Wis.—Capital, $5,000. Incorporators, A. Falkenheimer, W. J. Sader and H. R Furst.

Penn Motor Car Co., Philadelphia, Pa., and Dover, N. J.—(Under Delaware laws). To manufacture and deal in all kinds of motor vehicles.

James Leckie & Son, Camden, N. J.—Capital, $250,000. Incorporators, F. R. Hansell, John A. MacPeak and George H. B. Martin. To manufacture gas and gasoline engines, automobiles and bakers' machines.

MOTOR VEHICLE PATENTS

Reviews of Specifications.

897,598. Lubricator.—Paul Daimler, of Untertürkheim, Germany. September 1, 1908. Filed September 4, 1907.

This relates to a lubricator employing a pump or a number of pumps to deliver oil to a number of places on a motor. The pump mechanism comprises a cylindrical casing attached to the cover of the instrument, a rotary distributing valve, pumps with their driving mechanism, and oil outlets from which leads are taken as desired. A shaft is borne in the casing of the lubricator in a suitable manner and is fitted at the outer end with a ratchet wheel, by which it may be driven in any convenient way. A crank is fitted at the inner or pump end, and driving rods attached to pump plungers are worked by this crank. These pump plungers work in barrels integral with a cylindrical body or casing, the pump barrels being in communication with the interior of the casing. A two part rotary distributing valve revolves within the casing, it being driven by a gear on the shaft in the ratio of 1 : 2. Six or more outlets are also made integral with the casing, these being arranged in threes and projecting at the top of the instrument. Suction pipes for each pump project to the bottom of the lubricator body, which is intended to act as a reservoir for the oil. The distributing valve is made in two parts, connected by dog clutches, and hollowed for the reception of a spiral spring tending to draw them toward each other when in position. L shaped grooves are cut in the circumference of this valve.

As the shaft is rotated the pumps enter on their suction stroke, and the distributing valve is correspondingly rotated, so that its grooves establish communication between the pump barrels and the suction pipes, drawing oil into the pumps. As the pumps enter on the delivery stroke communication is established between the pump barrels and the outlets in succession, whereby the oil is forced through these outlets. The pressure of the oil during this stroke forces the two parts of the distributing valve slightly apart, allowing oil to flow along the seats and thus lubricating the valve. The spiral spring returns the parts when the pressure is relieved. A continued rotation of the shaft and mechanism causes these operations to be repeated.

Patents Issued September 8, 1908.

897,868. Electric Ignition Device or Sparking Plug for Internal Combustion Motors.—Charles O. Bastian and George Calvert, London, England. Filed June 27, 1906.

897,880. Wheel Tire.—Josiah S. Cushing, Norwood, Mass. Filed February 8, 1906.

897,881. Elastic Wheel.—André Dauvergne, Lyon, France. Filed November 29, 1907.

898,029. Metallic Tire.—Wolsey R. Barbour, Terre Haute, Ind. Filed April 16, 1907.

898,043. Shock Absorber for Vehicles.—Chas. K. Foster, Centerville, R. I. Filed June 12, 1907.

898,057. Wheel.—John W. Meixwell, Lewisburg, Pa. Filed February 17, 1906.

898,082. Brake for Vehicles.—William Wolfe, Patton, Pa. Filed August 22, 1907.

898,103. Explosion Engine.—Thaddeus W. Heermans, Evanston, Ill. Filed February 26, 1907.

898,117. Internal Combustion Engine.—Herbert J. Leighton, Syracuse, N. Y. Filed March 8, 1902.

898,124. Fuel Pump for Internal Combustion Engines.—James D. Macpherson, New York, N. Y. Filed August 25, 1906.

898,139. Internal Combustion Engine.—David Roberts, Grantham, England. Filed November 9, 1907.

898,156. Motor Vehicle.—Thomas J. Thorp, Corvallis, Ore. Filed July 12, 1907.

898,175. Power Transmission Mechanism.—Wallace E. Belt, Dodge Center, Minn. Filed July 8, 1907.

898,237. Radiator for Automobiles.—Joseph B. Long and Christopher Wright, Chicago, Ill. Filed October 23, 1905.

898,249. Steering Mechanism.—James G. Maxwell, Washington, Pa. Filed December 17, 1907.

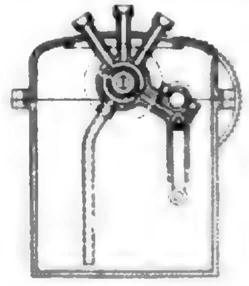
898,278. Steering Gear.—Daniel W. Smith, Oyster Bay, N. Y. Filed January 8, 1908.

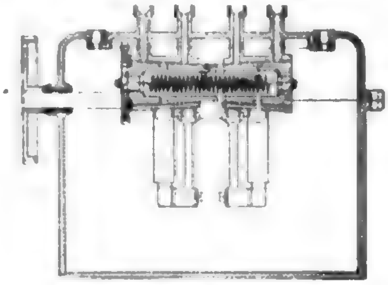
898,280. Vehicle Wheel.—Irving Snell, Little Falls, N. Y. Filed October 22, 1907.

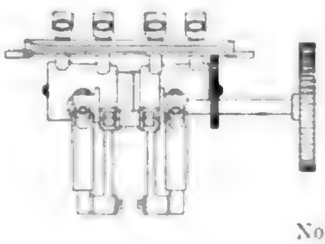
898,317. Explosive Engine.—Varnum F. Carpenter, Cleveland, Ohio. Filed December 21, 1907.

898,361. Carburetor.—Frank H. Heitger, Indianapolis, Ind. Filed March 31, 1906.

898,402. Elastic Vehicle Tire.—William Brameld, Paterson, N. J. Filed August 14, 1907.







No. 897,598.

Trade Personals.

Wm. E. Clark, of Moline, Ill., the mechanical engineer who several years ago organized the Deere-Clark Motor Car Co., has filed a petition in bankruptcy with the clerk of the United States Court at Peoria, Ill. His liabilities are said to be about $50,000, while his only assets consist of clothing and personal effects, which are exempt. The chief creditors are several banks from which Clark borrowed money on notes, which, however, were well secured.

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Specialization in the Design of Runabouts for Business Use.

By F. E. Watts.

The field for the small car is as yet only slightly developed, and its use for business purposes has scarcely begun. This being the case, the question naturally arises, What kind of a runabout will be best suited to business use? In answer, I think, we may safely say that the field for the business runabout is so enormous, and the conditions in different lines of work are so varied, that quite a number of differing styles of machines will be needed to adequately supply the demand.

Eventually we will have a million or more small cars in use in this country, and a large number of them will be used wholly or partly for business purposes. Long before that time comes the tendency of our age, specialization, will most probably have asserted itself, and we will have a typical car for each purpose where the demand is large enough to warrant the manufacture of a special type.

It may be of interest to consider some of the conditions which may determine the adaptability of cars for different services.

INFLUENCE OF ROADS.

Of the exterior conditions which influence the design of a car there is perhaps none more important than the road or street surface. It may be hard and resilient like brick, plank, dry macadam and dirt or cold asphalt; soft and yielding like sand, cinders or ashes; sticky like clay or loam mud, or as hot asphalt is to a much smaller degree; it may be smooth, may have a regular series of small projections like old brick, cobblestones or cedar block, or it may have occasional large holes and deep ruts like little used roads and cross streets.

These road surface conditions affect the running gear primarily. They determine the kind and section of tires, the diameter of the wheels and the spring suspension, and have considerable effect upon the length of wheel base desirable.

Where a car is used in deep sand the majority of the time, for instance, solid tires would be anything but desirable; while if it were to be used in streets and alleys littered with tin cans and broken bottles only solid tires would be practical. Over cobblestones and similar surfaces it is an open question which tire would be best.

For comparatively smooth surfaces rather small wheel diameters may be used, but where there are large holes the wheel sizes must be increased. Under some conditions on muddy country roads a small section solid tire on a large diameter wheel may cut through the mud to solid bottom and give the best propulsion, while on other roads there is apparently no bottom, and only large section pneumatics wound with rope or with something similar to give a paddle wheel effect, make a working combination.

Roads with excessive camber or with deep ruts may necessitate an unusual clearance and so affect the body design. Where there are occasional deep holes in the wheel tracks not only is a large clearance needed, but the wheel base should be longer than would otherwise be necessary to avoid too much pitching.

HILLS AND HORSE POWER.

Taken in connection with the length and steepness of the hills the road surface is a strong factor in determining the horse power necessary. The hills and their surface are, of course, usually the determining factors in the choice of the change speed gear, its type, the number of speeds and the reduction ratio of each. Brake leverage and the material and area of the rubbing surfaces are ordinarily decided from the nature of the grades, though occasionally the traffic through which the vehicle is operated is the determining factor.

The road width and the nature of the traffic fix the tread and help to decide the wheel base, since the tread and wheel base determine the practical turning radius. The road width and surface taken in connection with the traffic are also important factors in deciding the proper steering reduction, and whether the gear shall be "irreversible" or not.

In many lines of business it is necessary to carry a considerable weight of tools, goods, samples or luggage of a similar nature. The weight of these, added to the passenger weight, makes the load of the car, and a consideration of this weight, such road conditions as we have just itemized, and the speed it is desirable to maintain, or to attain at certain times, will usually determine the horse power required.

ENGINE TYPE.

After the horse power necessary has been decided there still remains the choice of the engine type and of the number and arrangement of cylinders. These points would usually be decided by the relative value of flexibility and low operating cost. Which would have most weight would, of course, depend largely upon the nature of the service.

Where speed and smoothness of operation is the chief requisite, the four cylinder, four cycle, or three cylinder, two cycle engine would probably be best. For rather smaller cars and a less exacting patronage the two cylinder, vertical two cycle motor, or the opposed four cycle will give almost equal results at a smaller expenditure. And specially balanced two cylinder, vertical four cycle motors deserve strong consideration.

For such work as demands a low operating cost and allows of moderate speeds the single cylinder, vertical motor, either of the two or four cycle type, will have a large field. Up to the present the four cycle is in the lead as regards flexibility and fuel economy, but there is no telling when the two cycle may overtake it.

CLUTCH AND CHANGE GEARS.

After the motor design is settled upon the next element in the power transmission system is the clutch. For most uses the simple leather faced cone or the metal to metal cone may be made entirely satisfactory. But there are certain services where frequent stoppage is necessary, and where the clutch must be engaged and disengaged frequently, such as where a car is used for calls in the business section of large cities. For such purposes the multiple disc clutch will probably prove most satisfactory.

When we come to consider the change gear we encounter most contradictory conditions. For use in some cities and over improved roads it would be almost practicable to use a multiple cylinder motor without any change gear, while in other places conditions vary so from level to hilly that a friction drive with its great speed variation would seem desirable.

Whether chains or gears should be used for the final drive is a question which depends almost entirely upon the design of other parts. If they are suitably enclosed either may give entire satisfaction for any service under any road conditions. But as gears require less attention than chains, they will probably prove most popular.

BODIES.

Perhaps no part of the business runabout will merit more careful consideration, or offer greater opportunity for the exercise of ingenuity, than the body. To render a body comfortable and attractive and at the same time provide for the convenient disposal of a large amount of luggage in the small space available will prove no easy task. In many instances bulky samples or large and unwieldy tools must be stowed away securely enough to avoid injury when making long journeys over rough roads. Of course, the requirements of the body will be a considerable factor in the determination of the wheel base.

INTERCHANGEABLE BODIES.

While the nature of the business a runabout is used in and the roads over which it must run form the determining factors in its design, it will not do to forget that nine out of every ten runabouts sold for business purposes will also be used for pleasure. This makes good appearance a most important requirement, and will in many cases have an important influence upon the question of the most desirable speed and flexibility. There will be many purposes for which two bodies will be desirable, one for business and one for pleasure. In many of these the only change necessary will be in that part of the body back of the seat. In others, perhaps, only special panels bearing the firm name or other advertising will need to be removed to convert the car into a pleasure vehicle.

PRICE.

Price will always be a strong consideration in deciding upon runabouts for any purpose, and as low prices are only made possible by manufacture in large quantities, the price they can be made at will quite largely decide how many types of runabouts will be produced and how soon they will be put upon the market. It is by no means likely that there will be a distinct type for every business that runabouts are used in. For many lines of work the characteristics of the best car will be near enough alike so that one type will be good enough for all. In many other lines standard types of pleasure cars will serve all practical purposes, with perhaps a few changes in the body. Other lines may offer a large enough field so that one company can specialize on cars for that purpose only.

The High Wheel Runabout.

By Lewis F. Rhodes.

The high wheel auto, in my opinion, will find an unlimited field among the masses. The greatest expense of a car of any description is considered to be the pneumatic tires; even when the machine is not being used the tires deteriorate somewhat, so that expense goes on to some extent, and for this reason alone I feel that it is a safe prediction that the solid tired high wheel brings this type of car nearer the average person's means than the pneumatic tired vehicle, and it is also better adapted for persons of little or no mechanical ability.

MOTORS.

The use of the air cooled motor, which now may be obtained from a number of reliable manufacturers, is another factor tending toward the simplification and cheapening of this type of car, for I believe that the air cooled engine is the cheaper one, as so many parts prone to cause trouble are eliminated by its use. The car may be stabled in any shed, or even kept outside with only a covering of oil cloth, without fear of its becoming ruined. The power required for these rigs is comparatively small (12 horse power, I feel, is enough for any conditions that may be encountered), and the air cooled motor can be used without the slightest fear of becoming overheated. This much argued question is now settled, as some of the recent endurance contests have demonstrated. In fact, I understand that air cooled cars gave less trouble from overheating than did some of the well made water cooled cars.

CHANGE GEARS.

Many forms of transmission have been used for this type of car, such as a cable, planetary and belt transmission, and one maker at least uses sliding gears. The fact that a number of Western makers, who have brought out these high wheel cars, attempted to build them at a price at which they could be readily disposed of, somewhere near the cost of a horse and buggy, has led to the use of the friction transmission, as it certainly is less expensive to build than any other form, and has the appearance of being less troublesome in the hands of totally inexperienced people. As I have been employed by one of the large manufacturers of friction drive cars, I feel that I am in position to speak on this form of drive, having had road experience covering thousands of miles, and I wish to go on record as saying that, despite all arguments, dynamometer tests, theoretical formulas, etc., friction drive in any of its forms (with, perhaps, the exception of one device which is used by one of the oldest builders at the present time) is certainly better suited for any other form of machine than it is for a self propelled vehicle, and I am very sorry to say that, while this form offers great inducements to prospective buyers of machines or manufacturers who are about to embark in this branch, it is far from being what is desired. The greatest fault is the loss of power from the twisting action due to the difference in inner and outer diameters of the driven friction discs. The aluminum or fibre combination with a single disc is, in my opinion, the most satisfactory arrangement of this form of drive. According to the arguments of some makers who employ more than two discs for driving, if two discs will do the work four discs ought to do it better. This, I claim, is wrong, for the simple reason that each added friction disc adds just that much more loss, due to the difference in diameter of the inner and outer edges of the friction discs.

A well designed oil tight planetary transmission with the bands enclosed and protected from mud and dirt leaves nothing to be desired. This form has stood the test of years in large and heavy cars, and after eight years' experience I have seen very few stripped gears in this form of transmission. Considering its cheapness, extreme ease of operation, etc., there is no doubt that this form will still hold the field in high wheel cars.

FINAL DRIVE.

Double side chain drive is the only practical form of final transmission of power, for the reason that, owing to the extremely large size of wheels and the fact that most of these cars are equipped with stock wheels which have only wooden boxes in the hub, shaft drive is practically out of the question. The ends of shafts cannot be secured in the wooden boxes. Also, as the rear axle on a solid tire car has transmitted to it very severe road shocks, a divided rear axle containing a differential would surely suffer in a very short time. I have seen the shaft drive attempted in several makes of high wheel cars in the West, and was unable to get a demonstration covering 2 miles in three different makes of shaft drive cars.

SUBSTITUTE FOR DIFFERENTIAL.

In my opinion the most desirable feature in the high wheel car is some satisfactory device that will work at all times and eliminate entirely the use of the differential. When a pneumatic tire encounters any obstruction, such as a small stone, the latter is forced partly into the tire, but portions of the tread of the tire still remain on the ground. In the case of a high wheel car the solid tire not having the same elasticity as the pneumatic, the tire, wheel and rear axle must be raised over even a very small stone or pebble, and when the wheel is raised from the ground as power is applied to it, the stone will roll underneath the solid tire, and naturally, owing to the presence of differential, the entire car loses just that much of its driving energy, and as this action doubtless takes place hundreds of times in a mile's travel, a device that will eliminate differential action and drive steadily on both wheels, even if one is raised off the ground by obstructions, will add greatly to the efficiency of the car. I have personally observed this action taking place, and have noticed on at least one occasion where a grade with loose surface was being ascended by a high wheel car that the rear wheels threw almost a shower of small stones from underneath them, while the pneumatic tire of another car right back of the high wheel car did not produce this result. As there have been numerous attempts to use ratchet devices, eccentric movements, etc., to get rid of the differential or equalizing gear, no doubt other manufacturers have observed the above described trouble peculiar to this class of machine. Whether this has been the incentive for the recent attempts to get something different from the differential, or whether it was for the sole purpose of cheapening construction, I am unable to say. I do not, however, recollect any mention of this defect of the solid tire ever having appeared in THE HORSELESS AGE.

SPRINGS AND FRAMES.

I believe that the employment of four full elliptic springs not over 36 inches in length fully covers the suspension of the high wheel car, as they are less liable to break than half elliptics, and can be obtained, in case of breakage, at almost any country blacksmith shop or carriage supply store, besides offering the advantage that clips and fittings for these springs are sold by large wagon concerns, which enables the manufacturer to use this form cheaper than a special form of spring. Angle steel for the frame answers the purpose very nicely, and can be made quite light if a truss rod is used, which insures a perfectly light and stiff frame to which the different machinery can be secured better than to a wood frame.

Owing to the large wheel dimensions and small engine power, comparatively low gear ratios have to be employed, which means that when the car is coasting or running without the engine power applied, a great deal of energy is required to revolve the transmission, as then it is "geared up" and the car does not coast easily, or not at all, even when the clutches are disengaged. A form of drive which will allow the rear wheels or transmission to be free when the power is disconnected would mean a more economical and swifter running machine, to say nothing of the saving in wear on different parts.

A COMPARISON.

I will conclude this article by stating the disadvantages and advantages, as I see them, of the two types of runabouts manufactured at the present time.

Pneumatic tired runabout: Much delay is caused by tire trouble in any of its forms. Space is required for carrying an extra tire and tubes, jack and tire tools necessary to repair this class of tire. Time is lost in making repairs to tires, etc. There is danger of tire bursts on stony and bad roads. Greater expense is incurred than is desirable for business purposes.

Machines so equipped are too low for a great many of our country roads. It is difficult to get under the car to make necessary adjustments or repairs. There are too many small parts. There is not enough carrying space. Owing to the oil, grease and dirt present, the owner or operator of the car, rather than become covered with dirt and have his clothes spoiled, will quite frequently run the car to its destination when he is well aware that it should have prompt attention. It skids badly. It is difficult to operate in bad weather. If water is used for cooling the engine great complication is added.

The high wheel type: Absolutely no trouble from tires, as $10 to $20 will buy a set of four side wire 1¼ inch tires which will last at least one season, and this is less than the cost of one pneumatic tire, with the added advantage that solid tires may be used until entirely worn to the rim. Owing to the greater road clearance, the machinery is more accessible, and in the case of repairs or adjustments becoming necessary they can be made without crawling under the car. At speeds not exceeding 15 or 18 miles per hour the car is fully as comfortable as the pneumatic tired over good roads. Water breaks may be passed over much easier and with less jolt than is possible with the smaller pneumatic tired wheel. Owing to the fact that standard wagon parts are employed so extensively, repairs can be had almost anywhere at a fraction of the cost charged by manufacturers of pneumatic tired machines. From the first these machines have been designed with fewer parts than are used in the other class, and quite naturally the fewer the parts used the less trouble should be experienced. If all nuts and bolts are secured by lock washers or drilled and wired no trouble will be experienced from these coming loose and being lost; neither will axles and parts crystallize, as is quite commonly believed, if proper springs are used.

The only sensible position for a motor is in the forward end of the car, covered by a hood, and as the double opposed, air cooled motor is without pipes, pump, radiator, etc., the entire power plant of the vehicle may be reached in a standing up position without soiling one's clothes or ruffling the temper, which is not the case with the customary low hung runabout of today.

Again, I would say that the field for high wheel cars is surely promising, and I feel that in a couple of years' time enormous numbers of these machines will be in daily use, and a man with even a very modest income will have his own conveyance. As there is no running expense when an auto is not in use, the difference between the keep of a horse and an auto can easily be figured. The difference is especially great in a large city.

The Runabout in General, Mine in Particular.

By FRANK N. BLAKE.

The runabout has from the first appealed to me as being the best, most useful and most interesting member of the automobile family, and as time passes these impressions deepen. Statistics are not at hand to confirm or refute the belief that among horse drawn vehicles intended for carrying passengers runabouts outnumber all other models; but if this conviction is correct and the runabout is in most demand for animal drawn vehicles it may reasonably be the same among self-propelled ones, if things are left to take their natural course. It is more than probable, however, that for good business reasons the makers of automobiles and their agents are responsible for the sale of many a four or five passenger car to a buyer who if uninfluenced would have selected a smaller one.

It may not be thought worth while to enumerate advantages possessed by the runabout over its competitor, the so-called touring car, yet to the many who have not given the matter much attention it will be interesting to briefly specify some of the considerations which point out the light car as the one most to be desired by the average user.

The cost will be mentioned first, this being a vital matter with thousands and thousands of men who want and need a motor vehicle. There are great numbers of men with whom the difference of a few hundred dollars means the possibility or the impossibility of having a car. Closely allied to first cost is the consideration of maintenance expenses, which may easily become more important; take the cost of tires for instance, a price list of the various sizes forms an index as to the relative expense of running a light or a heavy rig, even without remembering the fact that heavy vehicles wear out tires faster than light ones do.

LOW EXPENSE.

General replacements, repairs and accessories are more expensive for a large car than for a small one, often altogether out of proportion to the cost of production. Perhaps it is not fair to drag the bicycle into the discussion, but if the reader thinks it is he can find food for thought by referring to the prices charged for odometers, called "cyclometers" if sold for use on a bicycle; these instruments, made in the same factory, for the same sized wheel and of the same capacity cost the user $1 if it is thought that it is to be used on a bicycle, and $6 if for an automobile; to be sure the weight is greater by perhaps 2 ounces, but the layman sees no reason why the gearing is different or the expense of manufacture greater in one case than in the other.

The matter of gasoline and oil consumption naturally comes to the front, and in this the light vehicle compares favorably with the one which weighs a ton or so more. As there is nothing like a concrete example it may be in order to say that one day recently a large gasoline car owned in this place consumed 34 gallons of gasoline during a run of 142 miles, a little under 4.2 miles per gallon; a runabout went over most of the same road using gasoline at the rate of 44 miles per gallon. The less important item of oil was not reported, but probably it was used in about the same ratio.

CONVENIENT STORAGE.

Storage room, either for regular or temporary use, can often be found for a runabout which would not be of capacity necessary for the accommodation of a larger car, as those who have occasion to seek shelter from a passing shower sometimes discover.

Streets and country roads are sometimes too narrow for the convenience or even the possibility of turning a large car around in them, but which will accommodate one of moderate dimensions very comfortably in this respect. The ease of general handling is something which also deserves attention; aside from the occasional difficulty of turning the big car around where available space is limited it has greater weight and consequent momentum, which makes the sudden stop which safety sometimes renders necessary either a difficult matter or an utter impossibility, and also because of greater weight it sinks in mud and becomes stalled on hills which a lighter car will successfully negotiate.

UTILITY.

The utility of the light car for real, actual use, not for pleasure alone, can hardly be compared with that of the four to seven passenger car, so great is the difference. It would often be large enough if it accommodated but one person, that one being the professional or business man who has occasion to go between residence and office and to scores of other places in quest of men with whom he has dealings or to do other necessary errands. Naturally the physician is the first one we think of as needing a light car which will quickly and reliably take him over all sorts and conditions of roads, but there are many others who also need a like conveyance with which if not to save life to at least save time, which is closely allied to life and which is proverbially known as money.

And so it appears that the little car is superior to the big one in a number of particulars; of course there is another side to this question, but it will not be dwelt upon here, this being a brief in favor of the runabout

A FIVE YEAR OLD.

My runabout is one of the humblest of its class, being one of the little curved dash sort and of 1903 make, but it is now running more powerfully, quietly and economically than when new. This being the case it goes without saying that it has been taken care of and not much abused. During these several years of use some repairs have been necessary, and as might be expected sundry alterations and improvements have been made, as experience and observation indicated that they were desirable, and time and opportunity made their execution possible. In some quarters it is customary to hold such improvements up to pitying ridicule, as though the man who happens to own an automobile cannot be expected to be capable of improving what has engaged the time and capital of the large number of men whose combined efforts were united to produce. It is freely admitted that some attempts to "improve on nature" are failures, but at the same time it stands to reason that the user is in a position to observe defects and sometimes to suggest remedies which either have not occurred to the manufacturer or have not appealed to him as being of sufficient importance to make it worth while to make the improvement; sometimes it is suspected because the thing will sell without the added expense of costly alterations of patterns and methods, and all that such would involve. However, the proof of the pudding is said to be the eating, and similarly the question of improvements is settled by results rather than by theory; if power is gained, excessive heating overcome, economy of fuel attained and noise quieted, then the alleged improvement justifies itself.

RECORD FUEL ECONOMY.

Long before the advent of the automobile the man who could make two blades of grass to grow where but one grew before was justly acounted a public benefactor, and now in this age in which the noble consumer of grass is being dispensed with it may be a benefaction to some to tell how 1 gallon of gasoline has been made to propel a horseless carriage containing two adults over 58 miles of western Massachusetts roads when 29 miles per gallon was once considered good. My runabout did this so recently that probably the limit has not been reached, and hopes are entertained that under more favorable conditions and after making some changes it will do better. The run referred to was not made for the purpose of establishing a record, but was traveled over our common roads on a combined business and pleasure trip; filled tires were used, weighing twice as much and running harder than pneumatics.

It should be mentioned that the writer is not a practical machinist, and has never had the benefit of shop experience; however, having a liking for mechanical matters he has been better able to look after details than the man who cares for none of these things, and no doubt it was in a measure due to this that the car ran over 2,700 miles at a cost of only 27 cents for legitimate repairs outside of usual tire troubles. It is only fair to state that during this time the rivets holding the front sprocket to the transmission sheared off, and that the cost of this repair was put in as 2 cents, this being the sum expended for steel wire of which to make the five new rivets, with nothing added for time required to put them in. (Later a ten hole sprocket was procured and put on, thus doubling the strength of this weak point.) No account was made of 50 cents paid a blacksmith for straightening a knuckle bent by locking wheels with a carriage drawn by a horse which a steam roller had frightened on a narrow road, this not being classed as having been made necessary because of wear or any inherent weakness on the part of the automobile.

In the meantime various alterations have been made, such as separating the water and gasoline tanks to prevent heat from vaporizing gasoline, lowering the radiator front that air may reach it better and make the cooling more effective, remodeling the carburetor in order to make it furnish a better mixture, removing superfluous metal from the high speed spider to obtain better balance, shortening and lightening its set screw for the same purpose, removing locknut and holding screw with a piece of wire, etc.

CYLINDER BADLY SCORED.

As time went on it was discovered that the compression was not what it had been, and an investigation revealed the cause in a badly scored cylinder. The piston pin, not having been effectually secured, had worked loose, and not content with damaging one side, had worked the other way and plowed two parallel grooves in that side also. This was a serious matter, and in view of the abnormal prices charged for parts it was decided to have the cylinder rebored and ground. Accordingly it was taken to a machinist, who began the work by making the necessary appliances, some of metal and some of hardwood, all apparently well suited to the purpose, but before the grinding was quite completed some part of the apparatus went adrift. Careful measurements showed that there was a taper of about 9-1000 of an inch in the bore of the cylinder and pretty evenly distributed along its 11 inches of length, but aside from that the job looked to be well done. Disinterested parties advised that the taper be disregarded as being so slight that it was improbable that it would make a perceptible difference. Doubtless this was the case, but it seemed a pity to undergo the labor of making a new piston and rings without first removing the taper. Even if it did no discernible harm it would greatly detract from the pleasure and satisfaction of making the new parts, so it was decided to take it out, and this was done by hand work and lots of it.

A hoe shaped steel scraper was made and a lead pad 3 inches long and about the same width was cast in the cylinder. Carborundum powder No. 100 and oil were used with the pad, and by dint of grinding and scraping and scraping and grinding the bore was eventually made cylindrical. The progress of the work was tested from time to time by inserting the piston casting, which had been turned down until it would just enter the larger end of the cylinder. This process consumed the greater part of four days; probably a machinist would have done the work in much less time. When finished the cylinder measured about 4⅛ inches in diameter.

A DIFFICULT JOB.

Making a new piston, rings and pin on a foot lathe by an amateur worker was considerable of a task. It was decided to use "bull-ring" construction, which in this case consisted in making the inside ring one-half inch wide and three-thirty-seconds of an inch thick, and two outside rings, each one-quarter of an inch wide and three-sixty-fourths of an inch thick, to go side by side in the same groove. Two sets of these rings were used. The inner rings were cut at right angles and pins put through the cuts into the under side of the piston prevent them from turning. The ends of the outside rings were cut to lap instead of having the more common diagonal cut. No attempt was made to turn them eccentric nor to make the outsides truly round after cutting, it being expected that wear would make the slight correction needed. The rings held compression fairly well from the first, and improvement is noted as time goes on and still more is expected to follow. Objection has been made to halving the ends of the rings because of their liability to break off; but if a fillet is left instead of making a square cut this argument does not hold good. It is a matter of surprise that more attention is not paid to making tight piston rings, even a small leak in compression, explosion and possibly in so called suction must amount to considerable in the aggregate, as one of these several functions is in almost continuous operation whenever the engine is running. After otherwise finishing the piston a lot of three-eighth inch holes were drilled through the walls on those sides where there is practically no wear, the object being to lighten it.

IMPROVEMENT IN CARBURETOR.

Some experiments were made with furnishing warm air to the carburetor, and they resulted in making a metal jacket for the cylinder head and regularly supplying the carburetor with warm or hot air therefrom, it being thought best to afford every possible aid to the speedy and thorough vaporization of the gasoline. This process was further assisted by putting four layers of fine copper gauze, 110 meshes per linear inch, into the induction pipe, held by soldering each inside of a well fitting tin hoop. Two layers of sixteen mesh gauze were placed between the engine and the fine gauze to protect it by cooling the gas and breaking its force in case of backfiring. That the hot air and gauze made a better mixture—one which burned more rapidly—was proved by the fact that after these innovations were installed it was immediately observed that advancing the spark made almost no perceptible difference in the power of the engine, the reason assigned being that the mixture was a good one and burned quickly, and therefore did not need to be ignited so early in the stroke as it would otherwise.

The runabout left its makers with space for only eight cells of battery, but it was thought that the addition of two more cells gave better results without being unduly hard on the spark coil contacts, so now ten cells are regularly used, wired in "series-multiple," so that the obvious advantages of that system are enjoyed, while the one disadvantage of being without a reserve battery is guarded against by always carrying an ammeter in a little padded tray in the battery box top, and spending a few seconds testing the cells every hundred miles or so.

INLET VALVE SPRING LIGHTENED.

The original inlet valve spring was taken off and a much weaker one substituted, the new spring being made so weak that the engine will run well without the inlet lever. This gave a considerable increase in power, and showed that because of the small valve and its short lift the engine had not taken in full charges. It appears that now some of the advantages of both automatic and mechanically operated valve are combined. Ordinarily the piston is relieved of the work of opening the valve by suction; it is opened positively, and because of its weaker spring the valve is able to and actually does sometimes open faster and wider than the lifter compels it to.

Another improvement made in this immediate vicinity consisted in making a stuffing box to prevent the leakage of air around the inlet valve stem, thus producing a more homogeneous mixture at all times, but more particularly at slow speed when the tendency to leak is greatest and the quantity of gas taken in is smallest, thus throwing the proportions most out of balance at the very time when best results are needed.

The exhaust valve is set to open at 39 degrees before centre, and close 5 degrees after the following centre. Often too little attention is given to timing the exhaust valve; no exhaust is perfect, and a very imperfect exhaust is a serious matter, resulting in retention of heat and reduction of power, partly on account of back pressure on the piston and partly because of the smaller incoming charge admitted and its inferior quality, being diluted and contaminated by the burnt gas which should have been expelled.

IMPROVED WIRING.

The secondary wiring has been changed so as not to go through the battery box and around the body, thus making it more convenient as well as considerably safer because shorter. Shortening the high tension wire is always to be recommended as affording less opportunity for leakage. If the cable is not of the best quality there is some loss even if sparks do not jump from it. If examined while running in the dark a glow will be seen when the outside of the cable is touched with metal or even the hand, though no spark is seen or shock felt, and probably there is also some loss which is imperceptible by these means.

A species of muffler cut-out has been added. It consists of an inch hole cut in the muffler shell and closed with a slide. It is found to be too small to afford much relief from back pressure, for with slide wide open and throttle opened moderately a pressure of about 2 pounds per square inch is indicated. Still the cut-out must be of assistance on bad hills, where it is frequently used if no one is near to be annoyed thereby. The cut-out was put in chiefly for the purpose of giving warnings of approach, and so save the disagreeable noise of a horn, but it does not prove very satisfactory for this purpose, the sound being insufficient.

PREVENTING OIL WASTE.

Lubrication is an important matter, which has come in for some attention. Oil cups have been put on cam shaft and worm gear, and the oil hole by which the transmission was oiled has been moved from the outside to midway between outside and centre, so now the oil is not centrifugally ejected from the case if a ball valve fails to seat. All bearings are supplied with graphite, together with oil or grease; the cylinder was formerly dusted with powdered graphite, such as electrotypers use, by sucking a little of it in through the spark plug hole with the piston; but now the new form of graphite, which is supposed to remain suspended in oil, is being tried.

Preparing a Business Runabout for the Market.

By F. E. Watts.

If we glance back a few years over the history of the automobile movement we will notice that most of the companies who started to build low priced cars have made a failure of it. Probably in no two cases were the causes of failure quite the same, and in no case is it likely that the cause was at all simple. Lack of capital, insufficient business experience, poor workmanship and crudely managed sales organizations—one or all, no doubt, played their parts in many of these failures. But I believe that one of the most important causes has seldom been mentioned—that is, insufficient testing of the model before it was placed upon the market.

American manufacturers have had wonderfully good tools to work with: large amounts of capital, cheap land, fuel and raw material, together with efficient labor and a large home market. It is no wonder that they have been optimistic and have often rushed their products upon the public after only the most perfunctory preliminary tests. This has been the case in all lines of manufacture, and the automobile industry being a new business has been a conspicuous example.

So small cars have been designed, the model machines built and run a few thousand, or in some instances only a few hundred, miles. Work on tools had begun long before the model car was built, and after the few changes shown necessary by the short tests of the model manufacture begun.

The result was in many instances that before the year's output was more than half manufactured the cars which had been sold first were giving their owners so much trouble that they became an army of "knockers" and the company was left with a lot of unfinished cars on its hands.

Even now, while the memories of such experience are still green, the chances are that they will be repeated. We have learned much about automobile design, but not enough so that any new device can safely be placed before the public until it has undergone long and thorough testing.

Before any runabout is offered to the public in large quantities a model car should have been run on all kinds of roads at least 20,000 miles. It would be much better if several of these cars could be made and each run this distance.

These cars should, as far as possible, be identical in design and material with the car which will be manufactured; for the primary objects of such tests are to ascertain the strength, stiffness and wearing qualities of each part. And the secondary objects, to note their quietness, handiness, accessibility and maintenance of adjustment. With these objects in mind it will be seen that any change in material, form or method of attaching any part, from what will be used in the regular product, means that the part has not been tested, is an unknown quantity and liable to give trouble.

These tests are necessarily expensive in themselves, and in order that the greatest possible benefit be derived from them I believe that it would be advisable to have at least two experienced men on the car—one from the designing department and the other from the assembling room.

A complete record of the run should be kept by one or both of these men, detailing every incident of any importance, and giving complete descriptions of every accident, replacement and adjustment. These records should state weather, temperature and road conditions, and should be accompanied by photographs or sketches when illustrations will make the subject any plainer. They should be so made out as to show the number of miles traveled and the date at which any adjustment or replacement was made, and be kept in such form that they may be transcribed and become part of the permanent records of the company.

It is highly desirable that the car should be completely disassembled at stated periods—say every thousand miles—each part examined, and all bearing parts micrometered. Careful records and tables of conditions and measurements should be kept. From these records, at the end of 20,000 miles running, it should be possible to predict the life of every part of the car pretty accurately.

When such a test has been made a company can feel pretty safe in going ahead and making the highly expensive jigs and special tools required in the production of a small car in large quantities.

To many the foregoing will no doubt seem theoretical, and while very pretty to talk about, unnecessarily expensive. Perhaps they may be surprised to learn that some companies already have tests of this nature under way, and that before long the public will be able to buy cars at moderate prices, each one of which will be good for 50,000 miles of efficient service, with only ordinary care.

The value of complete records of such tests becomes apparent upon a little consideration. It lies in the fact that the records are company property, available in future years. Otherwise the experience gained is largely the personal property of those taking part in the tests and can be carried to other companies in case they change employers.

The Runabout from the Manufacturer's Standpoint.

By E. W. Winans.

The compilation of the Doctors' Number, Taxicab Number and Runabout Number by The Horseless Age points to the increased importance of the commercial or utility automobile as opposed to the exclusive pleasure vehicle. The automobile, once a luxury, is now becoming a necessity. In the field of the horse driven vehicle the two passenger or top buggy is the prevalent one in private use. This has not been true of automobiles, for the reason that these vehicles have been used in the past, more especially for pleasure purposes, and hence were designed to carry more than two passengers. The first cars were of limited power, and almost invariably very light and carried but two passengers, an increase in the passenger capacity later being provided for by two small seats with a rear entrance. With the introduction of a longer wheel base the doors were placed at the sides, and at the present time this type of vehicle predominates over the runabout at a ratio of about 3 to 1.

A prominent doctor of Detroit recently asserted that he was able to take care of a large practice by reason of the use of a runabout, which enabled him to respond quickly to calls, and while making other trips he made it a habit to make two or three extra calls, inquiring about the welfare of his patients. For these extra calls no charge was made. The doctor without an automobile is compelled to charge for every call, owing to the time consumed in making them, and, further, to the fact that although he might be passing a patient it is not convenient to leave the street car or other conveyance.

Contractors in the bridge or building lines find runabouts great time savers. Many wholesale houses from metropolitan centres send traveling salesmen in runabouts to the small neighboring towns and crossroad stores, thus picking up the trade that formerly was gotten by small wholesale houses in neighboring towns.

A short time ago runabouts were made to carry two only, and were provided with a fishback used for carrying tools and tires. These were suitable for business purposes, but as the owners frequently wished to use them after business hours for pleasure, the extra rumble seat gradually became adopted, which has expanded into the double rumble seat, with the indication this year that this seat will be used extensively. These two seats do not call for the lengthening of the wheel base to any large extent, and as they are generally removable they interfere in no way with the appearance or use of the vehicle.

POINTS OF DIFFERENCE BETWEEN RUNABOUT AND TOURING CHASSIS AND BODY.

From the manufacturer's standpoint it is desirable that the difference in the parts used for a runabout and touring car shall be as little as possible. It is readily seen that this means fewer duplicate parts kept in stock, and the fact that one chassis may be more easily transformed from a touring car to a runabout than if the two chasses were different in a great many respects. However, it is important not to lose the advantages obtainable through a number of small changes on account of the small extra expense involved. It is growing to be a custom among most manufacturers, and especially those of the popular priced vehicles now coming so prominently to the front, to use the same wheel base on both touring car and runabout. This leaves the engine and the transmission in the same place on both cars. A more roomy front seat may be had on the runabout by moving the seat back several inches, lengthening the bonnet several inches and moving the seat back a distance to allow additional foot room. At the same time the seat is lowered and the back is set at a greater angle, allowing a somewhat more comfortable and lounging position. This arrangement locates the seat probably three-fifths of the wheel base back from the front axle. This new position of the seat necessitates the lowering and lengthening of the steering post and wheel, giving a lower and more rakish appearance to the vehicle. If the gas-

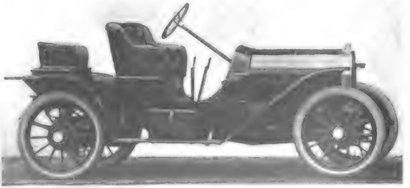


Fig. 1

oline tank is located under the seat this also must be moved back. The load on the front wheels being reduced but little, it is generally not necessary to change the front springs. The rear wheels having a much lighter load the springs may be made lighter by omitting the shortest leaf. On account of the lighter load that the engine must pull the reduction from the engine to the rear axle is frequently made less, allowing the car to ascend hills with as much ease as is found in the touring car, and giving greater speed on the level.

BODY DESIGN.

Fig. 1 shows a runabout body of standard design with a single rumble seat. This rumble seat may be removed or replaced by a double rumble seat. Compared with the touring car of this same make the seat has been lowered 1½ inches and moved back from the dash about 6 inches. With a 5 inch cushion this makes the height of the seat above the floor 15 inches. The steering wheel is a 16 inch wheel, located about 7 inches above the edge of the cushion, allowing ample room for the operator to sit and at the same time being low enough to give an unobstructed view ahead and within comfortable reach of the arms. From the upper view the width of the front seats will be noted as being about 21 inches each, which is enough for a large man and makes a comfortable and roomy seat for the average person. The artillery box on the rear is used for tools and extra parts, while the battery box and extra tires may be carried on the running board.

A customer frequently orders two seats on the rear which shall be identical in size with those in front. To make a good job the artillery box should be lowered to equal height with the front seat, and the floor at the rear lowered on a level with the front to make a more comfortable foot space, as these seats will be used frequently and require more comfort than is usually found in a rumble seat.

CHASSIS DESIGN.

The construction of the chassis on the runabout differs but very little from the touring car. However, it is essential that the construction should be extremely simple and staunch, as the majority of runabouts are driven by private owners. A complicated design is sometimes permissible in a high powered, expensive machine. These cars are cared for by mechanics who devote their entire time to the welfare of their machines, but where a car goes into the hands of a private owner, and receives only casual attention, it is necessary for the parts to be made so simple that little care is needed beyond the refilling of the tanks with oil and gasoline. First cost is also a matter of importance in the majority of cases, because many of these cars are bought as business investments. However, in spite of the necessity of simplicity and a small number of parts, the demand is more and more for noiseless, odorless and easily controlled cars. It is my belief that the car should be provided with an adjustment between the cam shaft and the valve. Where this is omitted it is necessary to machine the cylinders so that the distance between the base of the cylinders and the seat of the valve shall be exact in each case. To do this it is sometimes necessary to sacrifice the distance from the base of the cylinder to the top of the combustion chamber, thus giving uneven compression and spoiling the smooth running action that is so desirable. It is also sometimes necessary to sink the valve seat tool too far into the metal, thus leaving a shoulder around the edge of the valve. Again, the cam shafts, although produced by most careful methods, will vary so that the timing may be thrown out from 5, 10 or even 20 degrees marked on the flywheel. Owing to the fact that the engine may be thrown out of time, it is quite impossible to get the distance between the valve tappet and the valve stem accurate enough to produce noiseless valve action. A very good distance between the valve tappet and the valve stem has been found to be between .010 inch and .015 inch. If this space is adhered to an almost noiseless valve action will be obtained, but should this space vary to even so small a distance as one-thirty-second inch, which it oftentimes will if no adjustment is provided, the valve will produce a decided click and may be easily selected from the others.

Another feature of the construction of the runabout is distribution of the weight. The tractive effort or amount of horse power possible to transmit through the rear wheels depends first upon the weight applied. Thus it is desirable not only to move the seat back to apply this weight to the rear axle, but also that some of the chassis weight be located in this position. With a four cylinder engine it is impracticable to locate the engine at the rear, and so this leaves only the transmission to be so located.

DISTRIBUTION OF WEIGHT.

A Regal touring car, with transmission on the rear axle, carrying five men, was recently weighed, and it was found that there was 1,000 pounds on the front wheels and 1,700 pounds on the rear wheels. A runabout carrying two men has a weight of 850 pounds on the front wheels with 1,100 pounds on the rear. The weight of this transmission adds considerably to weight on the rear axle, and thus increases the tractive effort, especially on hills. Taking the coefficient of adhesion of the wheels to the ordinary roads as 25 per cent., it is easily seen that the horse power that may be transmitted is equal to the weight on the rear wheels, times the velocity of the car in feet per minute, times the coefficient of adhesion divided by the constant 33,000. This gives a possible horse power of about 44.

Now this latter should be reduced at least 30 per cent. on account of the fact that the rear wheels are not in constant contact with the road at high speeds. This shows clearly the importance of having a good percentage of the weight on the rear wheels.

The Two Cycle Engine for the Business Runabout.

By F. E. Watts.

For all automobiles used in everyday work it is freely admitted that each part should be as simple as it can be made without sacrificing efficiency. When we come to apply this axiom to the engine of a gasoline machine the two cycle type at once becomes an interesting probability.

From the fact that it gets an explosion per cylinder once in every revolution the two cycle engine offers a far wider range for practical inventive ingenuity than does the four cycle. It may be made very simple or wonderfully complicated. In the ordinary three port style it is about as simple as a reciprocating engine can be made. Three port engines have been made and sold in considerable numbers, and seem on the whole to be giving good satisfaction to their users. They are durable, require little attention, and if rightly made usually prove dogged "pluggers" for heavy work. With a sufficient number of cylinders they have a fair range of flexibility. Their chief faults have been rather poor fuel economy and carburetor troubles. These have proven sufficient thus far to prevent the general adoption of the two cycle engine, although its use is decidedly on the increase.

I think that as time goes on three styles of two cycle engines will be developed for automobile use:

First, a rather heavy, slow speed engine, which will combine great durability, high fuel economy, and wonderfully high torque at low speeds. This engine will be used upon trucks and delivery wagons.

Second, a light, essentially high speed engine, built with the idea of getting great power and flexibility for a given weight, these qualities being obtained with some sacrifice of fuel economy, such engines being used on the larger touring cars.

Third, a simple, reliable engine which will be somewhere between the other two as regards weight per horse power and fuel economy, and which will be the cheapest of the three to build.

It is the third type of engine in which we are interested. The question of how it may be designed might be put in another way, namely: How can the fuel efficiency and power output of two cycle engines be increased most without sacrificing too much of the simplicity of the ordinary three port style?

Since the engine is to be simple it is at once apparent that the precompression of the mixture must be in the crank case;

for any other form of precompression adds considerably to the cost of the engine. This much being decided upon, it remains to find means to get a larger and purer charge into the cylinder than in the usual three port type. While it may not be practical to fully scavenge the cylinder of a low cost engine, it is possible to partly do so in a number of ways.

One method of doing this, which appeals to me as among the most practical, is to use fuel injection instead of a carburetor. Where this is done only pure air need be compressed in the crank case; this pure air being admitted to the cylinder in the same way the charge is usually by-passed serves to clear the cylinder more or less completely of the products of the previous explosion. After the exhaust port is closed the fuel may be injected. And since it goes into a completely closed chamber none of it can escape.

By the use of this system, supposing our pumps to be working right, we can get a fairly large, reasonably pure and properly proportioned charge. To get the proper pump system is then the only formidable difficulty. While this is proving to be no small job for variable speed work, the difficulties will no doubt be surmounted; and once they are, this type of engine will certainly have to be reckoned with, not only for small cars but also for larger machines. There is also always the possibility that some form of friction speed change will be applied to these small cars which will render the use of a practically constant speed engine possible. For such an engine the fuel injection system should be easy.

While the foregoing method should give a better mixture, especially on small throttle, than the usual carburetor supply, and for this reason should result in a more powerful engine, it does not increase the amount of mixture delivered to the cylinder per stroke. With very large ports, however, it is possible that a full enough charge can be obtained for the purpose under consideration. If more is wanted the engine must be made more complicated.

Where only a single engine speed is required it seems hardly likely, from our present knowledge, that it can be used to advantage on automobile engines—at least to such an extent as to add materially to the volume of charge transferred. Still it is possible that this effect can be used to advantage in drawing more air into the crank case than would enter by crank case suction alone. This may perhaps be done by using a disc valve or other suitable form of crank case inlet, so timed that it will remain open while the piston is at the bottom of its stroke.

A surer but probably more expensive way of accomplishing this result is to use a differential piston. The larger windage and friction loss which this entails is much more than compensated by the increase in charge volume. Contrary to the usual idea, it is perfectly possible to build a piston of this type light enough so that its inertia will not be a serious drawback. It can indeed be made as light as the pistons in many successful four cycle engines.

Given a piston of this character many ways of scavenging the cylinder completely are open to the designer, but all of them add to the cost of the engine.

Where the designer wishes to use a carburetor it is possible to partly scavenge the cylinder by trapping a small quantity of air in an enlarged by-pass. Such an engine was the Hardt, patented in this country by a German some time ago, and described on page 346 of Vol. 13. This engine is an ordinary three port two cycle, to which has been added a small by-pass in the lower end of the piston. This allows the outside air to enter the main by-pass passage, from the cylinder to the crank case, at the same time mixture is entering the crank case through the carburetor and third port. Thus crank case compression takes place with the case filled with mixture and the by-pass passage filled with air, and the air enters the cylinder first, partially scavenging it. Probably a number of variations of this process are possible, and they should result in an engine of good fuel economy. But it should be noted that anything of this kind will reduce the volume of charge transferred to the cylinder, for the ports will naturally be so proportioned that part of the scavenging air is exhausted. Such a reduction of the weight efficiency of the engine is no doubt permissible in some runabout designs for the sake of attaining simplicity.

On account of getting an explosion per cylinder every revolution the two cycle engine delivers a much more uniform torque than the four cycle. This uniformity is also aided in the common types by the fact that the explosion pressures are generally lower and the expansion line comparatively high. So far as uniformity of torque is concerned, a two cylinder two cycle is rather better than a four cylinder four cycle, and a three cylinder two cycle equals a six cylinder four cycle. This equality is reached, however, only when the charge distribution and ignition is equally good in each type, and as there is more liability of one of the two cycle cylinders going wrong than of two of the four cycle, it is usual to employ more two cycle cylinders than would seem necessary at first sight.

Though the two cycle engine has the best of the four cycle in the matter of torque reaction, it is theoretically far behind it in mechanical balance. Both two and three cylinder engines have an unbalanced couple fore and aft, and the same may be said of any practical number of cylinders, unless two explode in the same time, though the couple becomes smaller as the number of cylinders increases. While this is so in theory, the fact that the two cycle piston is always working against compression and that its side thrust and friction is about the same for up as for down strokes seems to go far to compensate for the difference in direction of motion of the pistons upon opposite sides of the fore and aft centre.

There is one property which the ordinary two cycle engine possesses which is valuable for motor car work: this is the capacity for pulling well at low motor speeds. While they cannot usually be throttled as low as a four cycle motor, they give a high torque at nearly the lowest speed they will run at steadily.

I think we have said enough to show that there are quite a number of ways in which a good and fairly cheap two cycle engine can be built for business runabouts. But it must not be supposed that the substitution of a two cycle for a four cycle motor will render the car much cheaper to produce if both are equally well made. I have in mind a case where it was desired to produce a runabout in lots of 1,000 with a 15 horse power engine. A careful calculation of the shop costs for a two cylinder, three port, two cycle and a four cylinder four cycle, with valves all on one side, showed a difference of only $15 in favor of the former. As the other expenses of production are nearly equal for both types the two cycle engine must win out for this class of work, as for almost any other, practically on merit alone.

A two cycle engine can undoubtedly be made cheap, but to cut the cost it is necessary to make it "sloppy." Such engines are often considered satisfactory for boat work, but they are no good for automobile use.

A Curious Occurrence.

A doctor recently noticed that the motor of his runabout began to run very irregularly when the car was standing, sometimes racing slightly, then slowing down and shortly afterward racing again, the intervals between these changes in speed being irregular. The motor could not be run slowly, even with the spark retarded to the limit. The doctor, not being much of a repair man, figured that it was due to the timer; but upon changing the position of the roller the minimum speed was only slightly slower and the irregular action kept on. The local repair man put in a new needle valve, raised the jet, and even tried a lighter float, but the conditions were not improved. At last a smaller jet was tried, but the motor ran as irregularly as before and did not develop its full power. The feed pipe to the carburetor was thought to be choked, but upon passing liquid into the tube it emerged freely at the other end. Upon replacing the tube and starting the motor the irregular action continued. The pipe proving clear, attention was next turned to the gasoline filter, which, upon opening, was found to contain water and dirt. When it was cleaned and replaced the motor started up and ran regularly. These gasoline filters only serve their purpose when cleaned out at regular intervals.

The Ideal Doctor's Car.

By Roy Lindsay.

We hear much of the pleasure and commercial sides of motoring, yet it is the medical profession that has perhaps most thoroughly realized the enormous advantages of the mechanically propelled carriage. The special number of The Horseless Age published on November 1, 1905, which was wholly devoted to experiences of doctors with automobiles, indicated the wide scope of the movement, even at that time. Three years is, as events go, a long period in the motor car industry, and although nothing revolutionary in ideas has been evolved, advances toward the really perfect machine have been continuous. Every man and woman at some time or another has to ask aid from the members of the hardest worked profession on this earth, and such assistance is invariably rendered without questioning whether the reward is great or small, the call of our common humanity being sufficient to claim a doctor's unselfish services. All the year round, winter and summer, day and night, the doctor ever holds himself in readiness to assuage pain, and only in those rare instances when he takes a holiday can the doctor be said to be his own master of time. On the basis of the comfort they bring to every household, medical men deserve to be the wealthiest class in the community, but their average earnings are, unfortunately, on a much lower scale than those of men with equal education in the other learned professions. Therefore the consideration of a vehicle generally suitable for this particular section of the community is necessarily governed by an initial expenditure that ought not to exceed a maximum figure.

PRICE LIMITS.

What are we to take as the highest sum our suppositions medical friend can permit himself to spend? It is possible to approximate closely by scanning manufacturers' catalogues and observing the type of machines that are usually stated as "suitable for use of doctors," and we are safe in so doing, because makers who have been in the business for some time have been able to gauge likely wants from orders already executed or inquiries from prospective customers. Additional evidence on this point is also obtainable from the Doctors' Number previously referred to. In England the most popular car among the medical profession is the 8 horse power De Dion that sells for $1,150, and has about six times as many adherents as all other makes put together, while next in favor comes the 8 horse power Rover, selling at the same price. Allowing for currency differences and for a variation in the meaning of the words "completely equipped," as between European and American manufacturers, our definite maximum can be stated at $1,250.

GENERAL REQUIREMENTS.

First and foremost, a doctor's car must be a business vehicle—frankly, a money earner—therefore all thoughts of the pleasure side have to be kept in the background. The motor vehicle that will give satisfaction to an owner for intermittent pleasure will not necessarily perform efficiently in the varied work essential to the general practitioner's long round of visits, and it is therefore desirable to warn intending purchasers against taking too eagerly the advice of enthusiastic motoring friends outside the profession. There must be no question of having to do a number of small things before a car can be running on the road in a case of emergency, nor must forgetfulness on the driver's part endanger the continued smooth working of the comparatively costly mechanism. The initial outlay must be within the limited means of the medical man practicing in a rural district. The cost of upkeep—repairs, renewals, gasoline, lubricating oil, tires and incidental expenses—must be within a maximum figure. Renewals must be easily procurable, and any occasional repairs should not be outside the scope of the local garage or maybe the ubiquitous bicycle repair man. The seating arrangements ought to offer the greatest possible comfort irrespective of weather conditions. Provision must be made for instrument bags, notebooks, memoranda, etc., securely protected from the weather, together with stormproof garments and wraps, and climatic variations must be met by some form of covering above driver and passenger. The requirement of speed on the level can be supplied by the smallest of cars, while the ability to climb steep hills at a good pace is only governed by engine power, and, consequently, price. Most important of all, the engine and propelling mechanism must be simple enough to be understood and kept in order by anyone who possesses a smattering of mechanical knowledge, so that outside aid can be altogether dispensed with under normal conditions and expert assistance need be requisitioned only in the rare event of a serious breakdown.

If all the points just enumerated could be found on any one car today, native or foreign, such a vehicle would indicate the millennium of motoring. Like everything else in this world, we have to compromise between the unattainable ideal and the best of current constructors' efforts. Yet there is the consolation that, despite a few minor drawbacks, a purchaser is offered such immense advantages over the use of a horse drawn vehicle as to entirely overbalance any question of waiting for the problematical perfect car of the future.

EQUIPMENT FURNISHED.

The smallest car that can be expected to give good service cannot be purchased for much under $1,000, but we are faced with a difficulty here, inasmuch as manufacturers' ideas are extremely elastic concerning what the buyer ought or ought not to expect when he lays down his money. Some firms include in the catalogue price horn, pair of kerosene side lamps and a tail lamp; other firms are more generous, and add a pair of acetylene head lamps; a few others go a step further and supply an acetylene generator; occasionally a very complete tool kit is included, but generally the so called kit only comprises a very few oddments which the car owner has to supplement considerably as he finds the need when making adjustments. A really good set of well made tools that will actually fit parts of the mechanism they are designed for could not be bought for much less than $25, and when we reckon also lamps and horn on the basis of the first quality article, similar to those advertised in the technical press, the total of these things will be considerable. No maker is a philanthropist, therefore if any or all of these items (excluding the tool kit, that must be considered an integral portion of the complete vehicle) are "given" with the machine, and so reckoned in the catalogue price, the purchaser must not delude himself with the notion that he is obtaining them free of charge. Whatever may be the cost, it is either added to that at which the machine would otherwise be sold if they were not "given" or the value is cut off the machine somewhere. It may be in cheaper upholstery, cheaper tires, fewer coats of paint or absence of proper finish in some parts of the mechanism. This policy of apparently giving something for nothing has never found favor in Europe, makers there selling the chassis with tires, or else the complete car with fitted body, but the only accessories are a few tools that are usually specifically named in the catalogue. And there is sound reason why this desirable practice should obtain elsewhere. As matters stand at present in America, a purchaser may have a fancy for a certain pattern of lamp that may cost considerably more money than that supplied with the car, but he is bound to accept the standard equipment. We will therefore presume that lamps and horn are purchased separately, together with the necessary stock of spare parts, two spare inner tubes for the tires, a Cape cart hood, rugs, etc., and allow $150 for all these.

MISCELLANEOUS EXPENSES.

The expenditure is still incomplete, because the ordinary clothing suitable when driving in a horsed vehicle does not afford sufficient protection against the weather when a man is seated in an automobile. A thick outer coat reaching nearly to the feet, rubber garment of some kind, large enough to be slipped on over the coat, and a pair of leather gloves with gauntlets extending up the wearer's arms outside the coat are absolutely essential, and the minimum price for these might be $10. We have reached $1,200, and have not yet paid for State license tags, insurance of the machine against fire or accident and sundry small expenditures that will vary with every owner. The statement that $1,210 will be a figure upon which all else must pivot is therefore not so very wide of the mark as it might have seemed when given at the end of the first paragraph of this article.

Circumstances vary so enormously as regards the financial aspect and the district in which a machine will be used that a type of car one would be justified in recommending to a resident in a city favored with well paved and smooth road surfaces would be useless to a man whose patients are found in a sparsely settled agricultural district. Dollars and cents are again the centre on which everything else turns, and a slight digression must be permitted to put this quite clearly. Those who have possessed two or three cars will be better able to appreciate the greater prominence of annual outlay for running expenses of all kinds as compared with what may be properly termed the capital outlay. There is small advantage in purchasing a vehicle for $750 if its annual upkeep should come out at 25 per cent. more than the car upon which an extra $250 had been spent originally, and this statement is of more significance when we come to consider the merits of some of the very cheap cars marketed by a few of the lesser known firms. Competition in the automobile trade is excessively keen, and for this reason it is desirable to deal with those makers who, having made a reputation, must maintain the quality of their goods, irrespective of the price at which they are sold. If two cars are offered, one built by an established house and the other by those who have yet to achieve a reputation, buy from the former, even if they charge $125 to $250 more for the same horse power and cars identical in most other respects. We cannot overlook the fact that we are considering the motor car purely from a business standpoint, and if the man who drives for pleasure is prepared to sacrifice some essential details for the sake of particular features, the medical man cannot afford to do this, and should therefore leave experiments to those who have time and money to spare.

WIDE RANGE OF CHOICE.

Up to but a recent period the price we have set as the maximum of expenditure would have definitely confined choice to a few single cylindered engines up to about 10 horse power, but the large demand for machines priced moderately, coupled with improved manufacturing methods, has enabled multicylindered engines of perhaps 15 horse power to be marketed round about our price limit. This brings us to a point of supreme importance, and one somewhat difficult to convey to the prospective purchaser who has had no previous experience with the maintenance of a mechanically propelled vehicle. The only drawback to the single cylinder engine is the vibration set up when running "light," say, at the time a car must be pulled up for traffice stops, and the clutch has therefore to be withdrawn to cut off transmission between engine and road wheels. To a medical man this problem of vibration is important, more particularly if his practice includes the traversing of busy streets every day in the week, and for this reason alone it is desirable to have two cylinders, always provided that the extra cost involved is not pared away from other essential details of the complete car. Multiplication of cylinders is provided by the maker not so much to increase power as to decrease vibration. In this respect two are better than one, four are better than two, and six best of all. If the buyer can obtain rides upon a single cylinder, 10 horse power, and a two cylinder of about the same power, the difference in vibration between the two types will be better understood. The question of one or two cylinders versus four cylinders is a problem that is not always sufficiently realized and introduces factors other than that of vibration. One man may possess mechanical aptitude and finds no more difficulty in caring for one type than the other, while his neighbor, beyond knowing how to just handle a spanner properly, is quite lost when it comes to doing something requiring other tools. This much can be definitely stated: A single cylinder engine will pretty well care for itself so long as lubrication is properly maintained and the machine is generally driven with a fair amount of common sense. A little more care is needful with a two cylinder engine, but when it comes to a four cylinder the owner is confronted with more intricate problems, mainly relating to ignition, that call for more time being daily spent upon locating faults or in preventing such happenings prior to starting out on the road.

COMPLEXITY AND UPKEEP.

It is not the province of this article to dissect the details of construction, yet this matter of increased complexity has a bearing upon the cost of every mile traversed in the course of a year. Supposing that a single cylinder car costs a certain number of dollars per annum for maintenance—gasoline, lubricating oil, etc.—the four cylinder engine will involve from 50 to 75 per cent. more, the engine in each case being approximately of equal power. The man who is going to drive himself and make the occasional necessary adjustments, and is only able to devote a fraction of time daily to the latter purpose, is recommended to purchase a single or two cylinder engined car, rather than a four cylinder, even if he can procure equally good value for the same money.

IGNITION.

Next in importance to the engine is the method by which the charge of compressed gas is ignited to form the power stroke. Two systems are used—accumulator or dry battery, with high speed trembler coil and high tension magneto, the electrical current being chemical in the former and wholly mechanical in the latter. (The low tension magneto is practically obsolete and need not be considered for our purpose.) The accumulator coil permits somewhat easier starting up of the engine than the magneto, but in out of the way districts presents the difficulty of having to recharge the accumulator from some prime source of electrical energy. The dry cell coil system is as good as the accumulator, and can be used until the cells, usually six in series, are discharged and must then be thrown away, but has not hitherto attained the favor it deserves, because most users have treated them improperly. To obtain satisfaction, two sets of cells, six in each set, need to be wired up to a two-way switch and used alternately for about one hour, this method allowing the set not in use to recuperate. The high tension magneto is, as yet, not fitted to machines in the United States coming within our price limit, owing to the comparatively high cost. When the manufacture of these fitments comes down to a commercial basis no car will be deemed complete unless so fitted. Except for a few drops of oil given daily to the bearings, a high tension magneto will be serviceable for thousands of miles without any other attention. In Europe it is now the general thing to fit even machines sold for $1,000 with both accumulator coil and magneto ignition, a two-way switch enabling the engine to be started up from the coil and then switched over to the magneto for running purposes. Ignition used to be the main worry for a novice, but such great strides have now been made in perfecting details that no one need hesitate to purchase a car for fear of trouble in this direction.

COOLING SYSTEMS.

The internal combustion engine must have some of the heat that is generated by the firing of the charge carried away in some manner, either by blowing cold air on to the cylinders or by surrounding them with water jackets. The water cooling can be either by a pump that continually moves the liquid or by thermo-siphonic circulation, but in both the hot water that leaves the cylinder heads must be cooled down by being passed through a radiator exposed to the atmosphere in front of the vehicle. It is in connection with the latter that the writer desires to utter a most emphatic warning. Two types of radiator are installed upon modern cars—the flanged tube and the cellular—and in no circumstances whatever should a medical practitioner purchase a car fitted with the latter unless he is anxious to continually dip his hand into his pocket for repairs. It came into fashion with the advent of the racing car monstrosity, but it is quite out of place on a business vehicle such as the one we are considering. The cellular radiator is composed of many hundreds of extremely small diameter tubes soldered together, and vibration from rough roads will quickly start these joints leaking. Apart from mechanical questions of manufacture it has always to be borne in mind that facility for cleaning all portions of the mechanism is desirable, and the cellular radiator falls below the ideal in this respect. The water in some neighborhoods carries a considerable amount of lime in suspension, and after a time this deposits on the walls of the radiator and chokes the circulation. With a flanged tube radiator having tubes of large diameter the lime deposit can be dissolved by mixing a strong solution of common washing soda and running the engine for about one hour, but doing this repeatedly with the cellular type will not have much effect.

LUBRICATION.

The transmission of power to the road wheels, whether by side chains, a single central chain to live axle or propeller shaft and live axle, can well be left to the maker, but any sort of chain drive is far more trouble to keep in good running order. Lubrication is an important—if not the most important—detail on a car, and just a few words on this matter will not be out of place. With the great heat generated by the quick succession of explosions it can be well understood that the proper quality of lubricant must be fed into the engine and in sufficient quantity to prevent the piston seizing. Too much oil means a trail of pungent smoke being left behind the car as it proceeds on its way, and too little oil will cause the engine to stop, either from heat generated from the friction of the piston against the cylinder walls, or because the crank shaft and its bearings may score each other badly without the necessary film of oil between them. On very cheap cars oil has sometimes to be forced into the engine by means of a hand pump, usually fixed upon the dashboard, and if this is not done at the proper time a repair bill for $50 or $100 is the result. This is only one of the very many reasons why the so called "cheap" car should be tabooed. The best method of lubricating the engine is undoubtedly by means of a mechanical pump forcing oil from a reservoir into various pipes leading to each bearing, and with means for adjusting the proper supply to each bearing. On many well constructed vehicles, what is known as the exhaust pressure feed oiler is employed, its only faults being that variations of temperature will necessitate alteration of the sight feed adjustments on the dashboards, and that it does not cease feeding at the moment the engine stops, as does the mechanical pump. If the bearings of the change speed gear shafts and the differential bearings are also lubricated by pump or exhaust pressure, so much the better, but this need not be insisted upon as an essential portion of the car's equipment. The gasoline tank should carry at least 6 gallons, and should be situated either beneath the driver's seat or in the more convenient place as an attachment to the dashboard. Beneath the car, from the front almost to the rear, and extending from side to side of the framework, a detachable metal apron should be suspended, to prevent mud and dirt from reaching the lower portion of the engine, gear box, etc.

BODIES.

We can now deal with what may be termed the comfort side of the proposition, and it can be said at once that there is hardly a car on the market which meets the special needs of the medical man. The majority of the two seated or moderate priced cars are fashioned with the weird contraption popularly known as the bucket seat. This is one of the many abortions that were right enough on racing cars, but is quite out of place for any other purpose. The front seat should run straight from side to side without any projections or arms between passenger and driver; the back of the seat should be as high as that of an ordinary rocking chair and slope back at a gentle angle from base to top; the actual seat should also slope slightly from the front edge down to the base of the back support, and along the front edge a small roll should be formed in the upholstery. The back upholstery must be supported on concertina springs, as well as the seat cushions. Buttons and fancy trimming of any sort should be eschewed, as they form receptacles for dust in dry weather and each button makes its own little pool of water after rain. The materials from which motor car upholstery is made are as various almost as the cars themselves, and this is, unfortunately for the user, the part where it is possible to put the "just as good" that looks all right for a few weeks and thereafter gives the whole vehicle a shoddy appearance. Cloth is quite useless, and imitation leathers sold under many fancy titles are bad, because they deteriorate quickly on exposure to sun and rain. The only suitable material is real leather, fixed without folds or creases, and preferably of the description known as grain hide. Leather can be frequently washed, and if by any chance oil should be dropped upon it, a few drops of gasoline immediately applied will remove any tendency to stain. The seat cushion should be in two halves, to save throwing rugs and other impedimenta on the floor when the gasoline tank has to be filled, if it happens to be fitted beneath the driver.

The right hand side of the car, where are usually placed the change speed and emergency brake levers, should be fitted with a door dropping into slides at the dashboard and front edge of the seat, while the near side should have a door hinged to the dashboard, that fastens with exterior and interior handles to the side of the main body work. Further, these two doors should be as high as the dashboard itself. The writer is unaware of any car selling at a moderate price that has been built with doors in this manner, except to special order; the comfort they add in wet or windy weather is so great as to make it a cause for wonder that they are not built as a standard on every car.

CONVENIENCES.

A top of some sort is a necessity, and is usually charged for as an extra at from $50 to $125, according to size and quality; $75 has been allowed for this hood in the estimate. The type to select is that known as the "Cape cart hood," constructed of two thicknesses of stout cotton twill, with a proofing of rubber between the two, and carried upon a folding framework of ash bows and light steel clamps. This is light in weight, always looks neat, can be permanently retained upon the car, is removed entirely in five minutes, prevents dust entering the car from the rear in summer, and if fitted with side storm curtains gives nearly as much protection from heavy rain as does a closed brougham body. A car destined only for town work in well lighted streets is made more comfortable by the addition of a glass wind screen above the dashboard, and is then quite equal in comfort to a limousine body, with a great saving in cost and quite 50 per cent. reduction of weight for the engine to propel. A glass screen is not included in our price limit, but is worth the extra cost under special circumstances. Saving of weight is of more importance on a motor car than the majority of buyers appreciate, as, all other things being equal, the lighter the complete car the easier it is to drive, more economical in gasoline and lubricants, and the cheaper it becomes for annual upkeep. Weight, again, is the prime factor in tire expenditure, and this brings us to a point around which there used to be more controversy than almost anything else in the motor world.

TIRE CONSIDERATION.

Pneumatic tires of not less than 3½ inches in cross section, with the very thickest of treads (known in the tire trade as "reinforced"), are desirable, and there should be no hesitation in paying extra for this size and thickness, if they are otherwise outside the car manufacturer's specification. If initial cost must be saved somewhere, and it becomes a question of purchasing a single or two cylinder car and having cheaper tires to procure the latter, it will be found more economical in the end to have the single cylinder and put the difference into the tires. Pneumatics of small diameter and small cross section are a source of constant worry and expense, as, in addition to their own inherent faults, they permit too much vibration from bad road surfaces, etc., to reach the mechanism, and thus needlessly add to the wear and tear of all the working parts, to say nothing of the increased strain on the passengers' nerves. Large, solid tires are better than small pneumatic, and many practitioners who use their cars throughout the year effect a considerable saving by fitting pneumatic tires to the front wheels and solids at the rear. Such a compromise is only possible where the road surfaces are uniformly excellent and the speed never exceeds 14 miles per hour. On a really light car solid tires cannot be employed, because the vehicle has been designed to travel upon pneumatics, and would shake itself to pieces in a month if others were fitted.

CARRYING SPACE.

Only one other detail remains to be provided for, and that is a receptacle for instrument bags and cases and something in which to carry notebooks. The latter can conveniently be housed in a flap covered pocket attached to the inside of the seat; to make this waterproof it will be found advisable to have a second flap pocket of some waterproof material in which the books and very small instruments can be carried when entering a patient's residence. When again ascending the car the detached waterproof pocket can be slipped bodily into the fixed pocket, and if the latter has a simple turnbuckle fastening it is but the work of a moment to remove the notebooks. On a small car the gasoline tank is usually supported within a cupboard beneath the driver's seat, the space beneath the passengers' seat being used for stowing batteries, spare parts for engine and tools, etc. A division between the gasoline tank space and the tool space is rarely, if ever, fitted, and one flap door hinged at the base and held in position by a spring catch at the top serves for closing in the two spaces.

Convenience is quite as essential as comfort, and the following suggestions are made to this end: The batteries can be placed in a box upon the running board at the driver's side of the car; the tools, spare parts, lifting jack, tire pump, tire repair material, etc., can all be carried in a lock box at the rear of the seats. Arranging a division from front to rear beneath the seat, with a separate door to each, will at once provide the wished for accommodation for instrument bags, etc., in the space beneath the passengers' seat. The door to the latter can be hinged at the top and fastened at the bottom. Carriage builders, for some inscrutable reason, always fit these doors with hinges at the base, and it is a nuisance to get at them in wet weather. This division can be lined with thick rubber matting or felt, and if a few hooks are screwed into the back quite a number of things can be carried without the slightest fear of breakage from vibration. Nothing complicated or outside the regular scope of the body builder's business has been indicated in these notes, and a car on the lines set forth should not cost a cent more to construct with such a body than the normal design for purely pleasure vehicles.

MAINTENANCE COST.

In considering the question of annual cost of maintenance, the purchaser should not be misled by the glib argument of the salesman that a car can be run at a cost of one cent per mile, for this statement is but half truth, and refers only to gasoline and lubricating oil. These are minor items when compared with the cost of keeping pneumatic tires in good condition or the possibility of having to repair some portion of the mechanism. Omitting depreciation, it can be accepted as a correct statement of fact that the absolute minimum expenditure cannot possibly be below 4 cents per mile on the basis of running a small power car, such as one with a single cylinder, six horse power engine. Even then, this figure is only possible provided the owner makes all his own adjustments, repairs punctures to the tires, and carries out the small but necessary operations which can be included in the generic expression of "keeping a car tuned up." Washing down the body and polishing the metal work can be undertaken by a boy or youth, and big repairs or adjustments are better confided to the local garage proprietor. The heaviest expense will be for tire repairs and renewals, and with the portable tire vulcanizing outfits that can now be purchased at a moderate figure any common-sense person can perform the simple processes of tire mending.

ANTI-SKID DEVICE.

Side slip is the one drawback to the use of a motor car, the popular remedy for the trouble being to have steel studded leather bands vulcanized to the rubber treads of the pneumatic tires. As a preventive of side slip these bands are successful, but they cause trouble in another direction. The leather treads have a life of about 1,750 miles, and then need renewal, but unfortunately the process of vulcanizing leather to rubber appears to affect the quality of the latter, and it is only in rare cases that rubber will stand a second leather band. Those who desire to run their cars economically should purchase a pair of detachable tire chains that are quite as effective in preventing side slip as the leather bands, do not injure the rubber, and can be removed in two minutes when dry roads do not call for their use. They are as quickly attached, and four years' personal experience with tire chains in all sorts of weather is behind this expression of opinion.

SUMMARY.

To sum up the recommendations, the purchase is suggested of a single or two cylinder, 10 horse power car, with seating accommodation for two persons only, dual ignition, flanged tube radiator, tires 3½ inches in width, doors at each side of the body, no division between the two seats, a special locker or cupboard for instrument cases, and a Cape top. The necessity of buying from a well established manufacturer is again emphasized, for, in addition to the reasons previously given, it must be borne in mind that there is always a good market for a second-hand car with a reputation for reliability. Vehicles of little known origin realize but a fraction of the original cost when changing hands, either privately or through the medium of an auctioneer. The design and exterior finish of the body work is no criterion as to the fitness of the propelling mechanism for a particular purpose, and in this respect the second quality article is usually as well, if not better, painted and varnished on the outside than the more mechanically perfect machine.

General Requirements in Runabouts.

By Albert L. Clough.

By a "business runabout" is here meant a small motor car adapted primarily for convenient and economical service in the everyday pursuits of life, covering both the requirements of utility and pleasure. The business runabout should carry its owner from his home to his store or office, and upon his errands; should be available for the delivery of reasonable dead loads, when required, and on evenings, Sundays and holidays should be capable of carrying seats for more than two persons, thus becoming a family car, able to perform considerable cross country work. In other words, the business runabout should be the useful small car, and as such is likely to be more constantly used than any other type of motor vehicle during pretty nearly the year around.

Among the requirements of such a vehicle may be mentioned a moderate first cost, reliability, durability, low cost of operation, small attendance requirements, ample but not exaggerated power, comfortable riding qualities, independence of weather conditions, and adaptability to the varied service requirements. The first cost can be kept down by the elimination of all expensive body work, and all external finish of the mechanical parts, by the simplification of the power plant as far as it can be carried without serious sacrifice, and by the production of the type of car in question on a very large scale, with a large proportion of its parts produced by specialty manufacturers, by a company which does not indulge in expensive and vainglorious publicity methods. No attempt should be made to reduce the price below that at which first class workmanship can be obtained throughout, and the best materials used in all essential parts.

RELIABILITY.

Reliability in a business runabout is actually of greater importance than in a touring car, as delays occasioned by defective operation in such a car often involve business losses, while with a strictly pleasure car they usually result only in the curtailment of idle enjoyment. As the business runabout is unlikely to be cared for by a chauffeur whose spare time is devoted to going over the car in search of defects and remedying them, it should be assembled with the greatest care so far as the permanent security of all holding devices is concerned. For the same reason all the auxiliaries, such as the carburetor and the ignition apparatus, from which a large proportion of troubles arise, should be of the very best quality obtainable, irrespective of first cost. In short, the business runabout should be a plain, simple car of small size, but not slighted in quality.

DURABILITY.

As most business runabouts are likely to be owned by persons who value utility higher than style, they will, if once proved satisfactory, be kept in service for years or probably until a period of general decrepitude, not capable of profitable correction, is reached. Durability is thus a most important consideration, much more vital than in the case of the stylish car which is likely to be discarded when something more up to date appears.

First and foremost, if durability is to be secured, the maximum attainable speed must be strictly limited. In my opinion it should not exceed 25 miles per hour on the level. A whole article might be written on the price which car users pay for speed in hastening the early retirement of their cars. If a car of this class, used, as it is sure to be, almost constantly and largely over the villainous pavements and crossings of towns and cities (which are much more severe on cars than the macadam and dirt roads ordinarily met with in touring), is to be durable it must not be over engined, as are some of the popular runabouts on the market today, and it must be geared low. Being intended mainly for city use, a speed of 25 miles per hour is ample. A large proportion of all motor cars at present in use have too large engines and too high gears for the strength of their vehicular parts. Every competitive tour and common experience prove this. The motive power pounds to pieces the vehicle which carries it long before it itself has seriously deteriorated. Owners of runabouts bought for general utility purposes should not be deceived into the idea that they can buy vehicles of this class at a moderate price which are at the same time durable and capable of touring car speed. If these purchasers desire high speed it is certain that they are not the ones to run runabouts.

Durability, so far as freedom from breakage of vital parts is concerned, can only be obtained for long periods when steels of the best dynamic qualities are employed. Durability, in point of freedom from rapid wear, which is even more important, can be secured only by the provision of extremely large bearing surfaces at all vital points, the complete exclusion from such bearings of all dust and the constant and unfailing provision of the best lubricant thereto. If long usage is to be obtained from the business runabout every part, not only of the power plant but of the running gear, must be assured of infallible lubrication secured without the possibility of the entrance of dust. No other consideration is of more importance than this. Operative cost, in contradistinction to the fixed charges, may be divided as follows: Tire maintenance, fuel consumption, cost of ignition current, oil consumption and repairs.

REASONABLE TIRE COST.

Tire cost per mile can be kept within bounds by a strict limitation of the maximum vehicle speed as above outlined, by the use of tires somewhat larger than the specifications of the tire makers demand, by the proper design of the vehicle springs and by a correct distribution of the load. At speeds not exceeding 25 miles per hour the solid tire is perfectly practical, and it is only a question for individual decision whether a certain amount of discomfort involved by the use of the solid tire is or is not of less moment than the money saved over the use of pneumatics.

LOW FUEL CONSUMPTION.

The fewer the cylinders required to develop a given horse power the less the consumption of fuel and oil per horse power hour and the less the smoothness and quietness of operation and the flexibility of the motor. A happy medium must be struck between good fuel economy and a reasonable degree of freedom from noise and vibration and good "picking up" ability. This matter will be referred to later.

It seems quite important that the carburetor of the business runabout should be an efficient one, as fuel cost is proportionately a larger factor of the total operative cost in the case of a small car, like this, than in that of a large vehicle. The carburetor, too, should be water jacketed and supplied with a warm air intake, and the inlet manifold should also be surrounded by the circulating water. This will enable low cost heavy fuels, such as heavy naphtha and gasoline-kerosene mixtures, to be successfully used, at a considerable financial saving. Extreme fuel economy, if counted of prime importance, may be secured by the use of the air cooled engine.

ECONOMY OF IGNITION CURRENT.

It is extremely desirable that the cost of electrical energy should be reduced by dependence upon a good magneto. In the case of the ordinary runabout the per mile cost of dry cells is one of the largest factors of operative expense. The aggregate outlay for dry cells by owners of runabouts must be enormous, especially in the case of the small four cylinder cars. There is a deal of disappointment and worry attendant upon the dependence on these cells. Now that the price of magnetos has been so largely reduced, the fixed charge incurred by their employment has become so moderate as to render them more profitable than any other source of ignition current, even on two cylinder cars, and, a fortiori, on four cylinder ones. It is believed that no auxiliary battery system need be installed upon the average business runabout.

Oil consumption can be kept within bounds if an oil tight engine and gear box are insisted upon, and this is extremely important, as the loss of lubricant through leakage is greater on a good many small cars than the oil which is actually used. Cleanliness is especially important, too, in the case of a small car cared for by the owner and usually kept in his private stable. A completely housed mechanism with bearing ends properly oil guarded, the parts of the housings put together tightly and the use of non-fluid lubricant on the running gear conduce to a minimum loss of oil.

ACCESSIBILITY.

Freedom from repairs is partially covered in the conditions governing durability above mentioned. To minimize repair costs all individual units of the motor power plant should be capable of removal without the necessity of a general disassembling. All wearing parts should be easily reached through large hand holes and should be adjustable through a wide range. If not readily adjustable, their bushings should be readily replaceable, interchangeable and constantly carried in stock by the manufacturer, both at the factory and at his branches. The use of any wearing part bearing in an unbushed bracket or other part should be avoided, and wherever permissible shafts should be hardened so as concentrate the wear on the replaceable bushing.

SIMPLE OILING SYSTEM.

Unless the amount of attendance required by the business runabout is kept at a minimum it will either prove unsatisfactory to the owner on account of the large amount of valuable time which its care consumes, or else it will be slighted and fail in reliability and durability.

It is essential that the number of points to which oil has to be applied be kept as low as possible. It is probable that there is no better method of lubrication for a four cycle runabout engine than crank case splash, with the supply constantly replenished by a positively driven sight feed oiler. If engine and gear box are integral and include a metal clutch, the mere filling of the lubricator reservoirs ought to insure the oiling of all parts of the power plant. A try cock indicating the oil level should be fitted without fail. A handy filling plug should provide for the replenishment of the oil supply of the bevel gear box, it being assumed that the shaft drive is employed. The maintenance of two oil supplies will thus take care of the lubrication of the power plant. If the clutch is not within a tight housing it should be of the leather faced cone type. The necessity of oiling with a squirt can should be eliminated as far as possible, as it is dirty, inconvenient and allows of the access of grit. Compression cups for the use of non-fluid lubricant should take the place of oil holes. These cups cost but little and are worth more than they cost. The steering column, all joints of the steering linkage, the spring joints, the clutch, brake and gear shifting levers and torsion and radius and pivots should be provided with these small cups rather than with oil retainers. The universal joint or joints should be in grease bags, and large grease cups should be provided on the front wheel bearings so as not to necessitate the removal of the wheels when repacking becomes necessary. Similar cups should be used on the outboard rear axle bearings. The periodical screwing down of these cups will take the place of much unpleasant squirting with the can.

The provision of a high tension magneto eliminates at once all testing and changing of dry cells, the charging of accumulators and the adjustment and refinishing of vibrator points. Of course, the magneto has its troubles, but they are generally very few.

SIMPLICITY IN COOLING SYSTEM.

Thermo-siphon cooling is obviously the thing for runabout use, if not for all cars, and its adoption obviates the care required by the circulating pump. There is absolutely no call for a radiator fan in a runabout equipment, the draught created by the fan spoked flywheel being sufficient, assuming ample radiator surface to be provided, as it should be in order to preclude the necessity of frequent filling. The labor of tightening the fan belt and the lubrication of its bearings is obviated and the engine is rendered easier and safer of access.

It is probably of no avail, considering the prevailing feeling concerning air cooling, to mention it in connection with the business runabout. The writer, however, regards it as the probable ultimate method when unreasoning prejudice gives way to common sense.

SECURE FASTENINGS.

If there is one thing which must be insisted upon if a car is to be operated with but a slight amount of tinkering, it is the provision of proper fastening devices throughout—not at a few important points. Check nuts and the ordinary use of cotter pins is not sufficient. Either lock washers, locking nuts of the best types or castellated nuts are absolutely indispensable literally everywhere, even in parts which do not perform an absolutely vital function. The only exceptions are the parts of the running gear which are painted over. For securing the wheels only the most advanced methods, insuring the highest degree of security, are admissible. Only by such provisions can the necessity of constant inspection of parts be avoided and the car be kept from falling apart.

Unless a complete underpan protection for the power plant is provided and continuous flush guards are fitted a great amount of time will be wasted in keeping the motor parts clean, and unduly frequent washings of the body work will be required to keep it in presentable condition. The business runabout must be a reliable wet weather car, and if water can reach the carburetor or magneto it will fail in this respect.

TYPES OF MOTORS.

As to the type of motor most desirable for a business runabout there is ground for wide difference of opinion. There are available the horizontal, double opposed type, the two cylinder, vertical type, with special rotary balancing device (a close competitor of the former); the two cylinder, vertical two cycle engine, and the four cylinder motor. The single cylinder, vertical balanced engine, while possessing merit, will hardly be regarded with favor, for the horse power demanded in a general utility car such as this; the six cylinder type need not be considered seriously for this service for reasons of high first cost, low fuel efficiency and complication, and the three cylinder engine seems rather unfortunately to have dropped out of sight—a fate which it hardly deserved.

The double opposed engine is an "old standby," and when transversely located in front deserves the first consideration. Its running qualities should satisfy the moderate requirements of the class to whom the business runabout will naturally appeal. It is rather more accessible than any vertical type of motor, and its qualities are well known to all motorists.

The vertical two cylinder motor of the four cycle type offers no advantages over the double opposed, and involves some complication. It is, however, available to those who have a prejudice against horizontal engines.

A remarkable degree of simplicity is afforded by the two cylinder, two cycle motor, as it involves no independently actuated valves, and no special valve gearing or gear reducing mechanism. It has all the flexibility of the four cylinder engine, and rather more at low speeds. Its sole objection is that it possesses a considerably lower fuel economy than the double opposed, and probably is slightly less efficient than the four cylinder, four cycle, although there should be little difference.

The four cylinder engine, as is well known, has double the complication of the two cylinder opposed, but is decidedly more flexible, and usually more quiet than the latter. There is actually very little vibration from either. The four cylinder is, however, distinctly less economical of fuel and lubricating oil than the opposed motor.

It is fruitless to deny that the four cylinder motor requires more care than the two cylinder opposed, although per cylinder it is not unlikely that the four cylinder is slightly easier to keep in order. It is impossible to say which of the two is better for business runabout service, as it is a matter of the personality of the user. The man who considers simplicity, small amount of attention required, and high fuel and oil economy as of more importance than extreme quietness of operation, high flexibility and the ability to start on the spark, will lean toward the opposed motor, while the person who takes the opposite view as to the weight of the qualities enumerated will incline toward the four cylinder. Personally the writer is one of those who favors the double opposed engine for this particular service, considering the output required.

TWO CYCLE MOTORS.

The choice between the opposed and the two cylinder, two cycle is based upon somewhat similar grounds. If very smooth running qualities, very uniform torque and simplicity so extreme as to almost eliminate the probability of small derangements are considered of more importance than a certain wastefulness of fuel, the two cylinder, two cycle is likely to be preferred and vice versa.

Comparing the two cylinder, two cycle and the four cylinder, four cycle, they are found to stand about equal in every respect except complication. Here the two cycle, two cylinder possesses an immense advantage. There are, nevertheless, a great many people who will prefer the well known four cycle type to the less highly developed two cycle. However, those who have investigated must know that perfectly satisfactory two cycle engines are on the market.

The double opposed four cycle and the two cylinder, two cycle seem to the writer the most available types, and he is inclined to lean toward the latter as the more available for this particular service, on the ground of the small attendance and few repairs required.

For the propulsion of the business runabout two 4½ inch four cycle cylinders, rated at about 16 horse power, should be about right as being sufficient, if a correct gear is used and not developing excessive power. Two two-cycle cylinders of 4 inch bore or slightly less, or four 3.2 inch four cycle cylinders will afford this same output.

TYPES OF CHANGE GEARS.

As to the type of change speed gear to be employed, the choice will naturally lie between a two speed planetary and a three speed gear of the sliding type. It is a fact that the planetary is well adapted to this service. Gears of this type can be built which will operate quietly for a considerable period. With a heavily engined car the direct drive may be used so nearly all the time that the planetary combination proves satisfactory in practice. The business runabout, as here outlined, is not of especially high ability, as it will probably weigh 1,600 pounds, at least with the detachable tonneau on. Although rather low geared, there will be a good deal of hard traveling which cannot be covered on the direct drive, and as the low gear must be made very low the two speed arrangement will hardly give satisfaction. A two speed planetary may be very satisfactory so long as the motor is in good order, but let anything happen to seriously reduce the output, so that the direct drive does not carry well, and the only recourse is the low. Even if the engine of a three speed car is slightly "off color" the chances are that almost everything can be handled on the intermediate.

Only a few years ago the "fool proof" qualities of the planetary were a decided point in its favor, especially in such service as the business runabout performs; but now the use of the sliding gear is so generally understood that this point is of little importance. Everything considered, it is probable that a three speed gear of the sliding type, a permanently meshed jaw clutch combination giving three speeds, or one of the "direct drive on all speeds" type, will prove most desirable. It is certain that the change speed gear should either be integral with the engine base or with the rear axle housing, and that the units should be nondistortably supported. The latter disposition offers the advantage of giving an excellent distribution of car weight, and there is very little to be said against it for runabout purposes, although it may not be the most desirable arrangement if solid tires are to be used. An actual combination of the change gear function and the driving gear function, such as is brought about in the "always the same number of gears in mesh" type of transmissions, seems a natural solution of the problem.

GEAR RATIO

The gear ratio of such a car as this should not be higher than 4 to 1 on the high speed, which corresponds to a speed of very nearly 30 miles per hour at 1,200 engine revolutions, 32 inch wheels being assumed.

The lowest gear should not be faster than one-fourth of the high gear. This may seem extreme to some, but it is a fact which has been proved over and over again by competitive tours and common experience that a large proportion of cars lack a sufficiently low emergency gear. The low gear of the business runabout should be so low that it will carry the car anywhere, even though the engine is working badly. The writer believes that the low speed of all cars should provide for this contingency. The intermediate speed should be closer to the high than to the low.

GENERAL DESIGN.

A wheel base of 90 inches seems ample for a car of this kind, but the spring suspension should be of the best, and the rear springs should not perform the added function of torque and distance rods, but rather the rear axle should be independently fitted to resist these stresses. Full elliptic springs in the rear and a platform arrangement in front make a most excellent combination. In the design of the rear springs the carrying of a tonneau should be provided for and the possibility of using solid tires should be kept in mind in the spring designs both front and rear. The body should be as plain as possible but with good upholstery. To the rear of the front seats a perfectly flat platform may well be fitted, having a low rail about it. A three passenger tonneau should be supplied which will bolt securely in place of this deck.

All brass may well be eliminated from trimmings, lamps and control devices and a baked enamel finish substituted, or possibly an oxidized finish on certain parts. The labor of keeping the car in presentable condition will thus be greatly reduced.

It is realized that a car answering the above specifications cannot be sold at a startlingly low price, but it is believed that it includes nothing which can be left off without a sacrifice of the car's value.

In some cities, like Indianapolis and Milwaukee, runabouts are in extensive use by city officials. The Milwaukee Board of Public Works has only recently bought a $1,000 runabout for the use of the electrician in keeping the patrol box telephones in good order. The car is owned by the Police Department.

The Farmer and the Automobile.

By Jarvis J. Roginson.

The public in general thinks that the farmer is the same as depicted on the stage—that is, a man with chin beard, chewing tobacco and having an absentminded look. Such a man we would hardly expect to be so progressive as to own a motor car. The stage seldom, if ever, personates the up to date farmer. Though the old style is in the majority, yet the up to date farmer is the one making the money and improving the conditions for farmers in general. The up to date, progressive farmer knows something of mechanics. He has had to learn these things to handle his binders, threshers, gas engines and steam engines.

Now, having told you the class of farmers that own motor cars, I will say that farmers were the pioneer auto owners in California. In 1900 there were few motor cars in California; in fact, they could all be counted on the fingers of two hands.

A BIT OF AUTO HISTORY.

Frank H. Holmes, a farmer of San José, Cal., owned and ran a Stanley steamer for thousands of miles in 1900. It was J. C. Smith, a farmer of Fresno, Cal., who owned and used a locomobile in 1900. This was the only auto owned and operated in the whole San Joaquin Valley of California, a strip of country measuring over 400 miles long and about 100 miles wide. It was J. C. Cunningham, a rancher and miner, and Fred Wolfsen, an extensive farmer of Merced County, Cal., who owned the second and third cars in central California. I mention these things to show that it is not the city where the progressive spirit always springs from. I know these men personally and saw them buying new cars each season, and watched their struggles with them. Although the first cars were far from practical, these men got more work out of them than most men of other professions could have done.

I cannot say I am a pioneer motorist, for it was not until the fall of 1904 that I bought my first car. I spent considerable time looking into this car, and even though it was my first choice I have never regretted buying it. It was a single cylinder car, rated (at that time) at 8 horse power. The same car is built and sold to-day at $950 as a touring car. The runabout of the same make is sold for $750, even at this late day, when two and four cylinder cars are selling at the same price. The same make of car, however, that I bought in 1904, rated at 8 horse power, is now rated at 10 horse power.

BETWEEN TOWN AND RANCH.

I bought my car to use principally for going back and forth to town, about 6 miles distant. I used it nearly altogether as a runabout, though there was a small tonneau that came with it. This tonneau was a small affair with rear entrance, and I had to lengthen the frame of the car out 12 inches and make a side entrance before it gave satisfaction as a two seater. My car was the first side entrance car in central California. It was built on the surrey style, having no doors. I made all the changes on the car myself in my country blacksmith shop.

As I said, I used my car principally as a runabout, with box behind where I could carry provisions from town to my ranch. I have often carried 500 and 600 pounds on the car. One hundred pound sack of potatoes, 100 pounds of flour, 100 pounds of coal, 100 pounds of sugar, with other sundries, making 500 pounds, was no unusual load. Very often I carried a hired man or two on the car. In the busy season, during harvest, when I had to hire eight and ten men, I found my car very useful.

HANDY FOR FETCHING HIRED HELP.

Hired help in California is the most unsatisfactory in the world. It is seldom one can get men to work over a week at a time until they must quit, either to get on a drunk or go to a new place. During the scarcity of labor here the last two seasons I have brought men from town out to my place of an evening, and they would leave me before the next evening. This was not because wages and conditions were not satisfactory, but because farm labor was in great demand and they knew they could get work any time.

DURING HARVEST.

I have used my runabout for almost everything that a team would be used for when the roads were not too muddy. In California we sack all our grain as it is cut and threshed on the big combined harvester, and I have often run out over the stubble field with sacks and twine to my harvester. In cases of this kind it was often a time saver, for if the machine—I mean my harvester—would stop there would be five men and thirty head of horses idle. It takes from twenty six to thirty head of horses to pull these machines.

Though I have a farm telephone, the telephone cannot carry parcels, and very often I find my runabout the greatest help during the busy season in going to the express office for parts for my farm machinery, saving several hours over a team. There are times when my car gets out of order, but as a general thing it is ready to go. As it has only one cylinder it does not use many batteries, and as I always carry an extra set and an ammeter with other extras, it is seldom, indeed, that I am laid up.

I have had some trouble with this car that has been expensive. The greatest was differential trouble; that was the most expense since I owned the car. I figure that when I take care of the car it is not any more expense in upkeep than a team and spring wagon, which I would use in its place. Of course, I have horses, but it would take an entirely different horse than the regular farm horse to get around like the runabout.

TIRES.

I believe when everything is taken into consideration, such as horse shoeing, setting tires and horse feed, the car is just about as cheap—in my case—as a two horse team. One great expense of automobiles is tires. I have tried different kinds of tires, both pneumatic and solid. For the speed of my car and the new springs I am now using I find solid tires give very good satisfaction. The solid tires I used were the kind that had holes through them about 1 inch in diameter and about 2½ inches apart all around the tire. These tires, though resilient enough, did not last or stay in the rims well.

I am now using pneumatic tires because of not being able to get a certain solid tire just when I wanted it. I shall again try solid tires when I get a new set. A high speed pleasure car, no doubt, should have pneumatic tires—that is, if it goes fast. I do not know from experience just how fast a car can travel with comfort with solid tires, but I know I have often run over country roads at 17 miles an hour with my old single cylinder car with them on.

Examples of the Use of a Runabout On a Farm.

CYLINDER NUMBER AND ECONOMY.

As to what is the best car, the number of cylinders, etc., for a farmer to use I cannot say. For my use I do not think I could get a more economical and reliable car than the one I own. I have a light, four cylinder, air cooled touring car for my family that we have been using for nearly a year now. Though this car is very economical in fuel, it uses about twice the oil and about four times the batteries (if I used dry cells on it) as my old single cylinder going the same distance.

I have a storage battery for it, but while getting it charged I use dry cells, and I know from experience it uses batteries up very fast. I also know that though we use this car only once or twice a week, on an average it requires just as much or more attention than my old car that runs every day.

Of course, being a farmer I am not so likely to follow conventional ideas as much as my city cousins, but I think the showing of the single cylinder cars in the Grand Prix des Voiturettes proved that motors built right do not need many cylinders to give all the power any runabout will need. In this race several single cylinder cars made a speed of over 50 miles per hour.

WHAT THE FARMER WANTS.

There is much talk about building cheap cars for the farmer. Regarding this, I will say that the farmer will not object to their being cheap, but he will want them well made and simple. There are cheap farmers, the same as cheap lawyers, cheap doctors, cheap grocers, etc. These people will buy cheap rigs if they are in circumstances to buy anything, but you can depend on the substantial farmer's wanting the best. His eyes will not be looking for frills and furbelows but for a simple car that will stand up.

The farmer who is progressive enough and in circumstances to buy a motor car is a man, as a general rule, knowing something of mechanics. He also has a shop and tools on his place to do mechanical work. It is also getting to be the exception when there is not a gas or steam engine on the farm to pump water, run the cream separator, saw wood, bale hay or thresh grain. Such a man should be able to take care of and handle a motor car in a better manner than a lawyer, doctor, real estate man or drummer.

BUILT FOR STAGE FARMERS.

The manufacturers turning out motor cars for farmers seem to be building them for the stage farmer—the man not able to buy or the kind that never could run one. Some of the cars I have seen, said to be built for the tillers of the soil, would certainly make them look more ridiculous than they really are if seen with one.

The farmer who is thinking of investing should never put off buying a car because he thinks he will not be able to care for it and run it, for there are but few men more capable, unless it is a professional mechanic.

Nearly every city motorist I meet tells me about what a narrow escape he had from some farmer who was going to kill him for frightening his horse. Nearly every motor paper pokes fun at the farmer, too. Now, as to the farmer's generally being an automobile hater, I will say it is all false. There is no one who uses horses more than the farmer, and no one wants a substitute more than he does. The poorest farmer I know of speaks favorably of the motor car, and only wishes he was in circumstances to buy one. Of course there are many among the tillers of the soil who are cranky and overbearing, but no more so than the city men. I have driven and still drive horses, and I know from experience that motorists do not show the consideration to the farmer that they should.

FRIGHTENED HORSES.

Though I have been trying to get all my teams accustomed to automobiles, I have not been able to do so. In hauling my grain to market I use two eight-horse teams, each eight horses drawing two wagons. These teams must travel a road for 4 miles which is frequented by automobiles, and it is very often necessary to send an extra man along to hold the leaders to keep them from running away. These big teams, being heavily loaded, cannot leave the middle of the road very well, especially in places, and many motorists will almost compel them to give half of the centre of the road. Of course the law would say that my teams are allowed only half, but small teams, through courtesy, always give the big teams the centre of the road and they go around. Not so with all motorists. In motoring about the country I often meet people who must get out and hold their teams or horses every time they meet a car. This must be a great trouble with the number of cars on the roads, and it is no wonder many people object to motor cars, though it is their fault for having such horses.

FUTURE PROSPECTS.

Though there are some very simple and reliable cars on the market now, I think we will still have them simpler and better. Instead of adding more cylinders the trend will be toward fewer cylinders, and the engines will be made better and will be better balanced. Any man may tell how a car should be built, but when those ideas are put into practice they generally fail. Since the first motor cars came out I consider we have made very rapid advancement. We would have done more, but the manufacturers have been catering to the rich, who cared more for show and pleasure than for a practical car. If I am not disappointed we will see some very practical cars the next season.

MOTOR EXPERIENCES OF PHYSICIANS IN ALL PARTS OF THE COUNTRY.

In a Massachusetts Country Doctor's Practice.

By S. F. Haskins, M. D.

In the fall of 1903 I purchased one of the then popular curved dash runabouts, I being the first one to own an automobile in our village. While I was never partial to the horse, I have always been interested in mechanics, and in machinery especially, and while the smell of the horse about my hands and clothing has always been repulsive, the fact of having machine oil clear to my elbows never ruffles me at all, and this latter condition of mind was essential to the satisfactory operation of an automobile five years ago, when there was not a garage for many miles, and the operator of a car was the only man who knew anything about it, and, as in my case, that knowledge was very limited, for at that time I hardly knew the gasoline tank from the muffler. But under high pressure we think quickly and learn rapidly. So with me. Knowing that I must depend upon myself I "absorbed" the principles quite rapidly, but not until I had run up against many difficulties and had called upon the experts several times.

BUILT A GARAGE.

After having my car in a garage several times I determined to cut that out and build and equip a small garage of my own, and with the aid of an intelligent blacksmith, whom I could call to my aid, I would make my own repairs, outside of actual machine work. So I built the garage and gradually stocked it with the necessary tools and materials, and for the past four years all the work has been done in my own garage and under my own direction. Working on this principle the actual cost of keeping my cars in good running order has been reduced to a minimum, and I can now afford to keep them. In fact I cannot afford to do without them. After using the curved dash for a season I exchanged it for a steamer, and I had considerable experience—valuable and otherwise—with that kind of a car. While there are many nice things about a steamer, there are so many disadvantages that I soon exchanged it for a gasoline car. The average time of about twenty minutes to get up steam—the quickest time was thirteen minutes—is too long when a physician is in a hurry, and several times I was in the garage getting up steam when I received a hurry-up call and found that I could reach my patient sooner on foot than by waiting until I had sufficient steam, and I have stopped and gone out and made the call.

AIR COOLER NOW USED.

For the past two years I have been using a four cylinder, air cooled runabout, and it has given me excellent service and great satisfaction. I have never had trouble with overheating, except once after making some adjustments when I neglected to connect the oil pump and ran the car 30 miles with only what oil there was in the crank case, about one pint. The car finally stopped when I was within a half mile of home, and I had to get a "hay motor" to tow me in. One other time only have I been towed, and that was after breaking a connecting rod and springing my crank shaft, and I consider that it is doing very well for two years' constant use of the car.

I have kept an accurate account of the cost of keeping an automobile for five years, and, although I have made some bad trades, I am perfectly satisfied with the showing. I formerly kept two horses during the whole year, in order that I might have them in the summer, when I needed them both. Now I keep only one for use in bad weather and when the car is out of order, thus saving the cost of the extra horse. I have been able to keep a car for less money than I could keep the extra horse.

CAR IS CAREFULLY DRIVEN.

One of the reasons, other than the fact of my looking out for my own repairs, why my expenses are low is that I am a careful driver, never going at a speed faster than 35 miles under perfect road conditions, and then only a short distance; taking all corners and even easy curves slowly, going very slowly over bad roads, starting and stopping gradually when possible. Every few days I thoroughly inspect the car and see that every part is properly adjusted. Another cause is the excellent macadam roads in this section. I have a horse drawn coupé which I use in stormy weather, thus saving a vast amount of wear on the car. On the other hand, we have so little snow here that I use the car during the mild weather all winter, there being but very few weeks that it is not in use during the whole year. By using the coupé in bad weather I save much tire expense. I can do an equal amount of work in half the time by using the car instead of the horse.

I have not yet arrived at the point where I can discard the horse entirely, but I am anxiously watching for some manufacturer who will build a four cylinder, air cooled, 15-18 horse power, long wheel base, high wheel, solid tire coupé body car with the speed limited to 30 miles per hour, with plenty of power for hills, mud and sand, and all brass work bronzed or painted. When a car is designed along these lines I shall be ready to discard the horse. The disadvantages of most of the high wheel cars on the market today are their short wheel base, the use of double opposed motors (in which it is very difficult to get both cylinders to work uniformly), too much vibration and unprotected machinery.

The demand by the country doctor today is for a car that is suitable for all weather and road conditions, reliable, durable, of moderate speed, and has plenty of power when needed. I think such a car could be built along the lines I have just mentioned, and that is the ideal car I am waiting for.

MECHANICAL INCLINATIONS ESSENTIAL.

If a doctor is a natural lover of a horse and has no mechanical tastes I should advise him to stick to the horse, for no man should depend upon a car unless he takes an interest in it and knows it thoroughly, and is both able to diagnose and cure its minor troubles. Fortunately, most of the successful physicians are naturally mechanical, for few physicians would ever succeed in their practice unless they were, and we therefore see a larger proportion of country doctors running their own cars than of any other profession (another reason is that most of us are also too poor to employ a chauffeur).

TIRE PROTECTORS A BOON.

A word about reducing tire expense. During the first few years of using a car I had the usual trouble with tires, e. g., punctures, blow-outs, etc. Last summer ('07) I purchased a pair of detachable tire protectors for the rear wheels, and they have been used constantly on the car for thirteen months with the greatest satisfaction. One of the tubes has not had to be taken out for any cause whatever during that whole time. The other one was in twelve months, and had to be taken out on account of a slow leak, which I discovered, after taking it out, to be caused by the nut which holds the valve stem to the tube being loose. But during all this time I have not been delayed a moment on the road from tire troubles. It takes more power to propel the car when these treads are used, but nails, broken glass and tin cans have no terrors to me, and I have no fear when I turn out in the ditch that I will have a cut tire. This confidence in knowing that I shall have no trouble with tires when I start out to make professional calls is worth many times their cost, as reliability is the greatest essential in a car for the physician.

STORAGE BATTERY NEGLECT EXPENSIVE.

I also had one experience with a storage battery. Having decided to get one, I bought a 6 volt, sixty hour battery of one of the most extensive advertised makes, costing about $25, as I wanted the best that could be had. I installed this in my car, and after running the car about 125 miles during a period of five weeks—it was winter time and I was using the car only on warm days—the battery wholly exhausted itself, and I was hardly able to get home. As I was too busy at the time to give it immediate attention, I set it aside, and in a little time it froze up and burst the outside casing, and that was an end of its usefulness. I sent it to the manufacturer's agents for repairs, and was informed that it would cost $6.50 to repair it, and so I concluded I had better go back to dry cells, which I have continued to use from that time to the present, as ignition by the storage battery cost me about 20 cents a mile and the cost of dry cells is about 2 mills a mile. I will allow that this is an extreme case, and does not represent the average cost to the thousands of users of storage batteries, but in this letter I am not striking averages but am telling what actually happened to me.

RETREADING TIRES AT HOME.

Another matter of repairs which has interested many of my friends is the retreading of my own casings. In the spring of 1907 the shoes of both front tires were badly worn and needed retreading, and I purchased a pair of bands and applied them to the shoes by the "acid cure" process, and while one of them came off during the summer, and had to be put on again, the other is on and doing service today, but is worn so thin that I shall have to again retread it very soon. So by retreading the front shoes, and using the protectors on the rear wheels, I am still able to use the same set of tires that was on the car when I bought it two years ago, and they are in good condition today and will last for the remainder of the year. If a man invests $1,000 in a good team for doing business he usually takes good care to see that it has good treatment and is properly looked after, and his coachman takes no "joy rides" for the delectation of his friends, but the owner usually knows where the team is and that it is properly stabled at night. If the owner of an automobile would only give the same care to his car that he does to his horses, knows where it is and in what condition it is in, the expense for the legitimate upkeep would be greatly lessened, and the far greater expense due to grafting chauffeurs and their garage associates would be practically at an end. The indifference of owners to the cost of running a car and the recklessness indulged in and allowed by them has educated the public to the idea that it has a perfect right to plunder them, and the same spirit is pervading our legislative bodies, and they are enacting unreasonable and unjust laws to such an extent that an automobilist will soon be taxed and tagged out of existence, unless a halt is called.

OPPRESSIVE LAWS.

In my own State (Massachusetts) the owner of a little runabout and the owner of a car as large as a canal boat both have to pay the same annual tax of $5 for "registration," on the grounds that they do great damage to the roads. The tax undoubtedly is all right for the large car, but is very unjust to the owner of the little runabout. But commissions have friends for whom places must be provided, and if no place exists then they must be created, and their increasing number demands increased revenue for their support, and this has gone to such an extent that last year we had to register our cars twice in the same year at a total cost of $7 for one year. Our Massachusetts laws will not allow you to forget that "those who dance must pay the fiddlers." But there is a day coming when the mechanic and small business man will have his little car, and they will form so large a proportion of voters that their votes will hold the balance of power and will be eagerly sought, and then some of us who have seen the injustice of the present laws will enjoy the spectacle of seeing the dictator changed to a supplicant.

Recent Experience of a Pioneer Medical Motorist.

By Dr. George P. Jessup.

It is almost nine years since I bought my first car—one of the very early steamers—and since that time my work has been done almost entirely without horses. I kept one horse for a year after getting my first machine, and since then have hired a horse for about five days each winter when the snow made travel on wheels almost impossible. With the early and somewhat crude machines I passed many strenuous days, and sometimes would have been glad to go back to horses if my friends had not one and all predicted such a return and been ready to say "I told you so."

NOW USES FOUR CYLINDER CAR.

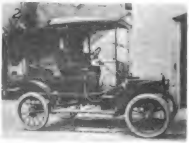
There has been a gradual improvement in cars till today the automobile is almost a necessity to the physician living in a "good road" district. Where the roads are still unimproved I doubt if a machine is practical for our work. With the improvement of cars has come a corresponding increase in knowledge and skill on the part of operators and owners, and I am inclined to believe that the increased reliability and efficiency of the present car are as much due to improved operators as to better engines. With the advent of the fair priced (commonly called low priced) four cylinder runabout the supremacy of the doctor's horse was forever destroyed.

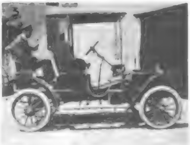
This runabout is a comfortable, practical and economical proposition for any physician whose work lies over good roads and who has some mechanical ability and a little patience. Like all things made by man, it is far from perfect, and every owner and driver thinks that he can improve on the work of the manufacturer. My experience has been with one of the first runabouts of this type brought to New York, and has been eminently satisfactory. Repairs and replacements have been comparatively few, and the car is always ready and reliable.

There are a number of small things that to my mind are entirely wrong and could be easily made right. Some of them are no doubt fads or fancies of mine, but some things I know should be changed.

SOME DEFECTS OF THE CAR.

The clutch lever is too short and works to much better advantage if lengthened 4 inches and brought nearer the seat. It can then be operated without bringing the driver's eye out of line with the road. The emergency brake catch never works, but can be made to do so at an expense of about 12 cents, by fashioning a catch from a hinge and attaching it to the car frame instead of to the floor boards. The oiler





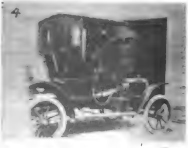


Fig. 1.—Top With Fishtail Body.
Fig. 2.—Rear Seat.

Fig. 3.—Rear Seat Occupied.
Fig. 4.—Glass Open.

on these cars seldom works, but can be converted into a very satisfactory gravity feed oiler operated by a lever on the dash. I have found a standpipe to the front crank shaft bearing a necessity, as this bearing does not get sufficient oil from the crank case and heats badly. This bearing has a feed from the oiler in the later models. Breaking of the front spring perch has been responsible for most of the serious accidents that have happened to this make of car in this neighborhood, and is a very serious matter, as it puts the steering gear out of commission, and this usually means a bad wreck. I consider this the worst feature of the car, and one that should have been eliminated long ago. In a single county accidents due to the breaking of this single part, costing $1, have cost more than enough to buy and equip a new car. The pump shaft is a source of constant annoyance. Being of steel, it is corroded by the water and must be replaced at least once in three months. The pin holding the pump fan will often sheer off in two weeks. This can be remedied by using a large pin or putting in a key.

The commutator is most inaccessible and wears very rapidly, needing renewal about as often as the tires. There are on the market several contrivances for bringing the commutator shaft up from the front end of the cam shaft, and these should work satisfactorily and make trouble hunting much easier. To replace the commutator in its present position means taking out the transmission. By sawing off the rear end of the cam shaft a quarter of an inch, and then taking the commutator apart, it can be removed without disturbing the engine or transmission. There will still be enough threads to hold the left handed nut securely, and it will very much facilitate commutator repairs and replacements. It is lack of attention to small defects in automobile design, and failure to correct such small errors, that has ruined the reputation of many a good car.

PECULIAR NEEDS OF PHYSICIANS.

I have always felt that the peculiar needs of the physician had not received sufficient attention from the designer. Perhaps it is because we never know exactly what we want ourselves, and sometimes do not really want what we think we do. I have never dared meddle much with engine design, except in small details like oilers, brakes and levers, but for a long time I have been trying to find a body that suited me, and have several times tried to produce a satisfactory top, usually with very moderate success. About two years ago I found a wind shield an absolute necessity, as the dirt and insects in summer and cold winds in winter were beginning to tell severely on my eyes. Goggles were only a partial relief, and as I was obliged to have specially ground lenses they were expensive. The plate glass wind shield has wonderfully increased the comfort of driving and is never troublesome, except in a very severe snowstorm or on a foggy night.

SPECIAL BODY AND TOP.

This spring I had an opportunity to buy a car that had been run into an electric light wire which had fallen across the road. The body was pretty well used up, and I decided to have a top fitted to suit myself and the body altered after my own plans. Details had been in my mind for a long time, and a cut of a car top by "Brewster" gave me some good hints. The car has since been very much admired, especially by my medical friends, and the remark is always made that it does not look amateurish. I find that it fully comes up to my expectations in the way of comfort and convenience, and am naturally rather proud of my success. Some of the lines are dependent on the fact that it is an old body remodeled, and would, of course, not appear in a new design.

FEATURES OF WIND SHIELD.

The dash has been widened 4 inches and the wind shield, mounted in a tubular brass frame, is divided near the middle, opening up and out—see photo—so that when opened on account of storm or fog it still offers considerable protection. It is absolutely rigid, being fastened to the top, and there is no rattle or noise of any kind from it. It is made of the best French plate, as anything else will cast shadows and sometimes distort objects in the road. It can be adjusted in less than a minute, and has no nuts or screws to move the frame, being closed by two long levers under tension. The top itself was made by a cabinetmaker under my personal direction. The frame is built of hickory. The materials were procured from a carriage builders' supply house. The cover, lining and fittings are such as have been used in the carriage trade for years. The top is absolutely rigid and would carry the weight of an ordinary man, but weighs only about 75 pounds, the plate glass windows being responsible for about 25 pounds of the 75. In fair weather the top is much less in the way, and more comfortable than the ordinary buggy top, and is entirely free from rattle. In bad weather, with the storm curtains up, it is absolutely dry. The rear seat was added later, and I find it a great convenience when I want to take anyone with me and do not care to leave my mechanic behind. It is the work of an ordinary carpenter and tinsmith, and can be fitted complete for about $20. The box is much more convenient for parcels, etc., than the old deck box.

The day of elaboration in automobile building is fast passing away. Simplicity, stability and practical utility are beginning to be demanded. Soon the successful builder will be the one who can cut out unnecessary parts and simplify those that remain.

BONNET SUPERFLUOUS.

The bicycle industry had the same experience, and the elaborate machine of 1892 is a curiosity today. For a long time I have felt that the traditional hood or bonnet must soon disappear. Cover the spark plugs and possibly the carburetor and what possible objection can there be to leaving the engine uncovered. Of course, there will have to be a little more detail of finish, and the radiator will need some modifying, but the engine will cool better, can be more closely watched, and, to my mind, the car will look better.

The question of speed is one of vital importance to the practical man. The law has decided that we shall drive only 15 or 20 miles an hour, and to habitually do more than that is sure to land us sooner or later in the police court, if we escape the hospital and the morgue. Still, cars are sold us capable of from 35 to 60 miles per hour and only working to advantage at from 18 to 30 miles per hour. The faster we go the more it costs—tires, engines, springs and bodies go to pieces much more rapidly at high speeds. Moreover, constant driving at speeds in excess of about 20 miles becomes a strain which most men feel severely after a year or so. At first the excitement of the sport makes them unconscious of the strain. The point is that we should be not only satisfied with but demand slower cars. They are cheaper to build and safer to operate, and they will last longer.

The Durability and Practicability of a Doctor's Car.

By A Woman Doctor.

Think of using one car for four years, winter and summer, through mud and sand and slush, without a single delay of more than twenty minutes, and at a running cost of less than $100 a year!

This certainly shows the endurance of my gasoline runabout, and is a far better test than any single trip could be, in no matter how severe a contest.

For the first year I used pneumatic tires, but our roads were strewn with horseshoe nails, and while I wore out and punctured and exploded two sets of tires and shoes, I was in danger of wearing out my own nerves with the worry which these pneumatic tires gave me.

It is hard enough for a woman to crank a car, but to pump a flat tire requires more effort than her heart can endure. It should be a law of automobiling that no woman be allowed to inflate a tire, even if she has strength enough to jack up the car and remove the tires. Realizing, therefore, that it is a greater art to prevent disease than to cure it, I was forced to endure the humiliation of telephoning to the garage for help whenever a tire was deflated, and this mortified me so deeply that I decided to equip the car with solid tires.

SOLID TIRES SATISFACTORY.

Solid tires have given me the greatest satisfaction. Nails have been driven into them, sharp rocks have cut them, glass has gouged them, but they are as good for the purpose now as when I had them put on in the very early spring of 1907. Agents, chauffeurs, car owners and the other wise heads, whose advice is freely given without expense, shook their heads when they saw my tires, and said, "You'll have an accident from skidding," "You'll never be able to make a hill or go through sand," "You'll never have any speed," "You'll be shaken to pieces with the vibration," "You'll break your springs and engine, and that's much worse than punctured tires to mend." But the joke is that none of these things has come true. Minor accidents have not been the fault of the tires, but of my own carelessness in neglecting to watch the supply of gasoline, lubricating oil or water. I have learned by experience that a car will not run without water, oil, gasoline or grease, and that old batteries are not so good as new ones. None of the springs broke nor did the engine suffer from the vibration due to the solid tires. A flaw in the frame of the car cost for repairs at different times $17, but was not due to vibration.

The speed of the car is the same as it was when new and equipped with pneumatic tires. It still makes a 16 mile trip over steep hills and through much traffic in forty minutes without trying to show speed, but with never a dread of a puncture.

SKID MORE.

It is true that solid tires skid worse than pneumatics, but knowing this one can be more guarded in turning corners and chains can be adjusted to the tires whenever there is a slippery or muddy road. The vibration is certainly greater, and the machine is more noisy in traveling than with well inflated pneumatic tires, but for the short runs between medical visits a doctor need not suffer from this vibration. I should not advocate solid tires on a touring car which was to be used for pleasure over all sorts of roads, but over good roads or for business purposes the solid tires are sufficiently satisfactory.

HOME GARAGE PREFERABLE.

One more point of practical importance is as to the care of a doctor's car. No matter how willing the agent may be, or how many helpers an ordinary garage may employ, a doctor's car is more useful if kept on his own premises, whether he runs the car himself or hires a chauffeur, or makes arrangements at a garage for the care of the machine. If the car is kept at the garage there is always the possibility of a delay in delivering it at the office door, or in caring for it at night or during a storm. Moreover, now that all sorts of men and boys can run automobiles, it is well to know where the car is when the doctor is not using it. A doctor's machine must be kept ready for instant use day or night.

A small shed at the rear of one's house costs about $150. No driveway is needed, because the two lines cut in the turf by the wheels are inconspicuous on the lawn, and boards can be laid on the soft turf during a wet period to prevent deep ruts or crosscuts.

This automobile shed need not be heated even in the coldest weather if a good antifreezing mixture is kept in the car, and therefore the car is ready for instant use, except during bad snowstorms or through drifted roads. As a matter of fact I scarcely used a horse a score of times any winter because of the impracticability of using the automobile, although for my personal comfort I took trolleys and trains somewhat more than in summer weather.

LOOKING FOR PERFECTION.

I find myself constantly looking for a more nearly perfect car than any now in the market—one that is practically noiseless, odorless, unbreakable, foolproof and perfectly comfortable on bad roads. A car with an engine started by pressing a button; tires which will not deflate, but which absorb the vibrations; machinery so incased as never to get dusty; wheels so high as to lift the car above deep mud; springs so easy as to make cross walks and gulleys unnoticeable. In fact, I am looking for some combination of electric landau and 40 horse power runabout which in these days of wonderful inventions ought not to be an impossibility.

ELEVEN OUT OF FOURTEEN USE CARS.

The practical utility of an automobile for doctors is well shown by the fact that in this Connecticut city of 17,000 inhabitants eleven out of the fourteen regular physicians use automobiles constantly in their practice. There are three Cadillacs, three Fords, three Compounds, one four cylinder Buick and one two cylinder Buick. Most of these cars are runabouts, some of them have detachable tonneaus and one has a rumble seat. A few of these doctors continue to keep their horses for use in bad weather, while others have sold their horses and hire livery teams when necessary. One of the doctors who has a good deal of country practice over bad roads owns two runabouts, an old one for bad weather or for emergencies when the more recent model car is out of commission, and he used an automobile nearly every day last winter.

None of these doctors employs a chauffeur; five or six of them keep their machines in their own sheds; several of them find it a pleasant recreation to potter with the machinery of their cars to see that the adjustments are all perfect, the oiling is accurate and the batteries are in order. One doctor, in his leisure moments, has invented a new automobile engine, and has worked at a storage battery of new type to eclipse Edison's in weight, power and size.

AS A MEANS OF RECREATION.

All of these facts got to show that automobiles are not only a practical necessity for doctors in small towns, but furnish recreation as well, and are much cheaper than horses. In rainy weather, with the protectors tightly adjusted, the doctor is more comfortable than in any ordinary horse drawn vehicle. He spends much less time on the road, and no time at all in tying or blanketing the horse, and he visits his patients so long as he pleases without thinking that his horse is hungry or will have pneumonia to pay for the exposure. These reasons apply in cold weather as much as in storms, for with the protecting sides and back and front closely fastened the doctor is much warmer than in an open buggy, because he benefits not a little from the unused heat of the engine.

MAKES THE DOCTOR MORE EFFICIENT.

As a matter of fact, since the general use of automobiles a doctor can give more time to each patient and better advice, for with quicker transportation he has more time for study as well as for rest, and therefore he becomes more efficient while he appears more prosperous, a fact which must not be overlooked.

While the automobile is of great advantage to a doctor wherever patients are concerned, it is also of value to him socially. Wherever automobilists meet there is at once an animated discussion as to different makes of cars, length of wheel base and size of wheels, springs, bodies, hill climbing power, cost of tires, non-skidding devices, non-freezing fluids, automobile races and accidents, cost of maintenance and special repairs, or of talkative agents and their promises, until the automobile has a great field as a social benefactor, as is well proven at all gatherings of doctors or laymen.

Accessories for the Physician's Car.

By Dr. Charles F. Smith.

In recent issues of The Horseless Age Albert L. Clough has been describing various accessories for the automobile. The following article will deal with these same accessories from the standpoint of an ordinary driver with a weakness for attaching anything to his car that looks like a labor or time saver, or that would make for comfort.

TOPS AND GLASS SHIELDS.

A good top is almost a necessity for anyone who intends to operate his car in all weathers. A point overlooked by manufacturers of the cheaper runabouts is to anchor the seat firmly enough to stand the strain of carrying the top when it is laid back. My experience has been gained with two runabouts, one a popular two cylinder opposed, shaft driven car, and the other an equally popular four cylinder runabout. In both these machines the seat was pulled off the body by the weight of the top.

A glass front is also practically necessary in cold and windy weather. It takes a good deal off the power of the car, and the shield is yet to be built that will not rattle sooner or later, but both these objections are overshadowed by the extra comfort and decrease of injury to the eyes.

TIRES AND RIMS.

For the smaller runabouts the ordinary clincher tire without staybolts has proven about as satisfactory in my hands as the quick detachables. It can be taken off with almost anything, from a screwdriver to a fence rail, and in the event of a complete wreck of a tire the car may be run a considerable distance on the rim without injury to the latter, especially if it be wrapped with rope, while the quick detachable rims will soon be ruined if run bare.

TIRE PROTECTORS.

I have at present two cars equipped with these treads, and am undecided as to whether they are the good thing they are claimed to be or not. They undoubtedly make a considerable difference in the power of the car on dry roads, and a light car rides a good deal harder with a set on, as the tires have to be blown up very hard to keep the covers from slipping and to keep the dirt out. I have known also of two instances of new tires of good make blowing over the rims with these treads on. Whether or not this is due to the outer cover being confined at the tread by the protector, thus throwing the strain on the sides, I am unable to say. A car equipped with treads is, however, practically safe from punctures, and the peace of mind acquired thereby is worth a lot.

BATTERIES AND MAGNETOS.

For a two cylinder car the ordinary dry cell is hard to beat. A couple of sets will run a two cylinder car a long way, and on the whole they are the cheapest form of ignition I have used so far. For the four cylinder, where the speed of the engine is very high, a storage battery has given fairly good results.

I have had two of the so called dry storage batteries, both of which were entirely unsatisfactory. The ordinary storage batteries have done better, though none of them have given the mileage claimed by the makers. Two magnetos have been tried out.

The first was run with a cork friction wheel, which wore down very rapidly and required adjustment about every 10 or 15 miles. It also would not spark when the car was running less than 10 miles an hour on the high gear. This was scrapped, and a magneto, constructed specially for the four cylinder runabout, and driven by a belt from the flywheel, was applied. This is claimed to start the engine by cranking, and so it will, too, if you crank hard and long enough. It also possesses the defect of insufficient "juice" being delivered to the plugs at slow speeds. It will probably follow its predecessor to the junk pile if it does not do better.

SHOCK ABSORBERS.

My experience with these devices has been limited to one set, in which glycerine was forced from one chamber to another through a needle valve on the upward motion of the springs. These worked fine, so far as holding the car down was concerned, so long as the weather was cold and the glycerine thick. When it got warm the glycerine soon leaked out at the stuffing boxes and the absorbers went out of business. Even when they were working all right the spring breakage went merrily on just the same. It is claimed that springs are broken on the upthrow. The downward bump has invariably done the business for me. The absorbers were removed from the car and can be purchased at a ridiculously low figure and on easy terms.

SPEED INDICATORS.

Two different indicators have been applied to my cars. Both are valuable, and in this country (western Canada), where settlers are far apart, they are almost as much of a necessity as a compass is to a mariner. Both have their weak points, breakage of the shaft being the trouble in one case, and unsteadiness of the pointer in the other. The latter works through bevel gears at the knuckle, doing away with one of the bends.

LAMP LIGHTERS, ETC.

An electric lamp lighter, which may be constructed with a single cylinder coil and a push button or snap switch, deriving its current from the ignition battery, will be found one of the greatest conveniences that can be applied to a car. A clock on the dash, illuminated by a miniature incandescent lamp, the push button for which can be located on the steering post, will also prove useful. The lamp can also be set so as to light up the speedometer.

DEFLOCCULATED GRAPHITE.

I am trying this at present, and so far have not been able to see that it is any advantage. In the four cylinder runabout it has neither decreased the noise or increased the power, and doubles up on the price of the oil. I also never had trouble from overheating, carbonization or the engine firing after the spark was cut off until I started in to use it. This, however, may not be the fault of the graphite, as in another four cylinder car of a different make none of these phenomena have happened since using it. So far as the preservation of the valves is concerned, I have never yet in any of my cars ground in a valve because I thought it needed it, pitting or loss of compression through valves being an unknown quantity with me up to date.

VULCANIZERS.

A small iron arrangement that fitted over the tread has been another investment. It would vulcanize all right, but would need a trained nurse to watch its temperature while in action. I now have an electric, which does good work, though on a light car an inner tube patched by the acid curing process will generally hold up till another nail goes through it.

There have been numerous other things that, according to the claims of the inventors would make automobiling a soft snap, have been tried out and discarded.

To sum up: For a physician, either of the cars mentioned, equipped with top, glass front and lamp lighter as necessities, and a clock, speed indicator and electrically lighted dashboard as indispensable luxuries, a set of good clincher tires with a couple of inner tubes under the seat, a bottle of acid cure, cement and some patches, a good jack and about 40 feet of half inch rope makes up an outfit with which he can go or be towed anywhere, and so far as my experience goes will about as near solve the transportation problem as it will be possible to do until the advent of the airship.

Keeps Two Cars.

By Dr. Arthur Mitchell.

As a constant reader of The Horseless Age since its first issue, and as a user of runabouts for business purposes, I want to personally thank the editor in advance for the promised number which is to be devoted exclusively to the runabout. I am sure from acquaintance with previous efforts in such directions that the number will be a great success and personal help to men like myself, who are poor but obliged to depend upon a runabout for the earning of our daily bread.

I will say by way of introduction that I am a physician, located in the country, where the roads are very good for eight months in the year, but with a territory to cover which compels me to travel from 10,000 to 12,000 miles during the eight months that I use an automobile. I have depended upon machines exclusively during the summer since 1901.

During the early period of automobile construction my constant complaint was a lack in the market of a machine suitable to my needs. Today I can no longer find fault in this direction, and since I must kick, I am compelled to complain because the things I want are sold for a larger price than my business warrants me in paying.

I am sure no reasonable man can say today that he is unable to find a runabout which is not constructed, or cannot readily be converted, to meet his individual requirements. If a man wishes to keep a chauffeur who will do his driving as well as look after the car he can obtain a machine so nicely made, so beautifully finished and so delicately constructed that his chauffeur can be occupied during his spare moments in keeping it properly cleaned and tuned up.

If he wants a runabout for rough and ready service, of crude appearance and cruder adjustments, and still capable of doing fairly satisfactory work, he can find such a machine, and for a comparatively small price, but for the man who wants a strictly first-class article, natty enough so that he is not ashamed to leave it in the yard of his wealthy patients, reliable enough so that he is fearless of all roads and conditions, strong and substantial, thoroughly made, requiring not more than a reasonable expenditure of time and brains to keep in first-class condition, there seems to be nothing on the market under $3,000, and that price is more than the physician who has not married or inherited money is able to pay.

RESERVE CAR NECESSARY.

For the last three years I have kept two machines, and I think every physician needs two, provided he runs his own car, as I do. It may be a matter of a flat tire; it may be that your machine needs half a day spent on it in general overhauling; it may be any number of reasons; but I should not care, even with a thoroughly first-class machine, to attempt to get along without two, and my idea of a proper equipment for my own personal work would be an open car of not less than 24 horse power, developed by a four cylinder engine. This car I would equip with a victoria top in case I was caught in a storm, but I intend to use it under ordinary conditions in pleasant weather only.

For a second car I would have one with an air cooled motor and an enclosed body for stormy or cold weather, which could be used as an emergency car in case of accident to the other car. In looking the field over, so far as I am able to discover, in order to obtain these two cars of strictly first-class makers the total cost would be about $5,500.

I have read that it is impossible to put first-class material and first-class workmanship into the popular priced car that so many firms are building at present. So far as I have observed the low priced or popular priced models, I do not care to risk my precious neck in them. But I do believe that at least $500 could be taken off the price of the cars that I describe without in any way affecting the dividends of the manufacturers.

WASTEFUL METHODS.

Take the recent Glidden Tour, for instance. Will you kindly tell me of what earthly use it was? And you and I, as buyers of automobiles, have got to pay for it. The money that they expended in that tour could have been taken from the selling price of the year's output to much better advantage. We, the public, have gained absolutely no information from the contest.

It is hinted that some of the cars that came through with clean scores did so by tricks that are dark, but we have not the slightest idea which one, or, for that matter, whether any one did or not. I was told the other day by a man who ought to know and who ought to be disinterested, that three cars of a perfect score team were on their last legs when the run was completed. If that is a fact, and the public could be honestly informed of that fact, they might get some information that would be of value regarding that make of car; but who knows whether it is true or not outside of a few?

All road racing, hill climbing contests, record breaking runs, sealed bonnet tests, etc., we, the buyers, have to pay for, and I, for one, am sick of it. It seems to me that the automobile industry has now arrived at a stage where it ought to stand with dignity upon its own foundation without the support of hot air from yellow journals.

It is not necessary for carriage builders to have contests of this kind to sell their vehicles; neither do they spend enormous sums in advertising in daily papers, as automobile manufacturers do; and while I appreciate the fact that the industry is young, I also know that the demand is great and that people of intelligence are beginning to be able to discriminate between the genuine and the false, and the best and most desirable customers to be obtained are not dependent in the least upon newspaper reports, or influenced by road races in their choice.

Neither do I believe that it is necessary to spend so much money in selling cars to the public. It seems to me there are eight or ten American manufacturers whose cars are so good and whose reputations are so strong that the public will seek their products without the products having to seek the public, as they now do. I know of one agent who made $100,000 in one season by selling cars. He made enough in his repair shop to pay all his expenses, so that his $100,000 was clean. As an illustration of his repair methods I will say that he charged me $11 for what my man did with the help of another man, who is not a mechanic, in an hour and a half.

I hope some day we shall have better repair shops. They are a little better now than they formerly were; but too often we find a boy using a sledge hammer where we ought to find a skilled mechanic using light taps with a small hammer.

The manufacturers are growing much more sensible about their products than they were a few years ago. I remember visiting a show in Boston with a carriage manufacturer in 1904, and the amusement of my friend at hearing a man from a well known factory exploiting the merits of his car, and among other things stating the number of coats of paint, varnish, etc., which were put upon the body, which my carriage friend informed me was two coats less than the majority of carriage men agreed was necessary for a decent job.

We have outgrown such follies; we have outgrown the time when anything on wheels that would go would answer; we have got simplicity, good material, good lines, good workmanship, safety and reasonable economy in operating expenses; now why not have a reform in the sales department?

Cut out road racing, endurance tests, hill climbing contests, sealed bonnet tests, transcontinental tours, ultra-elaborate advertising, gilt edged salesrooms with ornamentation that would put the old Romans to shame, and conduct the business along business lines, and give the public the benefit of this unnecessary waste. I, for one, would rather have my money in the car than expended in useless contests. How do you feel about it?

The Moderate Priced Runabout from the Physician's Standpoint.

By William Martin, M. D.

There is no question but that the auto has come to stay in the ranks of the medical profession, but the ever present query in the minds of many is as to its practicability. Four years ago, when I first started the use of a car in my practice, this question was well asked, for then there was so little range in choice of type and make, nearly all being one cylinder machines, and while they gave good service there were many points for improvement. The last two years, particularly, have revolutionized matters in this regard, for there is a wide range of choice from the one to the four cylinder types, all of which can be placed in the list of moderate priced runabouts, at $1,000 or less, some few being about half that amount. All of these have demonstrated their practical usefulness all over the country, some, of course, giving better and longer service than others. We find upon looking around and upon questioning the various owners that there is a gradual trend of opinion favoring the four cylinder car, especially in country districts, where the physician has long drives and poor or average roads, as the higher horse power and other points give this type of car the preference.

FOUR CYLINDERS POPULAR IN THE SOUTH.

In a trip through the South this past spring, taking in thirteen States, I made it a point to look into this question, and I found a large number of physicians using cars, and about 80 per cent. of them using the four cylinder type, usually runabouts. The few one cylinder cars noticed were of the now out of date curved dash type, but I was surprised to see so many modern cars and so few of the other.

The present tendency to follow the lines of the high priced and high powered cars adds much to the attractiveness of these more humble cars, and makes them more salable, so long as their worth is proven. The running board, instead of step, adds much to the usefulness as well as to appearance, for it offers a place for the tool box, storage battery, carbide generator or gas tank, or anything one cares to place there. The longer wheel base adds much to the riding qualities and gives the car a far more attractive appearance.

The wheel steering gear with the spark and gasoline control placed so conveniently at hand far surpasses the old tiller steer with its inconvenient spark lever.

IGNITION WEAKEST POINT.

Probably the most unsatisfactory part of the whole auto mechanism is that of ignition, for in this part occurs a large percentage of troubles, especially if the physician is not a skilled or natural electrician. The usual outfit of the moderate priced car is two sets of dry cells or one storage battery and one set of dry cells.

The average four cylinder car eats up the current in a most aggravating way, and you are forced to be fairly constantly renewing your batteries. The timer is usually placed where it is most inaccessible, instead of the opposite way, which is a point open to criticism, as we all find the commutator a thing needing a great deal of care and watching. It should not be so, and perhaps manufacturers will make improvements in this respect in the near future. The average physician does not have or care to have a driver, and he is not over fond of too much grease and dirt on his hands, especially when making professional calls, but this will sometimes occur, especially when there is something wrong with some part of the ignition.

TIMER INACCESSIBILITY.

My present car is a four cylinder runabout of a popular make, which is unsurpassed from the standpoint of compactness and (as they say) practicability. The timer is situated at the end of the cam shaft, close up to the transmission, and in order to get at it the floor boards must be taken up, and if it is to be examined properly the rod connection must be separated so as to turn it over. This becomes a matter of time, dirt and impatience, and sometimes something more, if the weather is hot, as it usually is. This feature is the one fault I find with this car, and yet there are many thousands of them in use or ready for use.

During the past year there have appeared on the market other cars of nearly the same cost which have this point of objection removed. The manufacturers of small parts now offer special brackets with bevel gear to be placed in front for the timer, but as yet they are not recommended by the car manufacturers, who state that they will soon add to one's troubles by the wear of the gear, causing irregular timing; so for the present we are still to retain our inaccessible timers and greasy fingers. Those fortunate ones who can either afford to install a certain patented type of ignition apparatus or can buy the higher priced car with it already placed, can look down upon the rest of us with a certain amount of equanimity, for they have little or no trouble with their ignition, and have the additional benefit of a marked economy in the electrical discharge. Those who have installed the moderate priced magneto are still in the experimenting stage, and must also have the dry cells or storage battery to start with, and perhaps come home with. Most of us cannot see our way clear to placing the large geared magneto, costing from $100 to $200, on our cars, so we are still waiting for others to demonstrate that these cheaper generators are practical.

I have never kept an accurate account of my expenses, but it is my candid opinion that if one drives his own car, and takes as much care of it as is possible, it will cost him considerably less per year than would a horse, and if he is not too horse proud he will get far more satisfaction and pleasure out of it, together with the advantage that there is no horse to care for and pity in hot weather, as well as a greatly increased mileage each day and more time for reading or pleasure as a consequence.

A GODSEND TO DOCTORS.

The auto has been a godsend to many busy practitioners who formerly were on the road most of the day, with little or no home life, and when at home too tired out to enjoy a social chat or reading, and therefore in position to grow stale. Now, with the modern car, the physician has ample time for recreation, for his work is done in half the time, and even the working hours are made more or less recreation hours, as the influence of autoing is invigorating and restful.

The ability to reach in a very short time a distant point where a human life is at stake is a great inducement to the physician. If, therefore, the physician can do more and better work in much less time, and has time for self improvement in addition, he can by the use of the car make himself a far better citizen and get a great deal more out of life in consequence.

The Runabout a Success.

By W. W. S.

'Twas 'way back in the good old early days of automobiling, in March, 1901, that I screwed up my courage sufficiently to order a motor for use in my professional work. In the nearly eight years which have since elapsed I have passed through many experiences, have thereby acquired considerable knowledge in the ways of automobiledom, and have crystallized my experiences and knowledge into the concrete form of an automobile which it seems to me should meet the needs of medical men wherever the automobile can be used. I am speaking now of its use in a business way and not as a family pleasure vehicle. For his professional use the physician had better not have one of the large, unwieldy, complicated machines, with an accompanying large upkeep account, but only needs a motor car with a seating capacity for two people, and of the very simplest construction.

My first machine was of the steam buggy type, which I will merely mention in passing, as, while steam is a very reliable power and provides a smooth running prime mover, the danger of a large tank of gasoline (part of which at least is under an air pressure of 50 to 60 pounds) in close proximity to an open flame, is too obvious to need further emphasis. I had a hair raising experience one very windy October day, and from that time looked on my machine with suspicion, and in about a year disposed of it.

In the spring of 1902 I purchased a sleigh front runabout which was then becoming so popular, and this little seven year old car has done my work ever since in a very satisfactory manner, and still appears good for several years' service. The maintenance cost has been reasonable, not exceeding $225 per year, including gasoline, lubricating oils, tires, new parts, repairs and labor, the tire expense being about the greatest item. In a previous number (Doctors' Number) I gave the itemized expense account.

PERSONAL CARE OF CAR.

I attribute my success with the automobile to the fact that I keep it in my own garage back of my residence and office, and largely take care of it myself. This serves three purposes: 1. When I start out in the morning I know what condition my machine is in, and am sure that I have enough gasoline, water and lubricating oil to run me through the day. If kept at a public garage, I must take some other person's word for it, and, while they would perhaps not intentionally deceive, in the rush of inspecting many machines some points are apt to be overlooked which may cause fatal delay on the road. I notice that the physicians who are having most satisfaction out of their cars are the ones who "hostler" them themselves. 2. This self care of the machine furnishes me with a healthful diversion which every man in the onerous practice of medicine ought to have. And right here let me say that one's success will be in direct ratio to his love for mechanics and his willingness to study and become familiar with the peculiarities of his individual auto. This should not be so difficult for the physician, as his life work is the study of the intricacies of the human machine. There is a pleasure in meeting and overcoming the difficulties of caring for and operating an automobile which it is hard for the uninitiated to appreciate. 3. And not least, the expense of operation is much reduced.

SPECIFICATIONS OF AN IDEAL CAR.

In order for the busy physician or business man to have time to look after his own machine it must be of the simplest possible construction to accomplish its work. For myself an engine furnishing 10 to 15 horse power would be ample. This motor can be of the four cycle, double opposed, or four cylinder type, air cooled or water cooled. In fact a single cylinder motor would suit me, as it makes the simplest engine, and the vibration while the car is in motion is not noticeable, and when standing still the motor should be stopped.

I prefer the planetary gear, as I consider it simpler to operate, and in such a machine more than two speeds forward and the reverse are not necessary. It goes without saying that it should be shaft driven, thereby doing away with the dirty, exposed chain, which is subject to great wear.

If the air cooled, two cycle motor should ever be perfected it, of course, would provide the simplest power plant for such a car as I am describing, and I for one would like to see it brought about. There would be no radiator, pump or water tank, no half speed shaft or valves. Possibly what would be gained in this direction would be balanced by losses in other directions, however. These points can only be settled finally by tests made by the engineers.

CUSHION TIRES SUCCESSFUL.

In my present auto I have for over two years used cushion tires on the rear wheels, and they have been so satisfactory and their use attended with so much freedom from tire troubles that I would want the rear wheels of any machine I might possess equipped with them. As evidence I would say that I have just completed a 450 mile tour with my little 5 horse power machine over some of the worst and most hilly roads in south-central Ohio it was ever my misfortune to ride over, and all this without one speck of tire trouble. I took a new pneumatic tire along, but did not even remove its burlap covering. As for the vibration injuring the car, I have yet to see it, and certainly two years ought to make it manifest.

I would want 32 or 34 inch wheels on this runabout, both front and rear, and the wheel base should not be less than 84 inches, and a little more would be better.

Given such a machine constructed of the very best materials and a horse would not be in the running. The price should be kept well under $1,000. In fact, it would not pay a professional man to tie up too much money in an automobile. It can be noted that the specifications above enumerated are very closely approximated by a number of standard cars already on the market. It is not a freak.

After almost eight years' use, my verdict is in favor of the automobile runabout. I readily understand (especially after my recent trip) that there are sections of country where the motor car cannot be used except under the most favorable weather conditions, and horses would have to be resorted to the remainder of the time. Here it would rest with the individual to figure out for himself whether or not it would pay him to invest in a machine which would probably stand idle half of the year. Certainly, while it is in use, the great saving of time is worthy of consideration.

ELECTRICS IN CITY USE.

I notice a tendency in this city and other large cities for physicians to use electric runabouts. These are all right where the calls are confined to the streets and boulevards of the city, but for country work I do not consider them feasible at this time. For the rougher work I do not think the gasoline runabout has a competitor, and where the roads are good not even the horse enters into the problem at any season of the year. In icy weather I have found my car very practical where a horse had difficulty in getting along though rough shod.

A New Jersey Doctor's Views.

By W. P. Glendon, M. D.

The transportation problem is always a most important and interesting question for consideration by the medical fraternity, and the Runabout Number of The Horseless Age is being looked forward to with pleasure by those of us who are using the horseless vehicle in our daily work. The intelligent consideration of this question necessitates the discussion of a number of factors that enter very closely into the matter, such as the type of car used, the upkeep and operating expenses, and last, but not least, the reliability of the car.

My first car was a runabout, a single cylinder affair of an early vintage, and this experiment I am free to confess was a failure, so after a trial of several months I exchanged it for a two cylinder touring car of 18 rated horse power. I fully realize that the large car is not an ideal vehicle for the physician, but in my practice I find it frequently necessary to transport a patient to and from the hospital, and this I was unable to do comfortably with the small car, while with a car that has a tonneau it is a very easy matter to convert it into an ambulance, and a sick or injured person can be bolstered up with pillows and made comparatively comfortable on the rear seat during transportation. When the question of expense of operation and upkeep enters into consideration, however, the decision would no doubt be in favor of the smaller car in some items at least. The runabout being much lighter, is easier on tires, but, on the other hand, those with multiple cylinders and whose engines are compelled to run at such high speed in order to develop their power, shake themselves to pieces much sooner and stand in more frequent need of repairs than the heavier car. In view of my own experience my preference is for a touring car with a detachable tonneau as best adapted to meet the requirements of my business.

DAILY INSPECTION.

In its present stage of development the auto is just about as reliable to depend on for business purposes as the horse or trolley, but to secure and maintain this state of efficiency means constant and unremittent care and attention on the part of the owner, so that when in daily use it is necessary to have it inspected and cared for before it leaves the barn in the morning, and this duty should not be entrusted to unreliable help, or the driver will have occasion to regret it. The constant jolting and vibration that a car is subjected to while in motion is bound to loosen nuts and screws, no matter how tight they may be set up, and eternal vigilance here is the price of safety. I remember one experience in particular that might have resulted disastrously to me, but fortunately nothing came of it.

In making the daily inspection the bolt that connects the starting lever with its mechanism shook loose and dropped out while the car was running, and when I attempted to stop the lever failed to disengage the clutch, so the only way to accomplish it was to throw off the switch. If I had been compelled to make a quick stop the mishap might have proved a very serious one. By exercising care in running the car over rough places the life of the tires can be prolonged, and the vehicle can be kept in a better state of efficiency.

ONE HORSE FOR EMERGENCIES

When I began to use the car in my professional work I disposed of my horse and depended on the former exclusively, but after a year's use I found it much more satisfactory to retain one horse for use in bad weather and at times when the roads are unfit for use. When a livery is handy there is no need for the doctor to keep a horse. The question of cost per mile traveled with the auto is a rather difficult item to get at. The owner of an auto is rarely contented to use the vehicle for business exclusively, and many side trips are taken and many miles of territory are covered that would not be undertaken with the horse. The bill for gasoline amounts to quite an item in the course of the season, but the tire expense is by far and away the greatest of all. With care I can manage to get along with one set of tires a year, that is, with some makes, for there seems to be a great difference in the wearing qualities of the different tires. I have long since learned that it is a needless waste of money to have a tire repaired after it has blown out, as the life is very short afterward, so after getting all the wear possible I cut the shoe up into sections, removing the bead or rim, and then use them for repairing blowouts. This I do in the following manner:

REPAIRING BLOWOUTS.

The section of an old shoe is placed inside of the casing over the hole, and when the tube is inflated it serves to hold the patch securely in place, as a tire so repaired is good for many miles, as the repaired part thus becomes the strongest part of the tire. In my efforts to make a patch hold from the outside of the shoe I was always disappointed, because the patch will invariably creep away from the part and your labor goes for naught; but when putting one on in the way described the life of the tire is greatly prolonged.

The tires are by unanimous consent the most troublesome as well as the most expensive part of motoring, and a successful solution of the problem seems as far off as ever, and until something more satisfactory is found than the pneumatic any little wrinkle that will tend to keep down the expense in this direction is a valuable acquisition to the rapidly growing class of business men who use their cars as they conduct any other branch of their business.

GARAGE WITH PIT.

Any ordinary wagon house or barn can with very little expense be converted into a garage, and if some means are at hand for heating in cold weather it will be found a great advantage. To facilitate adjustments of parts not very accessible to sight or touch, it is almost a necessity to have some means for getting beneath the car, and for this purpose I have a pit in the floor of my wagon house, 4 feet long by 4 deep and 2 feet wide, lined at the bottom and sides for convenience in keeping clean and dry. As some form of artificial illumination is necessary when working in this pit, a portable electric light and fixture is considered an assential part of the outfit.

DRY CELLS DISCARDED FOR ACCUMULATOR.

I have long since abandoned the use of dry cells as a source of ignition, having found them both expensive and unreliable. I get better results from a storage battery and find it very much more economical after the initial expense, as it furnishes a steadier current and hotter spark, but, like the one horse shay, when the charge begins to run down it goes "all in a heap." Having no power of regeneration it becomes necessary to look carefully after the matter of recharging to avoid getting stranded on the road. One charge usually suffices me for 600 to 800 miles. I do not carry any reserve cells, because they deteriorate as rapidly when not in use and they are not to be depended on in an emergency.

During the earlier part of my experience I had one or two unpleasant experiences in this line that taught me a lesson which I have since profited by. I have found that there is a great difference in the results obtained by the different grades of lubricating oil. Some will burn without leaving much residue, while others will foul the cylinders and spark plugs and cause no end of trouble by carbon deposits. For the relief of this condition nothing will do so much good as a liberal flush with coal oil, and, indeed, it is an excellent practice to wash out the cylinders frequently with coal oil. The ordinary axle grease of commerce, such as farmers use, is a most excellent preparation for use in the main engine bearings, and for me it answers the purpose as well as the more expensive grade of engine grease. For the transmission gears I am in the habit of using Petrolatum, with the addition of graphite, and the latter ingredient has been found to be a valuable addition to the lubrication of any bearing surfaces. Applied to nuts and bolts it will effectually prevent sticking on their subsequent removal.

FIRE RISKS.

A sight that I witnessed during the summer impressed on me the necessity of carefully looking after the condition of the gasoline feed pipe and see that its continuity is unimpaired. A car was standing nearby when a man in passing struck a match on the step and lighted his cigar. Immediately the car was in flames, and only by the most strenuous exertions on the part of the owner was it saved from total destruction. Investigation revealed the fact that the feed pipe had sprung a leak and a large pool of gasoline was lying near the car, into which the match had fallen, with what might have easily been disastrous results.

Some form of protection for the eyes is necessary to guard them against the injurious effects of dust and bugs, the latter being particularly annoying toward night. I have seen several cases of severe conjunctivitis superinduced by the dust irritation and the entrance of foreign bodies in the eyes.

HEALTHFUL EFFECTS.

A consideration of the advantages to be derived from the use of the auto would be incomplete without some mention of the beneficial effect on the health of the rider. I know of nothing so likely to benefit one with a tendency to tuberculosis as the recreation of automobiling. The lungs are constantly fed with fresh air, the appetite is improved, and nothing is more conducive to the health and well being of the rider.

When it is necessary to use the car for night driving some form of gas lamp is necessary for satisfactory illumination, as a coal oil lamp makes a very poor and uncertain light when depended upon alone, and one unpleasant experience in its use led me to always depend on the acetylene lamp for night use. One day last December, as the shades of twilight were beginning to deepen, I started for home, and as the distance was short, only 8 miles, I did not bother to add water to the gas generator, but thought I could manage with the coal lights alone. I ran very slowly and kept well over on the right hand side of the road. While passing through a shaded portion of the highway a large object suddenly loomed upon the field of vision immediately in front, and before I could stop the car I went crashing into the rear of a farm wagon. Fortunately I was running very slowly, and the force of the impact stopped the car without any serious injury being inflicted on the wagon or its occupants, but for a few minutes the air was lurid with invectives by the owner of the team. The promise to pay all damages sufficiently mollified the owner and clarified the atmosphere to allow me to proceed on my way with no greater damage to my car than the buckling of the steering knuckle, and the expense of $6 for repairs to the wagon completed the list of expenses for that venture.

SELECTION OF CARS.

In making a selection of the type of car needed for business or pleasure the decision is largely influenced by the size of the pocketbook of the prospective buyer, but among the many different varieties of cars now on the market, both new and second hand, there should be no trouble in getting one at a price to suit any size purse, and also one that will fill every need as a means of transportation for business or pleasure. The longer I use my car the more of a necessity it becomes to me in the management of my practice, and the amount of work that I can do outside of my own territory more than pays for the maintenance, so that it has not only been a convenient and satisfactory means of transportation, but a profitable one from a business standpoint.

Some Suggestions by a Virginia Practitioner.

By M. D. Hoge, Jr., M. D.

Probably there is no class of professional men who are more conservative than physicians. They recognize the limitations of the automobile for their use, yet having once gotten the fever the purchase of a car is the only cure.

As to the size of the dose, by all means take a runabout rather than a touring car, for the following reasons: First, the initial cost is considerably less; second, the larger the car the greater the running expense for tires, gasoline, oil and accessories; third, the lightness and flexibility of a small car enable one to turn in narrow streets, to go into places and come out again with greater ease; fourth, no doctor uses his horse and buggy for pleasure purposes in hauling his family and friends around the country, however much he may need the rest and recreation; fifth, as a rule he drives by himself, and extra passengers tend to detract his thoughts and add additional weight; so, for these reasons, purchase a runabout.

As to the kind this is not altogether a simple matter of taste, as some might think; but my experience is that a two cylinder, shaft drive, gasoline machine, with about 20 horse power, three forward speeds and reverse, a short wheel base, 32 inch wheels and provisions for thorough enclosure in bad weather, is the proper article. Such a car should be bought for $1,000 to $1,400.

EXTRAS NEEDED.

As to extras, a top is the first requisite. A well fitting storm apron is preferable to a glass wind shield, as it costs less, is warmer, never interferes with the view ahead, and keeps the storm from beating in on the sides. Acetylene lamps are convenient when in order, but require care and are an added complication; good oil lamps fulfill all conditions. Running boards instead of steps and enclosed mud guards are of great help in keeping the car cleaner and freer from splashing water.

An inexpensive and satisfactory foot warmer may be made by bringing the exhaust pipe up through the footboard and leading down to the muffler on the other side. This causes no back pressure.

When the doctor has electricity in his house a storage battery is superior to dry cells, as the former can be charged over night.

THE MATTER OF COST.

About the first question usually asked is, How much does your machine cost you? The answer to this depends upon such a multitude of conditions that no satisfactory or dogmatic answer can be given. For instance, if the owner never touches his car except to run it, the cost will probably be in the neighborhood of $40 per month. On the other hand, if he cleans, oils and keeps it at home, and makes very small repairs himself, it will be about half of that. As a rule a doctor can't afford to get his hands and clothes soiled, and his time ought to be more valuable to him in other ways; so, after all, it pays him to pay somebody else to do the repair work and have it done properly. There is a great deal of pleasure in getting intimately acquainted with the mechanism of the car, and all of us ought to be able to adjust the vibrator points, the air and gasoline valves on the carburetor, tighten the brakes and do the necessary oiling; but changing tires in cold, wet weather is a dirty job and hard on the hands.

By all means keep your car at home, if this is at all possible; it can then be constantly under your own supervision, convenient to look over, and especially useful for night work. The more "joy rides" one takes the more gasoline, oil and tires are consumed, and more accidents occur, all of which add in various ways to the expense.

SOLID FRONT TIRES.

The actual necessary wear and tear on a good car is small. Most repair bills are due to accidents caused by the driver, but this, of course, does not apply to tire bills. This may be reduced somewhat by a combination of pneumatic tires on the rear wheels and solids on the front, which will be found not only advantageous but economical, for the following reasons: In the first place, the trouble of punctures with flat tires and changing of inner tubes is cut exactly in half, and you can go out in the morning to your car with much more peace of mind and far less anxiety than before, for there is just half the chance of finding that one of your tires has "laid down on you" over night. Solids are not recommended for the rear wheels because the jar and vibration comes directly from the axle to the differential, while if used in front the usual elliptic and semi-elliptic springs are interposed between the engine and axle, thus absorbing a great deal of the vibration which may be further reduced by some make of spiral spring. With solid tires in front your auto fits the car tracks perfectly, and you may travel from one end of the town to the other with only occasional turnouts. They call for a little more power and are uncomfortable over 18 or 20 miles per hour, but even at that pace you break all city speed laws.

After all has been said you see how hard it is to answer the question, How much does it cost? For what one man considers a necessity another calls a luxury and vice versa. Every doctor practicing in a town or city should own an automobile. The road in our section make it inadvisable for country physicians to invest in machines at present.

Uses Both Steam and Gasoline Cars.

By W. M. Jones, M. D.

The Doctors' Number of The Horseless Age contained an account of the troubles and pleasures my old single cylinder runabout had given me since 1902. I have had since then a steamer, put out in 1906, at a price of $850, and a 1907 double opposed cylinder car with removable tonneau, listed at $1,350.

The single cylinder machine is in the hands of a friend, doing as good work as it ever did, much better than it did during my early experience with garage men, and, properly kept up, is good for another six years at least. This tells the story of how long a car will last. On the other hand, improper handling and lack of care can ruin a good car in a less number of months.

A GOOD WORD FOR STEAM.

The steamer for summer work has been most delightful, smooth running, easy riding, quiet, easily controlled, speedy and powerful. I have never found a hill or hard place that it has not negotiated with perfect ease, and notwithstanding its apparently frail construction it has stood up beautifully, and is today, in the midst of its third season's use, as good as it ever was. Only twice have I had occasion to stop on the road to repair its machinery—once for a clogged gasoline strainer, and once for a broken oil pipe. There have been times when it has not been doing its best work, but it has always taken me where I wanted to go and brought me back. I have had it thoroughly overhauled only once, but I try to keep it in the pink of condition all the time, seeing that everything is tight and right before I start out, and replacing at once any part that seems to need it. This is the car my wife likes, and is the one I invariably take for a long or hard trip. A hundred miles in this is like walking down street.

TIME FOR FIRING UP.

Steamers in general have been so much maligned that a word in their defense is only just. They are not difficult to learn, nor complicated to manage. This is contrary to the general impression, but it is a fact. It takes me twelve minutes to get 100 pounds of steam from a cold boiler. On this I can move off and make the rest as I go, and there is no more "firing up" for the rest of the day. The boiler is tested to 1,200 pounds, cold water pressure, and as I carry only 400 to 500 pounds steam pressure it is perfectly safe on that score. It is as safe as a gasoline car so far as fire is concerned. More gasoline cars have been burned in this city than steamers. Any man who insists on filling his burner with raw gasoline or goes about with leaky gasoline pipes can get trouble along this line, and "get it quick"; but that is the man's fault, not that of the machine. It uses more gasoline than the explosion motor, but in my hands it has been less expensive than the others per mile traveled owing to a smaller repair account. Taken altogether, it is the most satisfactory machine I have owned, but I hope its maker will some day wake up and make a machine as practical for winter as this one is for summer use.

MUCH IMPROVEMENT IN GASOLINE CARS.

My last car is the double opposed gasoline, of the same make as my old single cylinder, but so different. It is larger, stronger, more powerful and less complicated. The mechanical ideas are better worked out, the machinery is more accessible and better protected, and the control is more flexible. The difference between these two machines illustrates, I imagine, the great progress made in the past few years all along the line of automobile construction. The result of these improvements should be increased reliability, longer life and less cost of maintenance, and so far, at least, my experience with this machine bears out this expectation. It has been decidedly satisfactory. It has power enough, is fast enough for business, and is always ready to go. It is driven reasonably, and is thoroughly looked over every week or ten days by the best gasoline man in town to see that everything is just right. One or two hours is sufficient to do this, and the practice makes for economy and good service.

This, in brief, is my automobile experience, covering six years, and my conclusions are: That the cars of today are a business proposition; that they don't take care of themselves; that driven at the same rate for the same distance, and given the same intelligent care, they are cheaper than a horse; that if you depart from this standard in any one of the three particulars the cost will increase accordingly; that if you depart very far from this standard in all three particulars you will get all the trouble and expense that you deserve. Under these conditions an alienist should be called in, but not for the machine.

I formerly kept three horses and no machine; now I have two machines and no horse, and that tells the story better than anything I can write.

Six Years of Service from a Reconstructed Primitive Model.

By "Medicus."

In a city 70 miles from home, the writer, in September, 1902, purchased his present machine in the second-hand market. It was a 1901 model, and therefore about one year old at the time of purchase. Equipped with a dos-à-dos seat, it possessed the interesting history of having made a tour of Maine, starting from Philadelphia and carrying four persons. The machine appealed to the writer chiefly by its simplicity of mechanism, and was preferred to all others examined on that account. To this day the owner has never seen another vehicle comparable to it for absence of unnecessary parts. In fact, its freedom from accessories was extreme, and constituted a defect.

It had artillery wheels, shod with 30x3 inch cushion tires, weighing 25 pounds each, which contributed much toward hard riding, and which punctured as easily as any pneumatics. After two years' use these were replaced by 30x3½ inch clinchers, and the dos-à-dos seat was removed. This did much to modernize and lighten the car.

SPECIFICATIONS OF CAR.

The outfit weighed 1,450 pounds, and was equipped with a large, single cylinder 5x7 inch motor of a well known marine type. The cylinder was horizontal, longitudinally disposed at the rear of the chassis, and cast integral with the crank case. A make-and-break igniter, with platino-iridium points, was located just over the valves, and very accessible. A variable lift cam, formed on the shaft directly opposite the main exhaust cam, made it possible to relieve any amount of compression desired to facilitate starting by operation of a panel lever at the left of the seat.

An enormous flywheel, weighing 175 pounds, was mounted in the middle of the chassis, and served to divide the shaft into two parts—an excellent arrangement; the transmission shaft (carrying a two speed planetary, drive sprocket, high speed drum, pump and starting sprockets) having a flange abutting against the flywheel web, and bolting thereto. The planetary bands were of hard brass. The internal expanding clutch of the high speed drum and both brakes, in drums on the rear wheels, had blocks of maple inserted into them, approximating the principle of "cork inserts." They have proved entirely satisfactory.

A DEFECTIVE PUMP DRIVE.

This circulating system did more to destroy the reputation of this car than did all its other defects. The pump was behind the transmission shaft, from which it was driven by chain, and which rotated forward. Thus, the pump was pulled by the top chain, and the bottom, running idle and sagging, never could be kept from jumping the sprockets. The writer bought dozens of chains to replace those lost, and spent many dollars contriving idlers, without avail—the chain was always off. This happening, the water pipe, bending downward from the cylinder overflow, stopped all natural circulation; steam formed rapidly and could not get out of the jacket until it backed the water therefrom. Unless a stop was promptly made overheating ensued, pre-ignition set up a terrific pounding, and something had to go. Gaskets were blown, valve stems and pistons stuck by the heat, or back torque wrecked the shaft.

Bicycle chain and sprockets are excellent transmission devices where the load is light and speed not excessive. They are cheap, easily replaced, obtainable almost everywhere, and do not transmit enough power to break anything but themselves in the event of jamming. But, in driving accessories, the under chain must do the work and the upper chain run idle, in which case gravity makes a perfect idler. In this car the simple reversal of the pump to the front of the shaft (thereby working the under chain) stopped the nuisance effectually, and in three years' use the chain has never jumped. If this simple detail had been worked out in the original models this particular car certainly would have achieved success.

REARRANGING THE COOLING SYSTEM.

An improved arrangement of the piping, also, could have prevented serious disasters, and, in view of pump stoppages being constant occurrences, this was decided on. The overflow from the cylinder was led directly upward to the water tank (permitting egress of steam) and thence around. This afforded some natural circulation, too, but was open to the objection that it deprived the radiator of its duty as a condenser. The hottest water—i. e., that from the engine—should go directly into the radiator. It makes the latter hotter and increases its efficiency. Without downward bends this is impracticable on machines designed with the underhung type. Properly, the radiator should always be the highest point in the system. When it is low hung a pump should be supplied to positively force the hot water downward through the radiator, cocks being set into several high places in the system to test the flow.

DETACHABLE VS. RIVETED CHAINS.

This vehicle had no distance rods. The rear axle was kept in alignment by three-quarter elliptic springs. A detachable chain was furnished. However good a detachable chain may be on other cars, it was a bane on this. In heavy climbing, the axle, not being fixed by struts, was drawn forward, causing a corresponding sagging of the drive chain. Especially after some wear the slack under chain would slot the pins from their grooves in the side members, and, reaching the sprockets, they would fail to replace. The chain would jump or sometimes climb the teeth and break. Four detachable chains lasted two years; two riveted chains lasted four years. The former always came off when most needed; the latter never gave any concern. Both were made by the same firm.

The first ride ever taken in this car—the home-coming trip with three passengers—was a remarkable one, for 70 miles was a long distance in those days. It was accomplished with but a single mishap—the breaking of the carburetor feed pipe at the thread, a straight one-eighth inch brass pipe, from the gasoline tank. (This was replaced by a pipe with a complete loop at its middle to take vibration from the joints, and it has never broken since.)

AN ELUSIVE "KNOCK."

The ride, however, manifested a horrible defect in the machine—a difficulty which for three succeeding years puzzled every expert, exasperated the owner, and baffled all attempts at elimination. It was in the nature of a pound, the like of which we had never heard before—a terrible clanking, similar to that produced when a bar of iron, loosely suspended, is struck by a heavy hammer. It occurred independently of the position of the spark lever, and in spite of the vigorous circulation of water through an unobstructed and unusually capacious jacket. It would pound running idle, with the garden hose playing a constant stream through the water ports; and once well under way the electric current could be switched off and the engine run indefinitely from self-ignition.

The wise ones were consulted. Preignition was undoubtedly the cause; but what caused the preignition

The engine was torn down repeatedly, the combustion chamber scraped to a polish and all projections filed away, but not one iota did it help. The highest priced lubricating oil was used, exclusively and freely; "Sunlight" gasoline (guaranteed 76°) was burned in lieu of the ordinary stuff, without avail.

Then the carburetor and long inlet pipe were blamed; the mixture, being trapped in the latter, was thought too rich and slow burning. Accordingly the carburetor was placed close to the engine head and the lengthy inlet pipe abandoned. Throttle control was more positive—the pounding also!

Then a new carburetor with automatic air valve was installed. So far as the pound was concerned it might as well have been the old one; for every conceivable adjustment was futile, except a mixture too rich to be practicable—the very thing we sought to obviate. This subdued the noise, but choked all life from the motor.

Then some one said: "Even preignition should not be noisy unless there is lost motion in the reciprocating parts." So every bearing in the engine was remade, with precise workmanship, from the best phosphor-bronze obtainable, with the result that the pound was as bad as ever.

The design of the engine was attacked, notwithstanding the success of the makers in the marine motor field. The compression space was assumed to be too small. The head was removed, filled with water from a graduated pipette, and the capacity in cubic inches determined. It was found to be exactly 0.3 of the piston displacement. The engine was haunted!

Besides the timing of the valves and sparker, which were declared correct, there was only one other thing left on the car that possibly could be blamed, so we attacked the muffler. It was of ancient design and must make great back pressure. It weighed 75 pounds for the scrap pile.

A new muffler and cut-out of the very latest design was substituted. From an exhaust pipe of ample diameter all abrupt bends were removed. The change inspired hopes.

Before the trial run, with the motor unclutched and throttled down, a specially fierce preignition caught the flywheel on centre, stopped it dead still, and if the dense wire-woven jacket under the sparker had not obligingly blown out, who can tell what havoc must have come?

The pump shaft had an automatic grease cup. From the number of fillings needed it was estimated that about 3 pounds of grease had gone somewhere into the circulating system. It was clearly pictured surrounding the entire inside surface as a greasy layer, offering tangible impediment to the mode of motion known as heat. The cylinder could not give up its heat, the radiator could not get any.

Thereupon all the water was removed and the system filled with kerosene. The engine was run as usual, circulating this medium for three days, when it was drained off and replaced by a strong solution of sodium carbonate to remove the coal oil.

All this accomplished absolutely nothing. Then, leaving broad generalities out of the problem, for there were none not excluded, as a dernier resort we got down to finess points. Nothing but catalysis could do this thing! It seemed reasonable that during the brazing on of the igniter points some platinum black, contaminating the platinum alloy, might have gotten in adventitiously and forgotten the way out.

For the twentieth time the engine was vivisected, and the entire combustion chamber this time scrutinized with miscroscopic care in the fanciful hope that some platinum black would appear. It was this painstaking effort that saved the day.

In the head of the engine a circular crack (extending around the periphery of the bore at the junction with the head) was barely made out, being almost invisible to the unaided eye. A rap with a cold chisel cleared the mystery.

COMPRESSION ADJUSTING PLATE THE CAUSE.

There was a plate in the combustion chamber. This plate was drilled in the centre, just far enough to take a few threads. Then a bolt was screwed in and a puller improvised. Out came a cast iron disc, 5 inches diameter and ⅞ inch thick. It had been fitted with mathematical accuracy and sent home with a screw press. No provision whatever had been made for cooling, and after several charges had been fired this plate became so hot that ignition thereafter was independent of the battery. Full charges were always preignited, and light ones, too, if they were quickly compressed.

Thus expired a "bug" bought in a second-hand car. Obviously the plate was inserted to increase compression. It did that. But its other attributes caused the victim to shell out painfully often and inspired "brain storms" for three years.

During all this time the rig was kept running almost daily, summer and winter. The owner became a past master in the art of jockeying to prevent that clank; but he could never quite forget its latent possibilities, and so never rested well. As for anyone else driving the car—not knowing the nursing—the police would have suppressed it. Once a heavy road held us up in front of a church during meeting hour. It almost broke up the service.

COMPRESSION SPACE TOO LARGE.

The offending plate removed, the motor was found to have been designed with a too large compression space. It figured out 58.414 cubic inches, while the piston displacement was 137.445 cubic inches. Manifestly a plate of some sort was needed.

The engine was reassembled, carburetor adjustments were made, and the new trial trip was begun. There was no involuntary pounding and no pounding could be made. The passive delight of relief from that long standing affliction was too deep for utterance. But the engine lacked life. It picked up slowly, in spite of the new carburetor, and refused to pull as a big engine should. Something was clearly wrong, and the owner by this time was desperately determined to see the thing through to his own satisfaction.

The engine was dismantled. The old head had its bore turned completely through to the water space. Then it was threaded inside, and a new thin plate screwed in, with every possible provision for free circulation around it. This disc was set to reduce the compression space to 36.33 cubic inches, almost the maximum possible even in a modern engine. It represents an ideal efficiency of 27.6 per cent. against its original ideal efficiency of 19.32 per cent. With this arrangement the motor shows really remarkable power.

VIBRATION.

Originally the car was fitted with an unhardened 10 tooth drive sprocket and a 30 tooth one on the differential. The former lasted a very short time. To run 20 miles per hour, the highest speed then attainable, required this heavy motor to be raced in a truly heartless manner; and there were few individuals fitted by nature for such strain. The vibration was simply awful. It put one's feet to sleep and destroyed the dry cells. Nose glasses refused to stay on, and clenching the teeth was almost necessary to retain their feelings. On every long ride several ounces of nuts would be lost and every tool in the kit—not a single piece—would be shaken completely asunder. Still the makers insisted that a higher gear could not be used. Perhaps it could not with their excessive compression space.

However, a 13 tooth drive sprocket was made from machinery steel and really case hardened. When it was finally put into place the vehicle could not be recognized as the same agitator. The engine would turn up under load fully as many r. p. m. with extraordinary freedom from shake.

The whole outfit was so greatly improved by this step in the right direction that another was taken. Without waiting to get money's worth of service from this sprocket a new 15 tooth one was made and installed. The result was truly delightful. This old timer, built in 1900, will now run 12 miles per hour faster than the best speed of its earliest youth, and its performance in every way is the equal of, and in many ways superior to, the best little cars of today.

HEATING UP.

Really high compression in a cylinder of large bore is fraught with one great difficulty—that of keeping the engine cool. It was a revelation to note the demand now made on the cooling system, in spite of the reduced average engine speed. On heavy roads and on hills preignition again troubled, although it never approached the horror of other days.

The writer does not believe in hot engines. His never works so well when it is too hot to comfortably bear the hand. That, too, is the common observation of vast numbers of users of marine motors. Generally with an engine in a boat, where the work is full load most of the time, when any part of the jacket stings the hand it is time to shut down and look to the sea cocks or pump. This is believed a reasonable explanation of automobiles running better at night. Cooler atmospheric conditions prevail.

Hot engines may be more efficient with respect to fuel consumption, but that is largely the result of aspirating an already expanding charge. Of course, in short stroke, high speed engines the evil influences of heat are not so apparent. When it comes to a single cylinder with long stroke developing full power at about 800 r. p. m. it is a different matter. They must be just right (and, after all, what four cylinder of any dimension shows four times their ability?).

FURTHER CIRCULATION IMPROVEMENTS.

Determined to get the utmost from this cylinder, it was absolutely necessary to prevent preignition. The 5 gallon water tank was replaced by one holding 10; the piping was made as large as possible and free from abrupt turns; the heavy six tube flanged radiator was discarded for a twenty-eight tube modern flanged type. This was coated a dull black and suspended for the most favorable influence of air draft.

The nearly worn out centrifugal pump was replaced by an all bronze gear pattern, guaranteed to deliver 40 quarts per minute at 500 r. p. m., and geared to run at this average speed.

Here a remarkable surprise developed. There was absolutely no improvement in the cooling. The water entered through a three-quarter inch pipe at the bottom of the engine head, and overflowed through the same size opening at the top. Although the water jacket extended over both valves and the length of the stroke, there were three large spots on the jacket surface becoming hot enough to ignite matches without friction. This phenomenon showed plainly that merely letting water in at the bottom of a cylinder and taking it off at the top absolutely did not assure good circulation, no matter how great the flow.

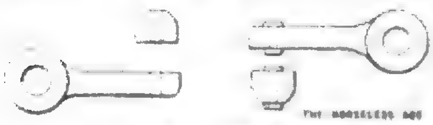
POCKETS IN ENGINE JACKET.

Like the electric current, water, under these conditions, follows the path of least resistance, and here at any rate made for a straight line between inlet and outlet and did not commingle at all. Stagnation of the water elsewhere contributed to the formation of steam. This backed the water from certain areas, causing their superheating. Deprived of its cooling agent, the lubricating oil inside the cylinder burned off in corresponding spots. Piston friction increased *pari passu*, augmented the heat, and preignition became inevitable. The waterway about the exhaust valve being somewhat to one side of the main reservoir was an obstinate offender, and it steadfastly refused to accommodate cooling water.

Following Napier practice, supplementary overflow pipes were fitted to straddle the exhaust valve and thereby encourage circulation at that point. These were connected to the main tank by flexible rubber tubing, carrying sections of glass for observation purposes.

A CIRCULATION TEST.

Crystals of potassium permanganate were slowly dropped through the tank hole, and, with the mechanism in motion, their appearance awaited at the glasses. They failed to appear, for in spite of this invitation water positively refused to circulate past this heated portion so long as it had any other escape. It was not practicable to make these straddling pipes of sufficient diameter to carry the entire flow, so recourse was had to this device: A shunt was made with the main supply pipe, and water at high velocity was forced through these straddle pipes at the top of the casting down each side of the exhaust valve. Similarly another hot spot in the jacket was supplied with a pipe conducting in at the top. Inertia carried the medium around the cylinder. Two overflows were provided. Part came out the original overflow, part came out the original inlet at the bottom. These two pipes were united by a suitable T to a delivery of larger diameter, which carried to the radiator. The cooling is perfect. Exhaustive trials demonstrated this result practical in no other way. Even carbon incrustations now show no disposition to ignite the charge.



FIGS. 1 AND 2.

As further improvements to the cooling system, flexible couplings have been substituted for all the rigid unions, and vibration leaks thereby eliminated.

A gauge screen is interposed between tank and pump to intercept foreign matter. It is readily removable for cleaning purposes. A short section of Para hose is inserted here. Being very soft it allows the hand to determine the force of circulation. (In cold weather it would be very easy to connect a coil of garden hose on the floor with the other piping for heating purposes, but this has never been done.)

The pump sprocket is secured to the shaft in such a manner that slipping can take place should the pump meet undue resistance in its gears. A simple set screw takes care of this.

By residents of the seashore the enormously destructive action of salt water or air on metal is appreciated. Bicycle spokes, piano wires, launch fittings, and even pier pilings, attest this fact too well. Witness the phenomenal deterioration of the steel board walk at Atlantic City, a comparatively new structure.

ANTI-FREEZING SOLUTIONS.

This influence of sodium chloride is possessed to even larger degree by calcium chloride, and it seems like abuse to use it in the water system. Its property of depressing the freezing point bespeaks its energy as an electrolyte, and therefore its activity as a corrosive agent. A solution of the strength generally employed when splashed, for example, over a handful of nails will rust them fast together in a few days.

In a cooling system, with its dissimilar metals, iron and brass in intimate connection, subjected to the action of an electrolytic solution, we have a large voltaic cell (with a decided E. M. F.) in constant short circuit. Impurities in the metals constitute an infinite number of smaller cells, where unceasing local action tends to pitting and ultimate destruction of the parts. This corrosion is due, not to the acid reaction (often present), as sometimes stated, but to the electrical and chemical behavior of battery fluids, of which calcium chloride is an active example.

Glycerine is free from valid objections.

FIXING CONTACT POINTS.

The ignition, being of the make and break variety with primary coil, was well designed and gave very little trouble. The platino-iridium contacts, after several years of service, showed signs of loosening, and to obviate a possible cutting of the cylinder from their probable migration the following expedient was contrived, and gave excellent satisfaction: The hammer and anvil each were drilled for one-eighth inch holes to coincide (Fig. 1). Small bars of nickel were turned by lathe to snugly fit these holes. These bars were inserted and allowed to project through on each side, far enough to rivet (Fig. 2). By careful peining the contact portions were built up as much as desired. These points are comparatively cheap, do not corrode, and are superior to platinum, in that no brazing is required, and their replacement consumes very little time.

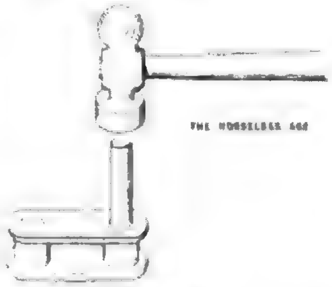


FIG. 3.

A porcelain washer, top and bottom, insulated the anvil member from the remainder of the mechanism. Vibration soon caused these to crumble. With the aid of a No. 12 gun wad punch a series of mica washers were cut of the required diameter. Through the centres of these small holes to admit the shank of the anvil were punched successfully by means of a drive chain link and its pin (Fig. 3). A sufficient number of these washers were placed side by side to make the thickness demanded, and they replaced the porcelains with lasting success.

STOPPING LEAK AROUND SHAFT.

The only other defect attributable to the igniter consisted in a leak around the hammer shaft. This member (fitting by cone and seat), from the wear incident to long use, had settled down, as illustrated in Fig. 4, causing a leak. Lather smeared over the parts with the engine in motion showed this leak surprisingly wasteful. The difficulty was effectively remedied by attaching a coiled steel spring to the top of the hammer, pulling vertically, its other end being affixed to an appropriate bracket. This scheme permits the necessary freedom of movement, it automatically takes up wear, and prevents to a certainty the loss of gas or the admission of air. Furthermore, the spring serves as a direct conductor of current to the nickel point, thus doing away with the necessity for metallic contact between the hammer and igniter, and allowing lubricant to be used between them.

Small linoleum washers made durable buffers where same were needed to lessen the noise of operation.

REDUCING BATTERY EXPENSE.

Battery expense in the beginning was appalling. This was partly due to an excessively long contact and partly to the extreme vibration ruining the cells through its dissociating influence on their component parts. High internal resistance was promptly induced. Altering the contact, so as to allow just time enough for the current to reach its full value before breaking, cut the expense in half. A box, built like an egg crate and lined throughout with one-half inch felt, accommodating six cells, prevented individual short circuiting and absorbed the vibration. The cutting into the external circuit of a length of ordinary iron picture wire (whose electrical resistance is, approximately, six times that of its equivalent in copper) did a lot more toward preventing the premature polarization of cells. To get the best results from these the external resistance should be made as high as feasible.

The use of a short circuiting ammeter was abandoned. Nothing could be more conducive to the destruction of a dry cell. Aside from the overwhelming polarization they induce, the electric endosmosis set up tends greatly to deprive the absorbent lining of its moisture.

ELECTRICAL CONNECTIONS.

Nothing has contributed more to the reliability of the electrical equipment than the use of grip spring connections (Bulldog) for all electrodes. Many a car, in the dark

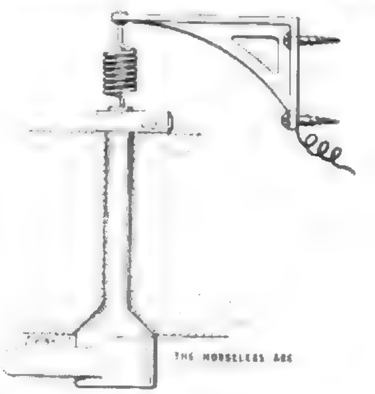


FIG. 4.

ages, had its organs removed in a roadside autopsy, when only a binding post nut had jogged off. With these grips the installation of a set of new cells or the removal of the magneto are almost a pleasure. Ground wires should invariably be soldered to the frame.

A MAGNETO FITTED.

A non-synchronous, automatic magneto dynamo was purchased for the nominal sum of $15. It is slidably mounted with a coiled spring to maintain the drive pulley against the flywheel at any desired pressure, and has a pair of electro-magnets in the base, which automatically slide the instrument away from the flywheel when the speed becomes excessive. By spinning the flywheel it is possible to start without batteries. It is one of the great advantages of the make and break that a magneto can be installed at very little cost. The instrument was mounted on the floor of the car directly in front of the heel board, and most accessible.

NOVEL FRICTION PULLEY.

The magnetic governor had this one fault—it tended to give the driving and driven wheels peripheral velocities greatly at variance, with consequent rapid disintegration of the pulley. This was furnished of leather by the makers. It was not possible to prevent oil from the machinery or water from the road splashing onto the flywheel rim, and its presence there determined a prompt stoppage of the magneto. Knurling the rim helped some, but it did not entirely suffice. In seeking a material having a high friction coefficient under these circumstances, cork naturally came first to mind. So a "cork insert" pulley was constructed as follows: Circles of the diameter of the pulley wheel were cut from the best linoleum procurable (which, as is well known, consists of cork on a burlap web, subjected to hydraulic pressure). A sufficient number of these discs were superimposed to give the requisite width of the wheel; they were punched through the centre and clamped onto a sleeve, which, by the aid of set screws, was firmly fixed to the magneto shaft. It is a revelation to note the wonderful endurance of this material and its freedom from slipping, even under adverse conditions.

REVERSING POLARITY OF ELECTRODES.

Since the perfection of its pulley the magneto never fails to fire. It gives a hot, fat spark, demanding little spark advance, and is not so destructive to the igniter points as the dry cells were because of this wrinkle: The positive point being found the chief culprit, so far as pitting and deterioration are concerned, the spring grip electrodes to the magneto posts are regularly reversed. This reverses the direction of current through the points, obviates unequal disintegration, and prevents the pre-ignition that sometimes occurs in make and break igniters at the make, the result of the acicular roughnesses on the negative point suddenly crumbling when contact is made. This extraneous metal is electro-deposited, having come from, and thereby left the pitting in, the positive nickel in much the same manner that arc light carbons are destroyed.

A set of six dry cells (2½x6), properly protected from vibrations, moisture and heat, will last a good long time when used only for starting purposes. These and the magneto connected by a two way switch with a really first class primary coil, constitute an ignition system second to none for reliability.

VALVE SPRING AND TIMING EXPERIMENTS.

The process of refinement was carried on in an effort to obtain the highest possible results. The original exhaust valve spring was removed. Weighing showed 75 pounds pressure required to compress it the lift of its cam. This spring was replaced by a livelier one just stiff enough to keep the valve well down on its seat with the engine closely throttled. An improvement in road ability was appreciable from the change.

The $1\frac{5}{8}$ inch inlet valve had the rather small lift of five-sixteenth inch. The writer could never understand why (when every precaution is taken in good designing to free the inlet pipe of all abrupt bends or other impediments to free gas flow, and an expensively large carburetor is attached) the inlet area should be restricted by the lift down to one-third or one-half the sectional area of the inlet pipe, thus choking the cylinder out of its due at its very threshold. With a high speed engine and very large valve the lift may be reduced to "the thickness of a half dollar" without objection; but increasing the lift in the writer's car to its mechanical limit of one-half inch increased the ability noticeably.

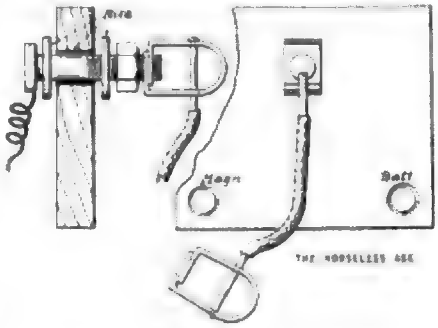


Fig. 5.

In the matter of inlet valve springs many experiments have been tried. This particular motor shows a great disparity of action dependent solely upon inlet spring tension, and other owners of atmospherics would do well to try changes. Helical springs, with as many turns as possible to postpone fatigue, seem to give best results. Curiously enough two springs made from the same material, and apparently exactly alike, even to the weight required for equal compression, vary the capacity for car speed by 5 miles per hour.

TWO MORE CAUSES OF KNOCKING.

Two mechanical knocks bothered from time to time. One was plainly due to looseness at the connecting rod ends. The other was a slapping sound proceeding from the cylinder, as the stethoscope indicated, and it came from too much play being allowed on each side of the wrist pin bushing. Slight bell mouthing had developed, and during a certain portion of the stroke the small end of the connecting rod would be slotted to one side, causing the bushing to impinge sharply against the piston boss.

The crank pin and wrist pin bushings were made from the same material that stood so well in the main bearings, but its record was different here. In spite of thorough lubrication both these bearings were taken up with infinite pains time and again; but they were forever in need of adjustment. The crank pin box was taken off, properly tunneled, and, by the aid of a mandrel, a layer of Parsons white brass, one-quarter inch thick, was made to completely face the bearing surface. It was faultlessly scraped to a perfect bearing.

The wrist pin bushing of phosphor bronze was replaced by one made from tool steel, case hardened and carefully reamed to just slide over a tool steel wrist pin, case hardened and ground. The new steel bushing was made to take up every particle of side play, each end bearing snugly against the piston bosses; and while this is contrary to standard practice, it has proved greatly superior thereto. There are no more knocks.

The matter of valve timing was investigated. The exhaust cam shaft being threaded into the hub of the gear wheel allowed ample opportunity for trying various positions, and together with varying the length of the exhaust valve stem, no difficulty was met in setting any reasonable time. This old motor had been timed to open the exhaust just before centre, and to close on dead centre.

Many experiments were made and tried out on the road. The best results ensued when the valve stem was lengthened to engage the cam 30 degrees earlier and leave 5 degrees later than the original timing. With the expansion of the exhaust stem, incident to its extra heating, this arrangement approximates an opening 35 degrees early and a closing 10 degrees late. It cannot be improved.

SWITCHES.

The writer has used several standard switches. Being necessarily exposed to the weather, all gave trouble at some period in their history by corrosion in the hinge or by the failure of their too little parts. The best switch ever used was improvised as follows: Three holes, triangularly disposed, were drilled through the toeboard at a convenient location. These holes were larger in diameter than the shanks of three brass bolts from dry cell carbons which were thrust through them. To the heads of these bolts were soldered the three electrodes of the two-way service. Mica washers insulated the heads and nuts from the toeboard. Then the nuts were screwed down and soldered to prevent loosening. The ends of the bolts projected through a quarter of an inch on the near side, and to the common electrode one end of a spring grip (Bulldog) battery connector was affixed, the other end remaining free to connect either the battery or magneto post at will. Snapping off both ends of the connector made a "safety device" equivalent to the familiar removable plug. Excepting the projecting ends, the entire fixture was coated with stove pipe enamel and is very sightly. The switch (Fig. 5) makes excellent contact and vibration serves only to improve it.

Starting was effected by a crank at the side, operating through bicycle chain and sprockets. The pulling sprocket was much smaller than the one on the transmission shaft and directly above it. The chain to this mechanism also had a knack for coming off, until the adoption of the following idler (Fig. 6): A link of drive chain of suitable size was placed to surround both sides of the starting chain. The latter reeved nicely through it. The link automatically took up all slack in the chain and caused it to cling to the sprockets. The behavior is faultless.

POINTS ON LUBRICATION.

This motor was very effectively lubricated by splash. Thin cylinder oils with very little color have given the best results. While a dark, heavy oil conduces to high compression, when the cylinder is cold starting is more difficult, and on heating it seems to get thinner than the light oils. Besides, its carbon content is undeniably larger. Outside of the cylinder the non-fluid oils and greases gave good results by staying in place and deadening noise. Special lubricants for special parts were needed. Only fibre grease, unthinned by heat, could be used for the pump shaft. Other greases rapidly emulsified with the hot water.

The planetary is kept filled with non-fluid oil to prevent undue capillarity. The owner of a similar car went to the expense of designing and fitting an entirely new clutch, deeming the original worthless, "because it would never hold." The high speed drum, being on the same shaft with the planetary, was always covered with the thin oil running from the latter. The amount of frictional surface was not adequate to this handicap and the clutch failed for no other reason.

TROUBLE FROM WASTE OIL.

The writer does not profess to know any thing about the matter of clutch design, but he cannot help feeling that to make one big enough to hold in spite of drenching lubrication is a shameful waste of metal. Putting oil onto the frictional surface of a clutch seems about as reasonable as feeding rosin to the main bearings. It is astonishing to see how firmly a very small clutch will hold when the absence of oil gives it half a chance. Personal experience has shown no oil, no slipping; no slipping, no wear.

On the other hand, in the starting gear, consisting of ratchet and pawl, the occasional advent of grease stuck the pawl out of action. Starting then was impossible without a kettle of boiling water coming to rescue the pawl. This mechanism adjoined the left outboard bearing, so it became imperative to use there only the thinnest oil in small quantity. With such the pawl never sticks.

Grease to the axle bearings should be of the fibrous quality (non-fluid), preferably mixed with graphite. Screw-down oil cups are preferred. Every automatic grease cup tried is unmechanical. They do all their work the first day. The unremitting pressure serves to squeeze out all the grease very soon, or, if the screw stop restricts this, the thin portion of the lubricant is rapidly expressed, oozes past the washer, and leaves the remainder too inspissated ever to be moved in the direction intended.

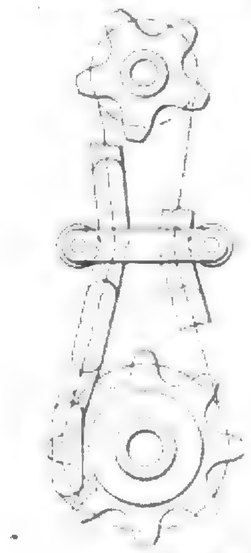

THE HORSELESS AGE

FIG. 6.

Electric furnace graphite looks attractive, but it doubles the cost of oil, and even the so called molecular form, on standing, will clog oil cups.

CARBURETOR IMPROVEMENTS.

The carburetor has been equipped with two meritorious devices. One is a butterfly valve at the air intake, operable from the starting position. It greatly facilitates starting in cold weather. The other consists of a slender rod attached to the needle valve, making the aperture of the latter regulable from the seat. It moves the needle valve handle through one-half a turn, and its careful manipulation shows in an interesting manner how defective an automatic carburetor may be. On heavy climbing power is greatly increased by feeding a very rich mixture. On the other hand, on level road, when speed has been attained, it is found possible to greatly reduce the fuel feed, and the car may gain speed thereby. However, on slowing down, this speed cannot be picked up again without first increasing the feed.

Shellac has been found superior to soap for gasoline pipe connections.

Gasoline should invariably be strained through chamois, and when a water pump of the gear type is used for the circulation all grit should be removed by straining through cheesecloth.

THE COST FACTOR.

In regard to cost of upkeep this little car compares favorably with keeping a horse. Gasoline consumption, by actual record, has averaged exactly 5 barrels of 60 gallons each per year, making a total of 1,800 gallons burned. Assuming the conservative mileage of 15 per gallon (more than 20 have repeatedly been experimentally made), the vehicle has 27,000 miles to its credit under the present ownership. This has required four sets of tires and 300 dry cells, most of the latter being used during the first four years' service before the installation of the magneto. Lubricating oil, bought in bulk, has cost $15 per year.

The car is housed and cared for on the premises without extra expense, and with this help, $1.75 per day has been the actual upkeep cost for six years. This includes repainting, reboring the cylinder, new horns, new mud guards, lamps, licenses, all the accessories and much more repair work than herein mentioned, of which the owner has done his share.

With these enumerated constructional defects eliminated before placing on the market this automobile would have found great favor. The owner has driven it enough to know. Unfortunately, many fell into the hands of persons disinclined "to labor and to wait." They quit. The makers quit also, and for three years all replacements have had to be specially made, thus augmenting expense.

IMPORTANCE OF GOOD TOOLS.

Beginners should be informed that nothing contributes more to peace of mind and flesh than a proper tool equipment. Many of the ingenious new devices are labor savers to a high degree. Occasionally it is not possible to use a standard tool to advantage. Then have one made to your own design by a first class blacksmith. Do not leave it home when you take to the wilds. Modern tire tools and socket wrench sets with universal handles are exceedingly useful possessions.

A Special Automobile for the Physician.

By Dr. Jabez Jones.

Are there not enough physicians who use automobiles in cities without hills and with well paved streets to justify a manufacturer building an automobile that will exactly fill the needs of these men? Why should these men be forced to use a machine that is made for all conditions? They do not want "hill climbers," "sand eaters," nor a 45 mile per hour machine, nor do they want a pile of junk. It is absurd for a doctor to drive a 15 or 20 horse power machine to do his work, carrying from 1,800 to 2,500 pounds of steel and wood, wearing out a great number of tires—a car expensive in every way.

THE DOCTOR'S WANTS.

The doctor wants a quiet, smooth running and at the same time a good car. It should be easy on springs, of small horse power, made of the best material with the best workmanship. It should not be a cheap car in any respect. Many firms make touring cars that are very easy riding, smooth running, quiet and of the best material that money can buy; why can they not make the same car with a 10 horse power motor and car in proportion? They will make a 50 horse power car for $4,500, and drop to $3,500 on a 30 horse power car, the lighter car having almost the same number of parts as the heavier one. Can they not build one of these cars reduced to 10 horse power for $1,500 to $1,800?

We realize that the first thing the average buyer wants to know is "What speed has the car?" and as a rule he selects the fastest one. This is absurd from a practical business standpoint. The higher the speed the more expensive to run and the sooner will it reach the junk heap. A doctor has no practical use for a car that will go over 25 miles per hour. Run this car not over 18 miles per hour, and with small repair bills and small tire bills the car will be running when ten years in use. On paved streets and in a city with easy grades 18 miles per hour will carry ninety-nine out of every hundred physicians to their calls during calling hours. I realize that the physicians who once made their calls in carriages will today make them in a 40 horse power motor car, but the great number are sooner or later going to look for a car on which they will not have to expend their income for upkeep, and a car that they will not have to replace with a new one in twenty-four months.

AN IDEAL.

The following, in my estimation, are the essentials of such a car: A 10 horse power, four cylinder, water cooled engine would give all the power and speed necessary; engine and as many moving parts as is practical should be oiled by a mechanical oiler of the best pattern; the best magneto on the market would be an advantage, with dry cells to facilitate starting; jump spark ignition; the radiator should be one of the most efficient types that is compatible with long life. The car should have a multiple disc clutch—this for several reasons: A clutch that takes hold too quickly throws great strain on everything, from the crank shaft to the rear tires; the flexible joints wear more quickly; there is danger of stripping the gears in the differential, and by spinning the rear tires on the pavement they are soon cut out. A doctor has to use his clutch probably more than anyone else. That so light a car should be shaft driven will not be questioned. Because of the many changes of speeds necessarily due to making many stops, theoretically a planetary transmission would be best, but practically a sliding gear with a direct drive on high is perfectly satisfactory. Three by 30 inch wheels should be large enough. The wheel base and springs should be such as to make the car very easy riding. If it cannot be made comfortable with semi-elliptic springs, double ones should be used. Some shaft driven cars have double elliptic springs, are easy riding and run successfully. A doctor does not want to be jolted in a wagon all day. The steering mechanism is very important for the physician. The most convenient would be a vertical steering column in the centre of the car just forward of the seat, with a right angle steering handle that could be thrown to either side. The change speed, throttle and spark levers could be placed near the top of steering column, all to be operated by the left hand, while the right hand would be used only for steering. The brakes and clutch could be operated by pedals; supposing that the doctor drives his car, as many do, he would want no side levers to crawl over or steering wheel to crawl under.

The car should be made as light as would be consistent with durability. Body and frame should be made of materials of the greatest strength. I do not see why such a car should weigh over 1,200 pounds. Begin with a light motor and build everything in proportion. Such a car would not only be used by the physician, but by many business men. Cars are built for the race track, for the man in the country, for the tourist and all kinds of pleasure seekers. Why is not one built for the doctor who does his work on paved streets?

Favors the Air Cooled, Shaft Driven Car.

By W. C. Deming, M. D.

I began my automobile life in 1900 with a steamer. This gave me a lot of trouble and experience, with a great deal of pleasure. My next venture was a French motorcycle, with which I thought to solve all my transportation problems, but before long I abandoned it as dirty, unsafe in wet weather and heart breaking to start in cold weather.

This gave me experience with the gasoline motor, however, and I then studied the situation pretty carefully, read books, examined many makes of machines, got others' experiences, and finally decided that my needs would be filled best by a four cylinder, shaft driven car with air cooled motor and removable tonneau.

One who has driven a four cylinder car will not willingly go back to a one or two cylinder car, I think. The latter do good work and are cheaper than four cylinder cars of the same grade, but, other things being equal, a four cylinder car is intrinsically superior. Long experience with chain and shaft driven bicycles has convinced me that the shaft drive is far superior to the chain. The shaft drive needs little or no care, while the chain is noisy and a source of endless trouble. This outweighs the slightly superior mechanical efficiency of the chain when at its best, which is usually but a small part of the time. The proportion of shaft driven cars to chain driven is increasing.

Air cooling must be efficient or the makers of cars with such motors could not continue in business and prosper. These motors are more economical of gasoline and not less so of oil. Road tests have shown this. They are not "oil cooled," as alleged by agents for water cooled cars. Then why pay for radiator, pump, pipes and water jackets, carry the weight of these and of the water, and have the trouble of non-freezing solutions in winter or suffer the penalty of frost wrecked parts? There are no disadvantages in air cooled cars that I know of as compared with water cooled motors.

I am inclined to think that the auxiliary exhaust is an important part of an air cooled motor. An adjustable tonneau is very desirable, for the runabout should be capable of quick conversion to a pleasure vehicle capable of holding the family. My tonneau is easily put in place with five winged nuts or a "fishback," made by a carpenter at a cost of $10, can be substituted and kept in place securely by a single nut. In this form a top from an old steamer was adapted and is removable.

My car is a 1906 model, and has been kept in constant service since it was delivered. Intelligent care has been given it. Since April of this year I have made over 2,000 miles in pleasure trips alone, besides using it in daily professional work. I have never abandoned my machine nor been towed home, except once, when stuck in the mud and unable to get out for want of tire chains.

I am a strong advocate of the four cylinder, shaft driven car with air cooled motor.

Ten Years in a Runabout.

By A. D. Hard, M.D.

What we now have, and what we really need in the way of a motor vehicle to use in our business, is a topic of great interest to 75,000 country doctors in the United States. I truly believe that our experiences of the past ten years qualify us to be better judges of what constitutes a practical utility motor vehicle than the usual mechanical engineer with his imaginative fertility.

My experience began with the fifty-second steam "Mobile" sent out by the Mobile Company of America, from Tarrytown, N. Y. It was used on the prairie roads of South Dakota, and was the first automobile ever used west of the Mississippi River by a doctor in his country practice.

In the ten years since then I have used seven different motor vehicles of various kinds, and have given much time and study to the question of what is best for the doctor from a practical point of view. A previous training as a mechanical engineer in a large factory in Chicago gave me some advantage over the usual user of an automobile in a mechanical way.

I am quite sure that the practical doctor's automobile has not yet been built. The reason for its non-appearance so far is not due to lack of ability to make it, but to the fact that the makers of motor vehicles try to follow the indication of largest present demand and most profit.

Heretofore if a practical doctor's car had been put on the market it would not have been properly appreciated as such, and the more freakish and gaudy though less practical car would have been unwittingly selected. The time is fast approaching, however, when the inadequate nature of the common types of automobiles will be common knowledge, and the demand for a utility machine which will take a doctor with unfailing regularity over absolutely all kinds of roads over which horses are expected to travel, in a comfortable manner in any weather, and with at least twice the speed of the horse, must be furnished to the doctor who is ready to put up the cash.

Tire troubles on the way, uncertain action of the motor, inability to negotiate the ordinary mud holes which a horse can easily pass, and that lack of dependability which so often makes prospects of a pleasant trip vanish into prospects of almost certain trouble, *must* be provided against.

If the requirements are clearly defined the mechanical engineer can easily design the machine to do the work.

The high wheel type of motor vehicle offers several very valuable features in securing the service required by a doctor. A clearance of at least 15 inches in the centre of the road is needed where deep ruts, projecting stones and sod ridges are as common as they are on the prairie roads of the West.

Solid rubber tires, in connection with long, soft springs and the best spring cushions, render pneumatic tires with their lack of dependability unnecessary. Air cooled motors properly fanned avoid all radiator and congealing troubles, and render the machine simple and lighter. Four cylinders of small diameter and stroke give the best results. Lubrication should be mechanical force feed. Gravity feed and air pressure from the crank case are unreliable means of distributing oil.

Ignition should be by magneto, with dry cells in reserve (if possible). Transmission of power should be by planetary system, through multiple disc clutch. Shaft drive to jack shaft, and substantial roller chains to rear wheels. A light folding top with storm front and sides is necessary. Good gas headlights are essential, but kerosene lamps must not be omitted for reserve in case the gas fails. Lever steer, with springs to restore direction to straight ahead, is better than wheel steer for speed of 15 to 18 miles per hour.

Such a machine should be made of good reliable material, in machine shop finish, with no appearance of crudeness which will suggest a cross-roads blacksmith shop, should sell for $750, and should weigh not to exceed 1,200 pounds all in.

Physicians are very skeptical about the dependability of a motor vehicle, and no matter how reliable an automobile may be no fancy catalogue or "patent medicine testimonial" will do much to give them the confidence required to induce a sale. They must be "shown." The best way to sell to a physician is to take him out in the country to see a patient in the car. If he does not order as soon as he gets back do not think the trip was made in vain; he will surely develop a severe attack of auto fever soon.

Almost any old car is now advertised by the manufacturer as a "Doctor's Car"; but very few physicians are taken in by such unsupported statements. "Nothing to watch but the road" and "the car of steady service," and such catchy expressions should not be thrust at physicians. A pretty little spin around selected streets with extraordinary favorable conditions may trap a few thoughtless doctors into buying, but these kind of sales are usually followed by dissatisfaction, which deters others from buying. A trial on unselected roads, in the doctor's own neighborhood and under the usual conditions of his work, will do more to convince him and keep him convinced than any other kind of sale promotion.

In a New Jersey Suburban Town.

By H. W. F.

Runabouts may be divided into business and pleasure rigs. Being a physician, and having discarded horses several years ago, my opinion on the business proposition may be worth something to the readers of this issue who are undecided as yet as to what is the best means of locomotion for a doctor. I live in a suburban community, where the roads, although somewhat hilly, are almost all good macadam. So, what I have to say from my experience should be taken by readers whose roads are poor with some allowance for road conditions. Although I would say that if I lived in a community of dirt roads, with their spring mud, and all the year round unreliability, I would have a light runabout for use much of the time.

COOLING.

I have tried air cooled and water cooled engines, and for business purposes think the water cooled engines are not to be compared with properly air cooled ones. I have tried one, two, three and four cylinders, and think that the two cylinder is about the proper number for everyday use. Haven't as yet tried the two cycle engine, but hope to see the time very soon when they will have the flexibility and reliability that the four cycle engines have. They are so much simpler on account of their fewer moving parts. If water cooling is used in business rigs, use the thermo-siphon system of circulation when possible, to avoid trouble from the water pump, which was one of the earliest and most persistent engine troubles to develop in my experience.

As for weight of vehicle, the lighter the better, consistent with strength. We must get away from the idea that because we are using something more up to date, as we think, than horses, we must split the wind all the time. A consistent 15 or 20 mile gait is all we should undertake, and that can be made on solid tires, thus eliminating all the endless nuisance of tire trouble on the road. I hear from my friends tales about no "tire trouble" for six months, etc. I never had any such luck, and think the fates must be with these particular men. Going out at 2 a. m. with your machine on an emergency call a couple of miles away, and finding a flat tire a few times, makes you swear to never depend on them for business again. I don't believe in putting solid tires on a rig that was built for pneumatic tires and using it hard; but I see no reason why it can't be used carefully with them, especially by adding some of the auxiliary spring devices that are helping so many auto users these days. For a doctor the starting crank should be attached in such a way that it doesn't have to be placed in position for cranking every time it is used. Much time is lost in hunting up a crank and appliying it and returning it to its bracket, once for every stop in a doctor's day's work.

EQUIPMENT.

A rig for business should be equipped for all kinds of weather. Doctors and others who use automobiles can't select nice sunny days, as the average family can, to use their machines. For slippery roads a good big tight top—tight on top, in sides and back—from which the side curtains and back one can be removed when the weather permits, is important. A good glass folding wind shield is most important. I use a heavily lined rubber lap robe always in place, but so fixed that it can be folded out of the way without being detected. Two oil lamps and a tail lamp are required by law at night, but I have a good 8 inch searchlight to drive by, one that can be easily adjusted from the driver's seat, and find it very convenient. One can throw it on the front of houses, and even pick up the numbers on the doors. This, too, is an important part of the business equipment.

DRIVES A HIGH WHEELER.

I have settled down to a high wheeled, cable driven, air cooled, 10 horse power buggy for strictly business purposes, for these reasons: It is light, air cooled, very simple. I find it very reliable and about $25 per month makes it do all that two or three horses did for me formerly. The tires are solid. It is as efficient with the thermometer at zero as at 90 degrees, and can also be used in deep snow. I find after sixteen months' experience with one that it is all I want. No piece of machinery can be kept going year after year without care and replacing of worn parts. Constant attention to oiling of every bearing is most important. Much unjust condemning of automobiles has been meted out to them because of insufficient oil. Oil is cheaper than machinery, and I use more of it than is called for in the books of instruction. Have found an occasional dirty plug. It doesn't take long to clean it. Nuts and bolts and bearings should be watched carefully. They get loose before they give trouble, and a turn with a wrench at the right time saves much road trouble and adds life and efficiency.

TRAINING A COACHMAN.

The average coachman can be taught very readily to take complete care of a doctor's runabout, and as he usually considers it a step higher in the social scale than caring for horses, he usually takes much pride in these new and more modern duties. In any suburban town and the neighboring communities it is very interesting to notice from year to year, and even from month to month, how fast the horse is being replaced on the road by self propelled vehicles. Go off on Sunday or a holiday, run through the country and notice how few people there are driving horses for pleasure and how many well loaded autos are bowling along among hills and valleys. Mechanical troubles give little worry, and if they do come a garage is usually within easy reach, and a large proportion of the country towns are equipped with a telephone for calling them.

OTHER POWERS.

I have said nothing about steam or electricity to run business motors with. It seems to me that the present limited radius of the electric vehicle and the necessary weight in the storage batteries make the balance much in favor of the gasoline outfit. Steam is very nice for continual using, but much of the time of the doctor's car is spent in front of his office and his patients' houses. In order to be ready for a quick start he must have gasoline. The steam engine requires much more care, he has to wait to get up steam when he is in a hurry, in the night the water will freeze in a cold garage, and altogether troubles of a steam engine are more than those of a simple air cooled gasoline engine.

EXTENSIVE USE AMONG PHYSICIANS.

It is interesting to notice in front of a number of suburban hospitals with which I am familiar, at the usual visiting hours for the visiting staff, how large the proportion of automobiles is to horse drawn vehicles. A few days ago I counted in front of our own local hospital five two cylinder, water cooled runabouts, three four cylinder, three air and one water cooled; then two cylinder, air cooled buggies, two one cylinder, water cooled rigs. There were also two horse and buggy rigs. Three years ago the number of horse drawn and self propelled vehicles would have been just about reversed. What will it be in three years more, not only here but all over the country?

The average cost of upkeep of a pneumatic tired, heavy rig has been about $1,000 a year; of the light, solid tired rig about—counting money invested, insurance, etc.—$350.

Experiences on Alabama Roads with Different Types of Cars.

By Dr. F. G. Du Bose.

As a business proposition for a doctor the automobile is "the thing," and marks a real advance in his moving career, especially if he is a hustler and has to keep busy and "on the go" to hold on to all that comes his way. Two things happened that made me buy a machine. First, a colleague beat me so far in two calls to emergency cases that in one instance I met him as he was leaving the house, and in the other as he was bringing a member of the family back to his office with him. He had actually in both instances done all that was required, and was leaving the house as I was driving up with my $300 three-minute steppers. Second, one of these steppers, while standing hitched in front of my residence, decided to set a pace to his own liking, and tore down an iron fence, broke a new buggy all to smash, and skinned himself up to boot. The total cost of all of his fun to me was over $50 in repairs and $150 depreciation in his own value. I sat down and calmly figured the cost of the team, driver and running expenses, excepting, of course, such accidents as above (and they have come yearly or oftener during the past fifteen years). My normal running expense for the team was $75 a month, including driver, but not including the runaways.

I purchased a four cylinder, 20 to 24 horse power, double rumble seat car, list price complete $3,000. It has served me for over a year for both business and pleasure, has been run over 8,000 miles in twelve months, and during that time the total cost was $600. This includes all running expenses and extra tires, searchlight and shock absorbers; also gasoline, oil, carbide, cleaning, overhauling and everything. The car is in better running order and actually gives more satisfactory service now than it ever did, and I feel sure that it will last four more years with the same service and less expensive care. As compared with a horse and buggy I am $300 "to the good" annually, which goes a long way to balancing the difference between the first cost of the machine and a pair of horses and two buggies. Added to this is the pleasure of outings in the country that would never have been taken with a team. This recreation has meant so much to me from the standpoint of better health and a happier existence that I would hesitate to compute its comparative value. Instead of coming in from the day's work worn out, so tired that rest in bed alone gave comfort and the necessary recuperation, there is now an exhilaration and an inclination for a 10 to 20 mile spin in the country in the bracing night air with wife and friends. The much dreaded call some miles distant ceases to be an onerous professional duty and becomes a delightful ride. The machine thus makes a pleasure of one's otherwise irksome tasks, not to mention a fee made in one-half the time. When troubled over serious cases, and worn out with the monotonous routine of daily work, when forgetfulness for a short space of time of the responsibilities burdening us becomes necessary, then it is that to go to the garage, look over the machine, clean the spark plugs, test the batteries, oil the bearings, blow out the cylinders, start the engine to running and hear how smoothly and synchronously she runs, to one with any sort of mechanical turn is true recreation, giving the desired lapse of memory and banishment of troubled thoughts.

That road and street conditions being ideal here and responsible for such enthusiasm is far from an approach to the truth. There are hereabouts no macadamized roads, no asphalt streets; there are much sand, some mud and a few hills. However, in spite of poor roads, "whether on business or pleasure bent," I have always reached my destination. It is hardly just to enumerate all the facilities and felicities of this mode of locomotion without reference to the disadvantages encountered. In wet and rainy weather, after a few days of motoring in the mud and slush, the car began to run heavily, the engine labored under the strain, so that a day off in the garage was required for cleaning up the entire car, making adjustments here and there, before it would again run smoothly. Tire punctures are more frequent when the ground is wet and muddy. A week's run under these conditions made one feel that it was an expensive luxury to so run and abuse such an expensive machine, and that perhaps it would so shorten its period of usefulness that it would in the end fail as a profitable business investment. I therefore bought a very low priced, high wheel auto buggy. This for the mud was at first simply ideal. It would scoot through the slush over road and street, running better in a downpour than in dry weather, the muddier the better, and for such work there was no comparison between it and the regular type of automobiles, though of less than half as high horse power. Alas! it would not stand the wear. A few months and it was "to the bad." The chains would stretch and slip off the sprockets, then the teeth in the sprockets began to break off, and the end of that car was the shed. This, as other promising ideals, became a disappointment. It was cheap, cast iron sprockets and block chains, and other less troublesome deficiencies in order to meet the requirements of low price. Therein was the reason it did not make good, and how could it for less than $400? I continue to believe, in spite of this experience, that the ideal and practical automobile for a doctor's use, purely as a business proposition and as a substitute for the horse and buggy, on the same basis of economy in the first cost, is the buggy type of automobile. An engine of not less than 16 horse power, with a pump driven oiler, planetary transmission, double chain drive, having heavy steel sprockets and roller chains of large size and great strength, so geared that the maximum speed of the car will not exceed 20 miles an hour (for this is as fast as it is ever safe to ride in so light a car with high wheels); spark and throttle on the steering wheel, stout running gear of reinforced wood, roller bearing between hub and spindle, wheels not under 36 nor over 40 inches in diameter, with 2 inch solid rubber tires; treads to suit the ruts in the local roads, standard for the North and 62 inches for the South; a wheel base not less than 76 inches, a Corning body or to one's taste, top curtains and storm front, with one or more good acetylene lamps—this represents to me the ideal car from a business standpoint. Such a car I have seen and ordered, and if it is made of the best materials obtainable, as claimed, it will absolutely fill the bill for $750. It will win out in every competitive point over the horse and buggy.

Whatever type one decides upon as best for the purpose, I would advise, as a result of comparing experiences with friends who own low priced regular automobiles, and also from personal possession of a low priced high wheeler, that every prospective buyer consider only the higher priced machines—not necessarily the highest priced, but certainly cars of standard make. It will be cheaper in the end. Certainly one could not expect at the present time much service out of a runabout of the regular type which cost less than $1,000, nor out of a tourer costing much less than double that amount.

Uses Closed Car in Winter.

By J. P. Hetherington, M.D.

I have depended entirely on the automobile in my practice since July 7, 1903. I sold my horse at that time and have used one but very little since. I have often made the statement, and still stick to it, that I would not accept as a present the finest horse in this State if I had to drive it.

My first car was a little curved dash runabout, which is still in commission, although I do not own it. I became so attached to the engine that I now have one of the same type running my motor boat, where it is just as satisfactory and reliable as in the machine

An automobile is entirely practical for any physician who has the slightest mechanical ability. He should become fairly well acquainted with the machine and its parts, the necessity of proper lubrication and of the absolute necessity of keeping his hands off the carburetor and timer until he actually knows what he is doing. I do not remember changing the adjustment of my carburetor in three or four months, and I have not touched the timer since I bought the machine. I never make any adjustment without being sure it is necessary. When in trouble, if adjustment is attempted without locating the trouble, the new adjustment may mash the original trouble and cause an unnecessary call for help.

SOME NOVICES' TROUBLES.

One night I met one of our neighboring physicians out in the country in a peck of trouble. His new machine had stopped. Without proper examination he decided it was the timer, which he attempted adjusting. When I happened to meet him he had tools scattered all over the ground. I examined his batteries, which were all right. I next looked at his gasoline tank, which was empty. I could loan him gasoline, but I knew nothing about his timer. His machine was heavier than mine, and while I will tow a proper load I never strain my machine pulling a heavier one, so I woke up a farmer, who towed him home. It is a pleasure to do all I can to help anyone out of trouble, but while I will lift and strain myself I won't strain my machine uselessly. Luckily I have never been towed in from the country myself, but when my turn finally does come I do not expect to allow another to injure his machine towing me if it can be helped.

One of our physicians bought a new machine. He took me out to show how nicely it ran. I noticed a click that sounded like a piston sticking in a dry cylinder. I asked him if his lubricator had oil or was working. He did not know whether he had a lubricator. He soon came to grief, and learned not only that he had one but its location and use as well. Another neighboring physician lost his radiator and ran a mile and a half without it. I guess he thought his machine looked funny without a front end gate. Each of these profited by experience and are now enthusiastic autoists.

Car Equipped for Winter Use.

TWO VS. FOUR CYLINDERS.

I am now running a light car with a double opposed cylinder engine under the bonnet. A four cylinder pulls steadier, but I like the simplicity of as few cylinders as will pull well. During the winter the most troublesome time, two cylinders are less to watch than four, and under the bonnet they are more accessible than under the body. I have had experience with both.

In a light car I prefer planetary transmission myself, and think I like the shaft drive better than the chain. In cold weather I think the cooling oil ideal, if one has a good pump. My present machine has no pump, so I used alcohol and water last winter, though I never felt absolutely safe, as with the oil.

I always have a gauge in my gasoline tank. It costs a little, but wears as long as the machine and tells instantly how much gasoline I have. It is especially useful at night should a leak occur and stop the engine, which happened one bitter cold night. In such cases the gauge locates the trouble instantly and safely.

A gas tank originally costs more than a generator, but it never freezes and is always ready for duty on cold, dark, frozen nights when most needed. An extra valve that regulates the light automatically saves double its cost in one winter month.

Many runabouts use crank case or exhaust pressure to operate their lubricators. These work well in summer, but I have gone through my last winter without a pump that will actually force the oil to the cylinders.

CLOSED TOP IDEAL.

The closed top caps the climax. A good one is expensive to buy, but to step in it out of the winter weather, close the door and ride ten miles against a biting wind in perfect comfort is ideal. I did not need a lap robe during last winter. While the windows open it is too warm and close for summer.

Some of my friends have different makes of high wheeled, solid tire machines. They seem to get good service out of their machines, though a comparison of tire expense show they wear out many more solid tires than I do pneumatic. The solid tires chip so badly. Then their machinery is subjected to a more destructive vibration, which makes me doubt if there is any great economical difference in favor of the high wheels and solid tires.

No difference which type of machine is purchased, a careless driver can ruin it in a short time, while a careful driver will get good satisfaction out of any good machine. Of course the machine having all the good points everyone wishes will never be put on the market—too many would buy it.

On Iowa Prairie Roads.

By Dr. A. A. Griffis.

I have been using in my practice for about fourteen months a car with a 24 horse power, double opposed motor and a detachable tonneau. As a touring or pleasure car it seats five people. When using it as a runabout I remove the tonneau and replace with a torpedo deck, the deck making a good place to carry various articles. I also have a top, side curtain and a storm front for the front seat, making a closed rig for use in bad weather and adding much to the comfort of riding.

As a touring car it will carry five people over our country roads, which are quite good, and I very seldom need to use the slow gear on hills. As a runabout it makes a good, strong car that can go anywhere. It takes about ten to fifteen minutes to make the change. This car will run from 5 to 40 miles per hour on high gear, but for the good of the car it should not be run over 20 to 25 miles per hour over our country roads.

I care for my own machine, going over it frequently to see that everything is in good order, and if any small parts become worn so that they are likely to give out, I replace them with new ones, and thus save any delay while on a trip. When I start out on a trip I do so with the utmost confidence of making the trip without any delay. I ran my machine last winter up to January 15, then laid it up until March 15. It cost me more for livery hire for these two months than for running the auto the other eight months from January to August, including repairs, oil and gasoline, and I made several long pleasure trips with the auto as well as doing professional work with it. It costs about 1 cent per mile for gasoline and a half a cent per mile for oil. I use a 6 volt 60 ampere hour storage battery for ignition and carry five dry cells for emergency, but have never had to resort to the dry cells since I had the storage battery. The battery should be recharged about once in two months, which I do in my office through my lights, which are supplied from a 110 volt direct current circuit. I use Woodworth's detachable treads, which save me a good deal of time and trouble. I have never had a puncture during the fourteen months. It takes a little more power with the treads on when the roads are very dusty or sandy, but I prefer to buy a little more gasoline to having as much trouble as some people have. My car has run between 4,000 and 5,000 miles, and it runs as well today as it ever did.

In conclusion, to have a car stand up and do good service at reasonable expense, do not run at a speed equal to more than one-half of its capacity. Keep all parts well oiled and everything tight and in good order, and do not wait for your car to fall to pieces before you do anything with it. I am a great admirer of a good horse, but a greater admirer of a good auto, and my combination car has given me excellent service, both as a runabout and a pleasure car.

In a North Dakota Practice.

By H. M. Wheeler.

I am entering upon my third year in the use of a single cylinder runabout, rated at 10 horse power. My satisfaction has been great and my tribulations have been few. My practice is not a country one in the ordinary acceptance of the term, there being days and even weeks at a time when I am not called upon to make the ordinary country call in the country immediately adjacent to the city. Still, in the time covered I have had in the aggregate quite a number of such calls, and except in deep snow or on the very muddiest roads I do not resort to horses. I have made many consultations in surrounding towns within a radius of 40 miles in the runabout, always getting there and returning in satisfactory time. I have never been towed a foot by hay motor or other power. During the past winter I used my car every day except four. The garage I then used was an old barn, without artificial heat, but with the wood alcohol, glycerine and water mixture used for engine cooling no trouble was experienced. My gasoline averages in cost $5 per month. I have had to replace all tires (pneumatic) once. My other expenses I have not kept accurate track of, but they have been very moderate. During the past winter I had chains upon all four wheels. My intake pipe projects upward so that a few inches of it is free. I made a wire frame to slip over this, covering it with surgeon's lint, making it resemble a chloroform inhaler. I carry a half pint squirt can of gasoline, and in cold weather saturate this inhaler, which procedure is sufficient for a ready start, except at very low temperature, below 15 degrees. When the temperature is lower than that I squirt gasoline into the cylinder through a pet cock tapped into the cylinder head, often taking the can into the kitchen and allowing hot water to run over it for a few minutes to raise the temperature and cause it to vaporize more readily. I do not find it difficult to locate whatever troubles arise, and when I go to the repair shop generally have the diagnosis made. My car, except for the effects of mud and rain upon the paint, is seemingly as good as ever. In short, I would not willingly return to a horse, and would not be without an auto for many times its cost.

In a Rural Practice.

By Blank, M.D.

I have used an automobile in the practice of medicine since May, 1904. At that time I had five horses and did a great deal of driving. Difficulty in securing reliable hostlers was the reason I looked for other means of transportation than the horse. At that time it cost me about $1,000 per year to maintain my barn. I live in a city of about 15,000 inhabitants, surrounded by a good farming country. In the city our main streets are paved, and in the country nearly all the main roads are graveled. On the west there is quite a little sand with stones in the road; on the south and east there are still many miles of dirt road, which is good in dry weather, but hard to travel after a heavy rain or after the spring thaws. There are numerous villages in a radius of 10 or 12 miles, all of which look to our city physicians a great deal. I have given up nearly all my country work for the reason that it takes too much time, and my time is taken up in hospital and office work.

During the past year I kept a careful account of expenses. Before that time, my sons being at home, much of the work of repair and care was done by them. The past year everything was hired. The car is kept at my own barn, where a warm room is provided, but the repairing and washing are done at a garage near my office. It is my custom to leave it there while at office when needing washing or some little adjusting. Many times, however, when the streets are dry it will not be in the garage for a whole week. In this way my entire expenses for new tires, new parts, all care and an estimated depreciation of car were $30 per month. In my opinion this would be very much more if a very large proportion of my work were country practice, for it is necessary to travel on an average five times the distance in country practice as in city practice—that is, in cities of the size of this one.

A very busy day will not require more than 20 or 25 miles, while a very busy day in country work would require from 80 to 100 miles of travel; I mean, to earn an equal sum of money. With this experience with the automobile I am strongly of the opinion that this is the best means of transportation. The time saved will more than pay for the expense. It is not fair to compare an automobile with one horse. In my case it does the work of at least three horses. The board of one horse here is $18 per month. This with the shoeing and repairs will bring it up to $25 per month.

During the past five years my books will show an increased amount of work over the former five years. The number of evenings at home with my family have been more than doubled.

As a means of giving the physician time for study and time to enjoy life the automobile is a success. A great deal remains to be done. A light car must be produced with not less than 20 horse power, simple in construction and with greater reliability. Pneumatic tires have not given me much trouble. I use heavy tires on a light machine, and do not keep a tire in use until it explodes, but have it repaired or put on a new one. I have a reliable oiling system and do not neglect small things. Above all things do not use a big car in practice. This runs your expense account up. Noise and vibration are rapidly becoming less, and will in time be almost entirely eliminated. A nice, trim little car, which runs like a sewing machine or hums like a swarm of bees, with 20 to 28 horse power, will give the doctor a happy look and inspire his confidence, make him live longer and enjoy life, making him a more useful man in his community. These conditions, I believe, are common in a great many cities of the same size in the Middle West, so my experience ought to be true of a great many others. Soon after purchasing an automobile in 1904 I began to reduce the number of my horses, until two years ago I sold the last one and since have depended entirely on my runabout. I have had two cars in that time. My present machine, a two cylinder, 12 horse power runabout, after two years of service and a mileage (by speedometer) of 10,000, is in good condition. A recent overhauling and the replacing of worn parts seemingly make it good for another 10,000 miles. My first car was also a two cylinder, 10 horse power, with seats for two or four. I ran this car 15,000 miles, but the car, being much heavier and not so simple in construction, was not so satisfactory and much more expensive. It will be seen by the above that my mileage is about 5,000 per year.

Six Years' Driving in Eastern Massachusetts.

By J. H.

I have used an automobile runabout in my practice during the last six years. During this time I have owned and personally operated four cars—three gasoline and one electric. The electric vehicle is delightfully slick and handy for short trips, but is too limited in its scope for the average physician in general practice except as an auxiliary to the horse or gasoline car unless equipped with a duplicate battery. Moreover, it is, in my experience, more trouble to keep in proper condition than the well constructed gasoline car.

My first gasoline car was a single cylinder rig, and a miserable failure. My second also had but one cylinder and was a splendid and efficient little car, except for one fault, which the makers have since eliminated. My third and present car has a two cylinder opposed 16 horse power engine under the body with chain drive; it weighs about 1,700 pounds, and cost $1,250 in the spring of 1905. It has a detachable tonneau, and so can be used as a family rig or as a runabout at will. My experience with this outfit has been so satisfactory that I have eliminated the horse altogether, except for a brief period in winter when there chances to be deep snow, which is rare in this section, eastern Massachusetts. There were not more than eight or ten days last winter that the auto could not be readily used. Denatured alcohol and water, in equal parts, is, in my experience, a more satisfactory non-freezing mixture than calcium chloride if the proportions are maintained.

AN ALL-ROUND SUCCESS.

This auto has covered over 9,000 miles, has never been "hung up" on the road, has always come home under its own power, and runs, as far as I can see, as well today as on the day it was purchased. I have never "ground" a valve, and as a matter of fact have seen but one of them which gave some trouble by the head working loose on its stem. That valve was not carbonized in the least. Breakage has been practically nil. My expense for breakage and renewal of worn parts (not counting tires) has not exceeded $50, and that includes two new chains. It is true I have made some changes and improvements that cost something, but they were not necessary to the successful operation of the car. I attribute some of my "good luck" to the fact that I have always personally operated and cared for the car, and therefore know that it has been properly oiled and carefully used. Working over it in spare moments has proven a pleasure and good recreation. I am interested in it and its good behavior, and consequently try to be quick to diagnose and correct "errors."

CONCAVE SOLID TIRES SATISFACTORY.

The tire question is a problem by itself. I found the use of pneumatics involved greater expense than I could afford, and more language than my conscience approved, so in the spring of 1907 I installed a set of cushion tires with concave sides, threw away my pumps and tools, and have gone merrily on without a thought or care about tires, without a penny's expense, and found I got along with a noticeably abridged vocabulary. This change was made under the protest of friends and dealers that my car would quickly be shaken to pieces. In refutation I can truthfully say that it never ran better or more quietly than it does at present. It is true that I have to look a little more carefully after loose nuts, bolts, etc., and it is also true that I find it expedient to drive more slowly over rough paving and other inequalities of road surface; but on hard, smooth roads one does not appreciate any difference at a pace under 20 or 25 miles per hour. The tire question is a more vital one to the physician than to any other class of auto users, for he must be able to depend on "getting there" when duty calls. One certainly cannot rely on a pneumatic tire. I have given considerable thought and study to this question, and with my past year's experience as a confirmation have reached the firm conviction that, given a well constructed machine with large wheels, soft springs, a gear to 25 or 30 miles maximum, and a willingness on the part of the driver to run slowly over rough places, the cushion tire of proper construction solves the tire problem for the physician. But if he has the speed mania he had better stick to his pneumatics and—punctures.

Sells Cars After Six Months' Use.

By Sidney V. West, M. D.

The most economical purchases I have ever made in my life have been automobiles. I feel that I should be perfectly able to express myself on this subject as I have gotten the good out of ten machines. I don't mean that I have worn them out, but that after constant use in all kinds of weather and over some very bad country roads for about six months I have sold each of them at from about $100 to $150 less than what I paid for them.

When I come to figure the amount of extra work I can do, the time and energy saved, and more than all, how much more rest I have been able to enjoy by having a machine, I consider that $100 or $150 for six months' service is cheap—more than cheap.

Many may wonder why I advise and practice keeping a machine only six months. During the first six months a machine should never be inside of a garage for repair work even if the owner has only a slight mechanical knowledge and the car receives only reasonable care. After that time a number of parts will need to be replaced. It will then begin to mean $50 here and $25 there, and the amount you would lose by selling will soon be lost in expense, and what have you then—nothing but an old machine. I, therefore, at the end of six months either sell a machine or trade it in and get a new one, letting some one with less experience and more time take car No. 1. During the first six months' time I have never had any expense beyond the original cost, other than for oil and gasoline.

Of course for a doctor's machine I would recommend a runabout. I have tried both, and a big, heavy machine was never built for anyone who must ride alone both day and night, with no choice of roads. A big machine no doubt rides easy when full, but when one must ride alone a runabout is the only machine to have. Everyone realizes that one who rides possibly 50, and sometimes 100, miles a day must think of comfort.

The most important thing in a physician's life is time. There is no one who lives in such a hurry as the average doctor, and few but he realizes what fifteen minutes on this visit and an hour on that one may mean. It may mean a life, and it may only mean that when the day's work is over he will have a chance to sit down and rest for a little while, enjoy life for a little while as men in other walks of life enjoy it, and even have time for a good night's rest.

People here in California have gotten to the point now that when they call for a doctor they call for one with a machine, and if the doctor hasn't one he must pay the garage owner a dollar a mile for the services of his—and where is that doctor's profit?

A Kansas Doctor's Experience.

By John M. Reid.

Within the last six years I have owned and driven three different makes of autos, and possibly my experience may be of profit to some practitioner or business man. Our roads are very rough, hilly and stony. The first car was a small one with narrow tread, and of only about 4 horse power; consequently it was of little service to me, except in making calls in town. The second car had a 16 horse power water cooled double opposed engine, and was a good strong car. It gave good satisfaction until the radiator began to leak. Sometimes, too, the high weeds in the road would open the pet cock, and before I was aware of the loss of water the engine would heat. This experience when on the prairie a long distance from water was anything but pleasant, especially at night. Another difficulty with this car was in the clips that held the springs to the rear axle. Be sure to see that your car has secure clips. After wearing out two sets of pneumatic tires I thought to avoid punctures by buying solid cushion tires. Then my car made about as much noise as a wagon and my speed was limited to 15 or 16 miles per hour, which is, of course, fast enough for rough places; but often a doctor would like to speed up on a specially good stretch of road. Therefore I was not so well pleased with solid tires. Still, I was not always afraid of a puncture and the necessary delay in patching. Another thing I learned, too, was that with solid tires I had lost nearly half my power when there was mud, or when coming out of a stream, unless I used tire chains, for the water made the wheels slip very easily.

Since last October I have used a motor buggy with 36 inch wheels fitted with 1¼ inch solid tires. This car has been in constant use when roads were dry, without one cent of repairs. The engine is rated at 12 horse power, is air cooled, and transmits its power through a friction drive. The car weighs about 900 pounds. I have some trouble in starting in deep mud and on a steep incline, but give me a start and I go through almost anything and over very rough places. The cost of running this car is about one cent per mile, and the mechanism is so simple that no one will have trouble in driving. The only trouble I have had is with the spark plugs and dry cells—trouble that may occur in the best and highest priced cars.

Again, horses do not take fright so easily at these motor buggies because they look so much like a buggy. At one time the farmers here were very much incensed at the innovation, as they called the cars, but now we go where we please and meet friends on every hand. I take great pleasure in driving my own car, and can make my trips in about one-half the time it requires with horses, thus giving more time for reading and office. Moreover, it is a pleasure, not a task, to drive out 15 or 20 miles for I come in refreshed in mind and body.

A San Francisco Physician's Experience.

By T. J. Crowley, M. D.

My machine, a double cylinder opposed "speedster," was purchased in July of last year, and it has been in use about one-half the intervening time. The ideal method of reaching one's destination is by the runabout, and one can easily accomplish three times as much with the machine as with a horse, provided, of course, that one becomes familiar with its weak points and gives them proper attention, although when one purchases the dealer will blandly state that it has no weak points, as all defects have been eliminated. My experience has been varied and interesting, as the car has been partly rebuilt (under my supervision). It is my opinion that at the present writing the nearly perfect car remains to be built.

I drive the car myself, my daily average about the city being 10 miles, considerable of which is necessarily on the slow speed, on account of the hills of San Francisco. On a good road the car will keep up to about 15 miles an hour, although it is rated at 35, and in about six months' average use it has covered a distance of about 2,500 miles.

My repair account is interesting. To begin with I jarred against the street curb heavily enough to turn the front axle, which resulted in the dishing of both wheels, bent steering rods and a bent front axle, which turned beneath the spring clips. Would this have happened if the front axle had been brazed on to the spring clip holder or if it had been fastened with a machine screw? The front axle bent more as time went on, even after retempering. This part of the machine should be made of heavier steel tubing and properly trussed. Another feature of the car's construction which might be altered to advantage is the position of the springs on the front axle, as they are too far inward from the hub, thus causing too much stress on the inner three-quarters of the axle.

CAUSES OF TROUBLE.

It has come to my notice that it is customary for some dealers to drive their cars from the railroad depot to their salesrooms, a distance of about 3 miles, without water in the radiators. Whether this practice is permitted or sanctioned by the manufacturers I am not in a position to state, but the effect is well known.

As is usual, the firm furnished a demonstrator to accompany me on my first trips. On one of these trips he proceeded without oil, and in consequence the machine went through that process known to machinists as freezing from the heat, following which my troubles multiplied, revealing some of the weak points which I suppose are common to the majority of runabouts.

The high speed mechanism required frequent adjustment on account of slipping, with loss of power, partly on account of the previous freezing. Within a year the engine has been taken out and overhauled in an effort to locate the cause of my many ills and complaints, and in particular because the flywheel wobbled considerably. Inspection showed that the end bearing of the crank case was cracked in several places. A new crank case end bushing and a new centre bushing were also required. The machinist in charge informed me that the trouble had been caused by the car having run without oil. I informed him that his conclusions were correct, and explained why. He then qualified his remarks thus: "Well, ordinary wear would do the same thing." Purchasers should insist upon getting at least one year's guarantee with every machine. This would in a measure compel the manufacturer to turn out a better product.

IMPROVEMENTS TO CAR

The following improvements were made in the car as circumstances warranted them. Running boards were adjusted between the fenders; these were covered with rubber and angle brass, one side being made into a tool box, thus giving the machine a touring car appearance. On account of the short wheel base and semi-elliptic springs, the riding qualities of the car left something to be desired, so a pair of new supplementary spiral springs were attached to the rear springs of the car, and the improvement was well worth the added cost. Speaking of springs, in my opinion these should be full elliptic, as I consider the semi-elliptic an economical feature only.

The small and ornamental Tuxedo on the back of the car has been replaced by a commodious oblong square sheet iron box large enough to hold an extra tire and suit case, etc.; this improves the general appearance of the car also. A pair of small adjustable boards were placed between the seat and the dashboard, and extending to the floor of the car; this arrangement protects the feet and limbs from the wind and cold. Lugs were attached to the front wheels (and I may add that they should be part of the equipment of every car with a clincher rim, for on one occasion while traveling up a slight incline on the high speed I struck a rut in the road, which sent the car spinning because of its lightness, and after making two complete revolutions it came to a standstill, my casings intact), and from others who have had the same experience with heavier cars on slippery pavements, and in consequence the usual bursting of the casing, I conclude that my deductions are about correct.

Referring again to the springs, I found it necessary to add an extra leaf to three of them. The spring that was first reinforced still continued to sag, and after more tempering (or rather tampering) another leaf was inserted. It is still too low, and I have had recourse to a pair of bumpers as a sort of compromise.

On my first trip into the country the machine gradually lost power, and eventually stopped. A good Samaritan came along who had previously owned a car of the same make, and after consultation and perspiration we succeeded in getting home with only one cylinder working. After some weeks of investigation I found the trouble to be in a broken intake pipe. This car had been sent out from the factory with the intake pipe disconnected and loose. This fault was remedied and I have had no trouble from that source since.

The gasoline consumption is quite an item for a small car, as I use on an average about 1 gallon to every 10 miles, which is about as much as is used in some makes of five passenger touring cars. The opening in the gasoline tank could be improved upon, particularly as to location in the case of the divided seat. I have had splendid results with the new deflocculated graphite, but only use it half the strength directed.

CONCLUSIONS.

The runabout of the future will have full elliptic springs and a sufficiently long wheel base to make riding easy and comfortable. The extra length will provide more room for the transportation of ordinary conveniences, such as tools, an extra casing, etc.; make provision for a tonneau and place brackets on the frame of proper material and of sufficient thickness to hold a pair of acetylene gas lamps. I have had experience of losing both lamps on account of the vibration of the car crystallizing a thin piece of iron to which they were attached. It seems odd, indeed, to think that the makers of an up to date car would turn it out without a pair of brackets.

The front axle should be trussed and made of heavier tubing. The hood should be so constructed that it will cover the radiator, or, more particularly, the water inlet of the radiator, so that this may be locked if necessary, as I have known of instances where the water cap had been removed and foreign substances placed in the radiator, which resulted in clogging and attendant troubles.

I think the timer should be placed where it would be more accessible. The thermosiphon system of cooling which eliminates pumps and their attendant troubles is very satisfactory. Larger cylinders and more power are essential in a runabout for use in a city built on hills like San Francisco. The shaft drive, universal joints and differential, also the combined power plant, are all that could be desired.

The brakes are of the contracting type, and a good point which I have found in practice is to keep one side always snug and fairly tight, and as it relaxes the opposite side is tightened. This gives considerably more satisfaction than if they were both kept taut. The hind wheels are protected with steel studded chrome leather tire covers. These were placed on the car last October. They are certainly puncture proof and a protection, although they cover a pair of uncertain tires. These covers have their disadvantages also, as they skid decidedly and at times alarmingly on street car tracks, round rocks and wet pavements.

When the car is laid up or not in constant use it is placed on four supports, each made of three pieces of 4x4 inch studding and braced.

The following is offered as a suggestion to inventors and automobile manufacturers: Construct a car which will have as many of the newer developments as possible as well as the older details that have proved themselves worthy to be retained and call this vehicle the composite or the inventors' car. This will in a measure stimulate the inventive faculties, increase the royalties and develop many good features that now lie dormant, as well as tend to the production of a better car.

Finds the Runabout Cheaper Than the Horse.

By E. B. Rossiter, M. D.

I have owned a runabout for a little more than one year. At first I was skeptical, thinking the machines were not practical for all kinds of work, but the longer I use it, and the oftener I ride in it, the stronger my attachment for the automobile grows. Being thus skeptical I bought a runabout, second hand, to first satisfy myself as to whether I would like it, and feeling that I did not want to invest too much money at first, but now I would not exchange it for the horse. Of course I keep one horse for emergency use.

My experience as to cost might not be a very good go by, as I have been exceedingly careful as to expense. My gasoline costs me about 11 cents per gallon, buying 20 gallons at a time, and I do not think even when very busy I use more than 3 gallons a day. Now I cannot keep a horse on 33 cents a day, with oats at 55 or 60 cents per bushel, and corn about 85 or 90 cents per bushel. My other expenses for tires have been very moderate. I have been running my machine for more than one year; the tires when I bought the machine were fairly good, and since that time I have bought two outer shoes and three inner tubes. The machine I have is particularly hard on tires, weighing about 1,450 pounds, and being fitted with 28x3 wheels. It seems strange to me that a manufacturer, who is supposed to have a full knowledge of mechanics, should put a wheel under a machine weighing so much, with such a narrow tread. It should have at least 4 inch tires, according to the rules laid down in books which I have read.

I have had the experience of all users of automobiles of being held up on the road by breaks. One time while crossing a street a man driving a milk wagon ran his horse into my machine, the horse striking the wheel with his foot, knocking the wheel off. Another time while in the country about 5 miles from my home my coil gave out and necessitated my being towed home. These were the two most serious and greatest causes of expense I have had.

In closing I would say that my experience with an automobile has been very pleasant. I have a great deal of riding to do, and I have often remarked that it does not make any difference now how far the distance, when I return I never feel tired or fatigued from the journey, which I cannot say for a horse and carriage. I do not think the vibration of a machine is to be compared to a carriage.

This is my experience with a runabout machine, and I believe I am voicing the sentiment of a great many when I say that the machine has come to stay, and it is only a matter of a few years when the influence of the owners of automobiles will be shown by having good macadamized roads, so that the expense of running a machine will be very small.

Lessons Learned by a New Orleans Doctor.

By A. C. K.

For business and professional purposes the average runabout of the present is a good roads success and a bad roads failure. The horse is undoubtedly superior to a light car in heavy, muddy roads and streets, storms and deep snow, but at times even he is useless. In its present stage of development it would be foolish to expect a runabout to go over and through all roads, no matter what the condition. Low wheels and low hanging machinery, with heavy weight, small horse power, tire cuts, punctures, etc., are all against deep mud traveling. However, as a good weather proposition, over good streets and roads, there is no equal as a means of quick and prompt transportation.

From the standpoint of a doctor my experience with a single cylinder car has been pleasant and profitable. Pleasant, because I am master of my car and know I will get there and back; profitable, because to a physician time often means saving a life; this means reputation and this means "other things." Again, profitable, because I am my own driver and do much of my own repairing, thereby reducing upkeep.

Cost for Three Years.

FIRST YEAR.

Gasoline	$31.20
Lubricating oil	3.05
Dry cells	12.00
Storm front	4.50
Tools	5.00
Cleaning and washing	20.00
	$75.75

SECOND YEAR.

Some new tools and storm front	$66.25
Repairs at shop	30.45
Repairs to tires	15.00
Material for tire covers	25.00
Odds and ends	10.00
	$146.70

THIRD YEAR.

Gas, oil, cells, etc	$69.25
Repairs	32.15
Painting	20.00
Two new tires	50.00
Sundries, as rubber base, wiring and battery connections, etc	15.00
	$186.40

I make a saving by doing as much of the repair work as I can and all the adjusting of coil, clutches, etc. Do my own vulcanizing of patches, as I am some distance from a shop. Get cells at wholesale price, gasoline at 13 cents, 68 and 70 degree test. Keep an hydrometer and watch the quality, have a voltammeter and watch the cells, and when they weaken considerably connect up all eight and wear them completely out. I watch for leaks, loose nuts and wire terminals, and I consider that I save expense by so doing. Eternal watchfulness is the price of getting there and back.

I usually grind in the valves, and in replacing them adjust their individual springs correctly, replace small worn parts with new ones, keep the coil well adjusted, carburetor thoroughly clean, wire terminals clean and bright; in fact, keep everything in shipshape and enjoy doing so. A little time every two or three days spent thusly is time well spent. With good compression, proper timing of valves, good gasoline and lubrication and plenty of "juice" your machine will go every time. To anyone lacking mechanical skill and unwilling to jerk off his coat and learn, I say don't, unless he is amply able to stand large repair bills and much healthy graft.

TROUBLES.

Now for my troubles. In six months after I got my first machine I found that an ammeter was a good thing in that dealers had much respect for me if I tested each cell as I purchased it. I got more "juice," too. By getting stalled on rough streets some few times I acquired the idea of keeping the vibrator adjusted. I also discovered that a clean cylinder worked better; nice dirty job, too, if you clean it yourself.

It is good to know how to improvise. Once the terminal to the timer broke off. On this machine the timer is well buried in the vitals, but I got to it, winding a piece of copper wire around the terminal, connected it to the timer and finished my calls. The next day I made and put in a new terminal of copper. On another trip, 8 miles from home, the high speed clutch required adjusting badly. This is also deep down in the interior; however, with the aid of a hammer and stick of stove wood, borrowed from a one legged negro, I soon got it in shipshape and went home "lickety-split." Some other poor unfortunate might have driven those eight miles on low speed and arrived with a nice hot engine. The vibrator got to giving a lot of trouble. I worked with it for a month, then went to my enemy, the repair man, who put in one and a half hours, charged me $1.00 and sent me on my way rejoicing—for half a block. Got home, took it off and gave it a vigorous bend—a mad bend—put it back, adjusted the thing and have had no more trouble. I afterward found out from the makers of this coil that the vibrator spring admitted of considerable bending.

IMPROVED GROUND CONNECTION.

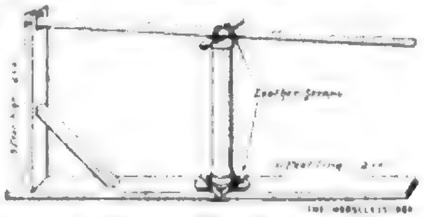
The ground wire in this machine is a short, 6 inch wire, attached to a bolt near the coil, the current finding its way back to the spark plug by following the starting crank, then down a support to the crank case, then along the engine to the plug. I decided to improve on this arrangement and made a direct connection by means of heavily insulated wiring running from the coil to an engine bolt a few inches from the spark plug. There is now no chance for looseness due to wear interfering with a free return of the current. The other arrangement struck me as being crude. After eighteen months' use my reverse band began rattling and no amount of adjusting seemed to help matters. No relining was necessary. I simply ran a short wire underneath, bringing it out on top, and fastened both free ends to a nearby rod and have not been troubled since. The arrangement does not interfere at all with the clutching of the band. My springs, which are of the side spring variety, running the entire length of the car, seemed stiff; so while having some other repairs done I had both springs removed, taken down and the friction surfaces ground smooth and bright, then graphite and grease mixture were smeared on thoroughly. They are now more springy and ride easier. Have applied the same treatment to buggy springs since with much benefit. Rusty springs don't spring satisfactorily.

STARTING UNDER DIFFICULTIES.

I got stalled on one occasion when my boy failed to put in the quantity of gasoline indicated. Car was running all right, but coming out after having made a call I cranked and cranked until my arm almost fell off, then I investigated and found only a quarter of an inch of gasoline in the tank. This car will not start on so small a quantity ordinarily, but I had recourse to strategy. I grabbed the top of my wagon and swayed the machine vigorously from side to side, thereby slashing what gasoline I had, then quickly cranked her up and off she went. I figured out that by this slashing process I could get started and suction would do the rest. Ran a few blocks and replenished my tank. The trick worked admirably.

HOME MADE PROTECTORS A FAILURE.

Punctures are sources of great distress to a professional man, as delays mean loss of time and money, so I conceived the idea of making protectors along the line of a well known make. Bought some good thick sole leather, tough in quality and long enough to make two lengths go around a tire. Had an Italian shoemaker cut strips 4½ inches wide, made a wooden mold the same size as the tire, wetted each strip and tacked it on the mold or shape, then when dry punched four rows of small holes lengthwise. Into these I bradded several hundred rivets obtained from a tinsmith, then cut narrow strips of strong, thin leather, over 500 in number, and with copper rivets fastened these around each edge of each completed protector, all of equal length. This was a big undertaking. Then bought wire and turnbuckles and proceeded to put my home made protectors in place. By having two turnbuckles opposite each other I could draw the protectors sufficiently tight to prevent creeping, especially as they were applied tightly over deflated tires. My scheme worked well, but my car rode somewhat harder and my home made affairs lasted only a few months. I would not advise anyone to attempt such a job if he has any regard for his religion, and I have promised myself never to do likewise again, even if I had to pay $100 a set for protectors. It was the biggest little job I have ever undertaken.



METHOD OF RIGGING TIRE PUMP IN GARAGE.

THE QUESTION OF TIRES.

Now comes that all important and exasperating question of tires, the abominable but comfortable pneumatics. The tire is and has always been the weakest part of the auto, and to think that the integrity of a $1,000 car depends upon a little, insignificant, 5 cent valve plunger is, indeed, disgusting. A pin, a tack, a nail, a blow-out, almost anything can put the whole thing absolutely out of commission for the time being; and it is indeed a sad sight to see a neatly dressed professional man down in the dust or mud, changing tires! It is either do it or ruin a $30 tire going home with it flat.

The pneumatic eats more holes in our bank accounts than anything else about a car, and it is up to some good human angel to give us a satisfactory tire, comfortable and puncture proof.

There are any number of substitutes now on the market, but unsuitable for light cars, with that abortion, the 28 or 30 inch wheel. Many people drive the high wheeled, solid tired vehicle for no other reason than to get away from this abomination, the pneumatic.

While driving my eyes are eternally skinned for nails, tacks and broken bottles, and I have even gotten to the point of kicking off the street any one of these things when out walking. Pumping up these inflated sausages is a nuisance, too, so to make it easier I have arranged my pump according to the accompanying diagram.

This works fine and is not tiresome. By having the pump fixed by means of straps it can be instantly detached and carried along when making long trips. Ordinarily I do not carry it with me.

ADVICE TO THE PURCHASER.

To the purchaser of a runabout I would give a word of advice born of experience. If he can afford to do so, avoid the single cylinder car and buy a two or four cylinder, preferably the latter, and you will save time, patience and money. Any single cylinder arrangement I have ever seen is unsatisfactory. There is not sufficient power to go on the high gear through deep dust or light mud or over roads not absolutely smooth. It is a rough, jolting thing on account of vibration and short wheel base. This car will do for "jump up and run around the block" business, but for an everyday, all day long affair it is most uncomfortable, and we physicians are in our buggies or autos nearly all the time. My idea of an ideal doctor's car would be one of four cylinders, about 16 to 18 horse power; weight about 1,400 or 1,000 pounds, or even less; 84 to 90 inch wheel base; either air or water cooled, and wheels of 36 inch diameter, fitted with a tire non-puncturable or even semi-solid, so long as it can be made comfortable. Not too many accessories. I hope some day to see such a car.

Four Years' Experience in Maine.

By Langdon T. Snipe, M. D.

The time has gone by when a doctor has to consider the reliability of an automobile as a method of making his calls, and now the only question is the condition of the roads in his neighborhood. If they are good his fancy and finances are the only determining factors.

Personally I have found that in Maine the use of a machine in the last half of spring, summer and fall, and the use of a horse in winter and early spring, is the ideal combination. Just because the automobile is impossible in the snow of our Maine winter or the mud holes of early spring is no argument against the adoption of a machine, for in those seasons it is very easy to obtain a horse by hire if one does not want to keep one all the year. Driving a horse when the sleighing is good is most delightful, the use of any method of conveyance when the frost is coming out of the ground is horrible, and after these two experiences the return to the automobile is doubly happy. In the larger cities and in warmer latitudes the all the year use of the machine is, of course, possible; but the summer and fall use is very satisfactory. So far as the reliability of a good machine is concerned there is little to be desired. In the four years' use of an automobile I have never failed to reach a patient more quickly than I could with a horse, and the machine has never been moved except by its own power. To secure such good results it is essential that at least a daily careful inspection of the grosser parts of the automobile be made, that all screws may be tight, all parts well oiled, and if there is anything wrong that cannot be readily corrected the repair shop must be sought at once. This is true if there is a reliable repair shop at hand. If there is no such shop the greatest objection to the use of the automobile is encountered.

TIRES

Tires do give trouble. There is no question about that; but the trouble is not frequent enough to impair utility or pleasure. My second season's use of the machine was noteworthy in that I did not have a single puncture; but my other years made up for it. The solid tire has been tried by others in this vicinity, but they have usually returned to the use of the pneumatic. If the pneumatic is kept well inflated there is relatively little risk of puncture and the riding comfort is not impaired. To avoid the danger of puncture it is necessary to bear this always in mind, and never allow the tire to become flattened, however much one may feel disinclined to pump.

THE EXPENSE

If the first cost of the machine, the interest on the money and the depreciation are taken into account the expense is somewhat greater than with a horse. On the other hand, the time saved, while hard to turn exactly into dollars and cents, more than makes up for the difference.

The following table gives my own experience for the three years before this:

	1905.	1906.	1907.
Gasoline	$42.76	$37.76	$25.81
Lubricants	5.00	4.72	1.16
Batteries	6.05	5.45	4.00
Repair parts	4.65	11.43	8.07
Labor	8.16	27.51	43.83
Tires	2.10	40.75	40.05
Accessories	18.37	2.15	....
Insurance	20.00	20.00	15.00
Total	$108.79	$149.79	$137.92

Thus far this year my tire bill is greater than any of the above amounts, being about $50 to this date. The bill for lubricants above does not, of course, show the expense of each particular year, some oil being left over each season. The machine itself cost $1,300, and it is now mechanically as good as ever, though the market price would be quite different.

No long pleasure trips have been taken, and the above expense table represents the use of a machine much as a horse would have been used for about half of the year.

Importance of Reliable Circulation Pumps.

By J. T. Slocomb.

After four years' experience with one machine and three years with another, both by well known makers, and having done all the running and repairing, perhaps some of the things learned will be of value to others. Starting with the problem of cooling, we hear considerable about the merits of water and air cooling, respectively. Now, this is not a question that concerns the user to a great extent, as both systems are good if properly carried out. The user need not concern himself greatly whether the radiator is on the front of the machine or on the engine cylinders, so long as it does the work intended.

The automobile is not suffering at present for new inventions but for some one who makes a good use of what is already known. The inherent troubles of a gasoline engine, together with those of pneumatic tires, are sufficient for most people, without mixing up with defective plumbing, toy pumps, soldered tinfoil radiators, and a myriad of details that might easily be made to give four or five years' service without expensive repairing.

The circulating pump has to do considerable work, and as it runs at a high rate of speed, and must be dependable, it requires liberal bearings, a good oiling arrangement and no trappy parts. The pumps used on both my machines were troublesome and had not evidently been intended for more than one season's work. Who would put a pump into a factory, in a commercial enterprise, that would not stay together and do its work for more than six months? One of these pumps is of the rotary, eccentric, two vane kind, and its whole action depends on one coiled brass spring, five-sixteenths inch outside diameter, wound of wire of one-thirty-second inch diameter. This spring is subject to wear on its sides, as it slides with the vanes, and after a little use will give out altogether.

Dr. Jones bought his machine with the understanding that these details had been taken care of reasonably by the factory. The doctor knows the human body, but has not yet mastered all the details of his automobile. One night he had a hurry call. It was late and very dark, and the call was urgent. His engine began to pound, everything got unusually hot, the doctor was in a hurry; there was no time and no inclination to find out what was the matter. Result—scored cylinders, broken crank shaft, a walk of several miles, a hired farm horse, patient dies, and automobile is laid up for a month with great expense, and for what? This little 2 cent spring gave out. It should not have been there.

My own experience was not so bad, but bad enough. The place was 50 miles north of Fredericton, New Brunswick, Canada. I was bound for St. John, thence by steamer to Boston. First, a little one-eighth inch pin, holding the driving dog on the pump spindle, came out. Everything got hot, but I discovered before long that the pump was not turning, and repaired the defect temporarily with wire nail; ran then about ten miles and found things getting very hot again; then the crank shaft broke. There was no railroad or steamboat available nearer than Fredericton, 40 miles away. Result: trip spoiled, a tow by horses 40 miles over very dusty roads, 'way into the night, laughing stock for all the natives on the way, an extra expense of about $150, and all for what? One spring, worth 2 cents, and one pin, worth 5 cents. The pump is cheap enough, but what about the maintenance?

South Dakota Doctor Adopts Air Cooled, Solid Tire Car.

By S. B. Dickinson, M. D.

The life of an auto and the expense of upkeep depend on proper construction and "the man behind." For proper construction ask any maker or salesman, and he will tell you his car is better than any other and show you why.

My first car was a 6 horse power machine of the popular curved dash type, and after I had become familiar with its operation and peculiarities it gave very good satisfaction. Its principal faults were lack of power, inaccessibility of parts and proneness to tire troubles. I recognized its faults, studied automobile literature, corresponded and talked with users of different styles of machines, saw the machines run and dissected, and when I finally decided to sell my little car I wondered if I would be able to better myself. After careful investigation I decided on the machine I am now running as being the nearest to my ideal of anything I had seen.

My car has 36 inch Timken roller bearing wheels with 1½ inch solid tires, 80 inch wheel base, six leaf end springs, drive by double friction discs pressing against a single friction wheel, and the engine is a 14 horse power, two cylinder, horizontal, air cooled one and located in front. In the rear is a large carrying space. The car weighs 1,250 pounds, and is built to stand the wear and tear of country roads. It is well proportioned, easy riding and attractive. I have been running my machine about two months, and very satisfactorily. It has operated surprisingly well in all the mud I have yet encountered, and I believe it will negotiate muddy roads to my satisfaction.

The friction drive, such as I am using, is as simple as anything can be, and does away with all gears and everything is in sight. I have used my car on extremely hot days for long runs without any trouble from heating, but I find from my own experience and the reports of others that air cooled cars are very susceptible to the kind of oil used, and the best oil is a saving in expense to the motor. It is quite a relief to start off on a trip without a thought of tire trouble, and I see no reason why I should not get good continuous service from my car.

I would not want one with higher wheels nor shorter wheel base, as they are ungainly in appearance and I cannot see that anything is gained thereby.

From a Kansas Doctor.

By Charles E. Pugh, M. D.

For five years I have been using the automobile for business purposes, and from experience and observation I have drawn some very decided conclusions as to its practicability. I practice medicine in a town of 10,000 people. Our streets are mostly macadamized with crushed rock, with surface dressing of gravel. The country roads are fairly well graded and kept in order with the King drag. We have good bridges, so the streams are no hindrance to travel. Our rainfall is 34 inches per annum, which gives us probably about the average share of muddy roads.

My first experience was with a runabout with a single cylinder, 4 horse power, water cooled motor. The wheels were 28x2½ inches, pneumatic tired. The engine and road vibrations would necessitate repairs almost after each hard day's run, but the mileage I negotiated with the little "one lunger" was surprising. The tires were single tubes and were always a great source of vexation. Cushion tires were lauded as a panacea for the much dreaded trouble, and I placed them on the driving wheels. While I felt more secure in their use, I found they caused more vibration, with increased breakage, which made the repair man wear a broad smile. This machine had some redeeming qualities. While the single cylinder made it lunge and pound my back with each engine impulse, its light construction enabled the driver to easily extricate it from the mud hole with a rail or a piece of board. The original cost was also a consideration, for my observation is that four years' use will get the best of any machine.

GRADUATED TO THE HIGH WHEELER.

Next I had an opportunity to thoroughly test the air cooled runabouts, both single and double cylindered. The light weight made them easy on tires, but they acquired the habit of refusing to be coaxed into returning the driver home whenever the cylinders got too hot, which occurred after a short run. Next came the high wheeler, with a tiller steering gear, which cannot be kept in the road while making fair speed. This, together with the continual slipping off of the cable and short driving chain, made life not worth the while. Now I am using a double cylinder, water cooled 1908 roadster with 32 inch pneumatic tires. This machine I would pronounce a success for pleasure, but it is too heavy and too expensive to maintain in competition with the horse drawn conveyance for strictly business use. The first few years I cared for my own machine, but it was too greasy a proposition, so of late I patronize the garage.

AIR COOLING DESIRABLE.

It is impractical to do much winter running with the water cooled machine. I have tried the various anti-freeze mixtures. Chloride of calcium will corrode and soon destroy radiators. Alcohol soon evaporates and glycerine sticks to radiators and causes water to boil unless the machine is in motion. A strong wind will cause a radiator to freeze, even when the thermometer is not very low. The thermo-siphon system requires carrying much water, and pumps require extra machinery, which is liable to get out of order. So the practical business machine must be air cooled. The fan system cools only one side of a cylinder, and is not effectual. Until the two cycle engine is better developed it is really necessary to have four cylinders in order to have that even torque essential to preserving the life of the machine. These cylinders should develop from 20 to 24 horse power and be located forward under a hood. All bearings should be encased and dustproof, and encasing the flywheel would help to eliminate the noise. The double friction drive with side chains has many advantages over the planetary or sliding gear type. For pleasure machines I prefer the live axle, but for business it is too hard to repair and too expensive.

THE MOST PRACTICAL TIRE.

What we all want to know is what is the most practical tire for a business runabout, which is to be used in all kinds of weather and over every variety of roads. The pneumatic tire will soon have run its day. It is true that pneumatics have been greatly improved the past few years, but will on an average not last more than one year. A set of pneumatics for my 32 inch wheels cost about $160, which would make an average cost of $13 per month for tires alone. Low wheels drop into ruts and undoubtedly wreck a machine more than higher ones. It is claimed that 38 inches is about the limit with pneumatic tires, and that is certainly small enough. Road clearance is essential for mud holes and small streams.

A COST ESTIMATE.

Now as to the expense of maintaining a machine. Here are my figures for a car costing $1,100:

Depreciation, 25 per cent per year	$275
Interest on investment, 8 per cent. per year	88
Taxes	10
Tires	160
600 gallons of gasoline at 17 cents	102
Engine oil	10
Carbide	3
Repairs	80
Garage	180
	$908

This in round figures comes to $75 per month, which, divided by the twelve running days of each month, will give nearly $6.25 for each running day. Counting cold days, wet days, rough roads and the occasional breakdown, I have found that with the low wheeled pneumatic tired car twelve days is about the average each month. Now with the high wheeled, air cooled, solid tired car the machine can be used twice as many days and at less expense all around. My machine makes about 13 miles on 1 gallon of gasoline. With the above figures in evidence I do not think any sane man will maintain that the pneumatic tired roadster or its companion, the touring car, is a business proposition. So far as I have seen the high wheeled machines have too short a wheel base; it should be from 102 to 108 inches. The side chains should be housed. The solid tired high wheel readily follows the wagon ruts and has everything to commend it. You cannot expect to run over even selected country roads and not at least occasionally get into chuck holes, so it is necessary to be equipped to extricate the car from the mud hole. Carry a rope so that you can hitch to a passing conveyance. A short handled garden hoe to dig the soft dirt from in front of the mired wheels has served me admirably. Some find that a block and tackle with a steel pin to hitch to answers the purpose well.

A car weighing 1,600 pounds or more should be equipped with 50 feet of steel cable with a hook at one end to drop over a steel pin driven in the ground. This cable should be permanently carried on a windlass capable of being run by the engine, and manipulated in conjunction with the regular running gear of the machine. One man thus equipped could handle most any car.

The Cost of Operating an Old Runabout.

By Medicus No. 2.

My runabout has a single cylinder, water cooled motor, rated at 10 horse power, is equipped with a leather top, and carries an oil and gasoline supply sufficient for 125 to 150 miles. The motor is located in the middle of the chassis, and fairly protected by an underpan. The power is transmitted to the rear axle by a heavy chain. Loaded with oil, water, gasoline and myself it weighs 1,000 pounds. The wheels have detachable rims and carry 28x3 inch tires.

The car was purchased in March, 1906, and has since been in daily use, except twelve weeks during my vacations, and while it was in the paint shop. It must, therefore, be apparent that the car has "lost its bloom," and has been thoroughly tested by summer's heat and winter's mud and snow. During the whole period of activity, twenty-seven months in all, nothing has broken, except tires and springs. The car, although old, has been well groomed and kept up. Every part showing material wear has been at once renewed, not only to preserve a high state of efficiency, a greater safety for myself and the public, but also to avoid as far as possible vexatious road delays. This policy has been eminently satisfactory. After 15,000 miles of road work the car is but little impaired in power and its value is no less than a year ago.

The operating and maintenance account for the year ending September 1, 1908, is as follows:

Replacements, tools and miscellaneous...	$174.80
Oil	6.70
Tires	95.00
Gasoline	63.00
Dry cells	11.25
	$350.75

The replacements were many, owing to the age and hard usage of the car, most being the renewal of original parts. To be more specific, the piston rings, main shaft bearings, crank bearing and the eccentric were renewed, also the steering rods, shackles, rack, pinion and cones, cups and one steering arm. Many of the parts were in fair condition and might have worn for a year or two longer, but loose parts are noisy, and an unnecessary rattle is an abomination. The really necessary replacements, such as chains, brake bands, sprockets and reversing gear, amounted to $75 or $80. The work was done piecemeal and at my convenience, the car being in the shop for four or five hours at a time.

POINTS ON LUBRICATION.

The oil was purchased at 35 cents per gallon by the half barrel, and has been entirely satisfactory. It is of medium grade, of 29° Baumé and 530° Fahr. fire test, and is used for lubricating all friction surfaces about the car. Through the cold weather kerosene was added to secure the requisite fluidity to feed readily through the oil pump and system. The oil cups and transmission were filled with graphite grease. The filling of the transmission case with soft graphite grease rendered the gears noiseless and dispensed with daily oiling. This was accomplished by means of a home made grease gun, consisting of an old bicycle air pump with a one-quarter of an inch brass pipe extension of proper length and thread to engage the oil hole in the transmission. To load the gun the plunger was removed and the barrel filled by the aid of a case knife. Sometimes, especially in winter, a gasoline torch was used to melt it down. Occasionally I filled the spaces between masses of grease with cylinder oil or kerosene. The plunger was then inserted, and after screwing the end of the nozzle into the oil hole the whole was forced by the plunger into the transmission case. This grease gun, 1¼x12 inches, holds sufficient lubricant for 400 or 500 miles drive. It is my practice to inject a new supply once a month.

The graphite grease proving so satisfactory gave encouragement to the use of graphite in the cylinders. My first impressions were favorable, but soon the graphite deposited on the spark plugs and short circuited them. Gasoline or kerosene failed to properly remove it, and only after redressing them with emery paper could a clean surface be obtained. The engine case and compression space were then cleaned with kerosene, but several weeks elapsed before the annoyance ceased. During the past year no particular care has been given the cylinder beyond supplying oil. Formerly the cylinder was flushed with kerosene every two weeks, under the impression that kerosene removed the carbon deposit, but close observation and experiments have dispelled the delusion. Bad oil may cause a deposit of carbon, but too free feeding of oil is sure to. Enough oil to hold the compression is the limit. Such an amount, or even greater, will be fully consumed. My cylinder has been cleaned but twice in thirty months, and then because the engine was taken down for other purposes.

DRY CELLS SATISFACTORY.

Ignition by dry cells has proven satisfactory, as it always does in single cylinder motors, especially in the summer. In winter they should be frequently tested with an ammeter, and discarded when reduced to five amperes, since they exhaust very rapidly at the last when chilled. A new dry cell may test 25 amperes in a warm room and only 10 or 12 at a freezing temperature. The life and energy is impaired correspondingly. Dry cells of high inital amperage are the most durable. I have tested half a dozen brands in pairs under identical conditions and have found them sure winners.

Chains of all makes have been tested on the several cars which I have owned for the past six years, but none have proven so durable as an English chain with chamfered side plates. On this car a chain will run from 4,000 to 4,500 miles, but it should be known that this portion of Connecticut is very hilly, with grades of 22 per cent. in many places. In a level country with good roads double the mileage may be reasonably expected.

CARE OF TIRES.

The tires have been satisfactory when comparison is made with the tires of four or five years ago. The lack of great speed and the small hill climbing powers of this type of car add materially to their durability. Every considerable cut in the shoe should be healed at the earliest moment with a vulcanizer. When the shoe is old and the fabric begins to break the spot may be reinforced by thin, tough leather held in place by cement and four rivets in the corners, inserted as far as possible from the tread, and an inner shoe placed between the inner tube and the shoe proper. With these measures worthless shoes have given four to six months' active service. With an electric vulcanizer inner tubes with holes or considerable rents may be permanently repaired. Two inner tubes have done service over the 15,000 miles traveled by this car.

NARROW ESCAPE FROM A TOW.

Although this car has never been towed in my resources have occasionally been put to test, but never more than one night some months ago. Rain was falling in torrents, the road was deep with mud and water, the darkness impenetrable, when the machine hesitated and stopped, although the vibrator buzzed cheerfully to the last. Alighting in a mud puddle, I examined the terminals of the secondary wires, confidently expecting to find them detached, but everything appeared normal. Removal of the spark plug and starting the vibrators gave no spark, while contact with the secondary wire demonstrated short circuiting through the old wet wires. Visions of an ignominious tow line chilled my spirits, but, happily, the thought of adjusting the spark points almost in contact came to mind. When so adjusted a feeble spark appeared. With strong misgivings I replaced the plug and cranked the engine. The second revolution gave an explosion and the difficulty was overcome. Although there was an occasional skip, I reached home, drenched to the skin but still triumphant.

REMEDY FOR A SLIPPING CLUTCH.

The high speed clutch is a friction disc at the outer end of the transmission. This locks the whole together by pressure. As originally constructed, it would soon skip and require relining with leather. Careful study of the cause disclosed the fact that the disc was too thin and would slightly dish when the adjusting nut was set up to give firm pressure, thereby reducing the friction surface. When the leather was new and rough it would hold, but when saturated and smooth a firmer adjustment failed to prevent the slipping. This difficulty was remedied by riveting on the outer side of the disc a second and smaller disc. Still, after several months' use the leather would become soaked with oil, and although the slipping was stopped for a few weeks by flooding the disc by the aid of a small oil gun with gasoline, the only remedy seemed to be relining. Some three months ago a new way of cleaning the disc suggested itself, which has given to this time perfect action from one treatment. I made a tin trough 12 inches long, 4 inches deep and a half inch wide. After freeing the disc by unscrewing the compression nut the trough was slipped upon the disc from the under side and filled with gasoline. After soaking the leather for a few minutes the disc was revolved by turning the flywheel of the engine and a new place soaked out. This procedure was repeated until the whole lining was treated. The engine was then turned over by hand while a coarse file was held against the leather. This was repeated several times. The trough was then removed and the adjusting nut properly set. The procedure may seem tedious, but it really consumes only about fifteen or twenty minutes.

The spark plug consists of two mica cores, each carrying a secondary wire. The position of the plug renders the tightening of the nuts on the terminal somewhat unhandy, and to correct this annoyance bulldog grips have been soldered on to the secondary wire.

COMMON SALT SOLUTION FOR COOLING.

The various anti-freezing solutions have all been used at various times, but the cheapest and most satisfactory is prepared by diluting a saturated solution of common table salt, one-fifth, with pure water and adding sufficient sal soda to give a slight alkaline reaction. An abundant precipitation follows the introduction of the sal soda, which should be permitted to settle. The clear solution may then be decanted and is ready for use. This solution has a specific gravity of 22° Baumé. Every few weeks I draw a glassful from the radiator and test it with the hydrometer. If the specific gravity is too high, water is added and the engine allowed to run for a time to thoroughly mix it with the salt solution in the radiator. This will guard against stratification and the possible freezing of the water. In general, only the stock solution need be added to replace such amount as may have leaked away. I have used this formula for two winters, and have never had the slightest trouble from it, although the temperature has several times been 15° Fahr. below zero. The water in the radiator becomes discolored, but not more so than pure water during the summer. A bottle of this solution containing a piece of polished brass and iron has stood in my office for two years. The brass is untarnished and the iron only shows slight rusting at the point of contact with the acid. A similar bottle filled with water is greatly discolored.

DRAGGING PLANETARY BANDS

Some time ago my car began to show a considerable loss of power, the engine speeding up sluggishly on changing gears. The compression was good, the bearings were well oiled, and adjustment of the carburetor failed to better matters. Finally an examination of the brake bands on the planetary transmission disclosed the partial contact of two bands. They would oscillate freely on the drum, but would not easily permit the passage of a narrow strip of cardboard beneath them. Readjusting them to give a clearance of an eighth of an inch restored the lost power. The contact was so light it seems unbelievable that so much power could have been absorbed.

A REPAIR KINK.

One of the most troublesome defects to cope with was a small leak in the copper water pipe. Repeated soldering was useless, the difference in the contraction of the copper and solder would result in an early reappearance of the leak. At last I conceived the idea of winding raw rubber over the defective spot, believing the high temperature of the pipe would vulcanize it. The pipe was first cleaned with gasoline and roughened with fine sandpaper, then coated with vulcanizing cement with vulcanizing rubber and firmly compressed with coarse twine. The experiment proved successful, and after several months' use the pipe is still water tight.

CHEAPER THAN THE HORSE.

To one purchasing an auto for recreation the original cost of maintenance is of small moment, but when business uses are contemplated it becomes of paramount importance. The doctor or merchant may recognize the superior speed and manageability of the auto, but the main question will be, is the auto as cheap and reliable as a horse drawn vehicle? My experience may aid in the solution of the question. All work on my auto has been done in a shop charging 60 cents an hour for labor done and contemplated. The general work I have done on the car, except washing. Twenty minutes a day represents the average time devoted to it. The total cost for the year, as before shown, was $350.75; the distance traveled, 6,300 miles; the cost per mile about 5 6-10 cents. In this locality the cost of maintaining a horse and carriage is $324. A robust horse will travel, if driven at a smart road gait, about 4,300 miles a year, or at the cost of 7½ cents per mile. Few living in small cities are able to make so favorable a showing.

The factor of depreciation is too complex for analysis. It is an individual problem, influenced by both chance and care. My car has suffered no depreciation in selling value in the past year, and is, I believe, capable of many years' use on the same basis of expenditure as experienced in the past year.

Runabout Maintenance in a Doctor's Service.

By A. L. Peckham, M. D.

I presume that one function of the Runabout Number is to serve as a "canned" experience meeting, where those who have had an experience or two can swap yarns. As I am one of them I am tempted to submit a few facts.

After occasionally running a hired runabout in 1902 I decided that automobiles were not yet "ripe enough to pick," but I kept an eye on the crop, and in the fall of 1905 I saw a shaft driven runabout with 10 horse power double opposed motor under the hood, and a price which made it the first really attractive proposition I had learned about. I subscribed for The Horseless Age, attended the automobile shows and wrote personal letters for information from users. In February of 1906 I ordered one of these runabouts, and on May 4 I received it—or rather the agent did—and I took it from the factory by storm. Since that time it or its successor of 14 horse power has been in operation every day except for two weeks in February, 1907, when the streets were blocked by a blizzard, and one week in July, 1908, when it was being repainted.

To keep it in commission every day (and night) it has cost slightly more for some repairs than if I had been willing to wait, but waiting was impossible, as my horse outfit had been sold shortly after getting the automobile. In July, 1907, the 10 horse power car, then in thoroughly good condition, was exchanged for the newer product of 14 horse power and a few minor improvements. The car I now have is practically a 1908 car and, in spite of a few minor changes that I would like to see, it is a very satisfactory investment.

The following condensed items of maintenance expense are for a continuous service of over twenty-nine months (except the three weeks above mentioned) and 11,600 miles of travel:

Gasoline at 20 cents	$165	
Lubricants	30	
Batteries	17	
	——	$212
Tires—		
New casings and tubes	$210	
Repairs to ditto	25	
Tire chains	8	
	——	243
Repairs and replacements—		
Broken body springs	$38	
General repairs	97	
	——	135
Miscellaneous—		
Painting and varnishing	$35	
Carbide, polish, etc	7	
	——	42
		——
		$632

This gives an average of 5.36 cents a mile, $22.57 per month, which I consider a maximum average, as it includes a recent general overhauling, fresh tires and paint and varnish. About $25 of the repair bill was for labor to prove—what I had every reason to assume—that engine and transmission were in good condition after more than a year of daily use. The overtime work of four men also cost something extra, but it enabled me to get the car out the day after it was put in the shop. The car would not have been spared a week for varnishing had I not been able to use another car in the meantime. The item of spring repairs was separated because it is abnormally large, and includes an entirely new set of body springs, with an extra pair for emergencies.

Even the above maximum average is less than the present cost of keeping a horse outfit, and the mileage includes vacation tours in three successive years, as well as considerable "joy riding" in between. The cost for purely business purposes in the same period of time would be much less, but the only fair way to consider maintenance cost is for miles traveled. Mileage is the real value received from either horse or automobile. On this basis, estimating the horse mileage, I believe the automobile for business and pleasure has cost me about half the cost of a horse outfit for business alone, and has given infinitely more satisfactory service.

My car is kept on the premises, and I find as much pleasure and satisfaction in caring for it as I would in many other forms of recreation, and the actual time really necessary is very small, not as much as the time saved by its use.

In reliability I must say that the continuous daily use of a car for 120 out of 123 weeks is fairly satisfactory. I have found the automobile really more reliable than a horse, and in convenience, general usefulness, ease and certainty of control, speed, endurance, in fact in every attribute I can think of except the ability to wade swamps or deep snow drifts, the automobile is not to be compared with a horse as a matter of choice.

The fever is evidently contagious, and is usually free from the chills which characterized it a few years ago. After watching my experiences throughout the first winter other physicians began to buy automobiles, until at the present time thirteen out of twenty-four in general practice in this city are using them, and others are "sitting up and taking notice."

Ten Years of Automobiling.

By Dr. Daniel Longaker.

Exactly ten years ago my attention was first seriously directed to automobiles. I say seriously advisedly, since my first outlay was made for an auto on paper which never ran. There was some consolation in the fact that others were caught like myself by promises never realized. Then it was impossible to foresee that the building of a good automobile was such a complicated matter. But it is needless to go into the details of early and later failures. After all, the successes are more numerous, and the auto remains, with rich promise of its ultimate triumph as a carriage for the man who must get there.

Among the conditions this universal carriage must fulfill none are more important than those of dependability and economy. By economy I mean that there shall not be needless expense of money, but, what is more important, there must be no excessive amount of labor involved. Reasonable first cost and simplicity of construction are prerequisites to the more general use of the automobile for purely utilitarian or business purposes.

For the past four years I have used pretty constantly a brougham built on conventional lines. Its weight is over 1,500 pounds, and its source of power is a two cylinder, opposed, air cooled engine, driving by shaft to a floating rear axle. Closed body cars, while ideal for very cold and inclement weather, are not so desirable from the viewpoint of economy. Their weight is excessive and the wind resistance is very great. I do not expect to own another car of this type again for these reasons. The great weight also unfavorably affects the wear of the tires, and the pneumatic tire is one of the main sources of expense, if, indeed, it does not constitute the largest single item. I have thought it well to give in detail, with dates, my expenditures on this account for the past two years. They were as follows:

September 5, 1906—	
Vulcanizing outer case	$2.00
September 8, 1906	
Vulcanizing inner tube	.35
September 14, 1906—	
One new inner tube	7.48
October 9, 1906—	
One new case (net)	23.50
October 13, 1906—	
Covering outer case, steel studs	30.00
October 16, 1906—	
Vulcanizing two inner tubes	1.00
November 1, 1906—	
One new case and covering same with steel studs	41.00
December 3, 1906	
One new case at half retail price—tire purchased in March, 1906	17.70
December 7, 1906—	
Vulcanizing two sections in case	7.00
January 22, 1907—	
Section vulcanized in non-skid tire	3.50
February 25, 1907	
Vulcanize two inner tubes	1.25
April 1, 1907—	
Vulcanize two inner tubes	1.25
March 22, 1907—	
One new inner tube	6.60
March 23, 1907—	
New lugs	1.05
Tapes	.20
Two new cases	55.58
Vulcanizing section in outer case	3.50
November 8, 1907—	
One second hand casing	10.00
March 2, 1908—	
Repairs to casing	6.25
March 9, 1908—	
One 2 inch hand shoe	10.00
April 29, 1908—	
Three tubes vulcanized	1.05
May 14, 1908—	
One tube vulcanized	.35
July 25, 1908	
One new clincher casing	19.00
July 31, 1908	
One new clincher casing	22.80
Vulcanizing one tube	.35
Total for twenty-four months	$273.55

While all items of money outlay have been set down, little has been said of the real hard work of removing and replacing tubes for purpose of repair. The handling of a 3½ inch or bigger tire is the hardest work that I have done at any time during the past few years, and unless one is pretty steadily at it one loses the knack or "know how." The steel studded, leather covered, non-skid tires, while puncture proof, lasted only one season. They gave great security against side slipping on greasy pavements, but they made the car run much harder, and the resiliency of the pneumatic was in large measure lost. In heavy snow the steel studs did not afford sufficient traction. Under these circumstances chains are necessary, and it is only when going through snow that I think of applying chains. The steel studded leather tire protector was used for a short time, but it made the car run like a cart, the consequent excessive vibration did much damage, and when placed on the four wheels it made riding conditions intolerable. While the tires, protected by a covering of leather vulcanized on the rubber, were puncture proof in the ordinary sense of the word, they were not entirely secure against leaks from blow-outs. The use of a leather covering over a rubber tire is a failure, according to my experience.

ADOPTS SOLID TIRES.

A few months ago the conviction grew very strong in my mind that pneumatics on automobiles were after all a dispensable luxury. I was certain their use involved an excessive amount of labor and an undue money cost. Besides this, they are uncertain, and I was therefore quite hopeful of better things when accounts of solid rubber tires on larger or buggy wheels came to me from enthusiastic users of these newer cars. At last I felt we were to be emancipated from the one weak feature of our cars! The bugbear of the pneumatic was to become only a memory. An improved transmission of the twin friction disc type eliminated also the split rear axle and the differential gear. In brief, there was offered me a car without gears as well as without pneumatic tires. The millennium was surely about to dawn, I thought. I may mention a few additional details of this particular new car, which has been operated over 1,100 odometer miles during the past two months. Its engine is four cylinder, vertical, air cooled, mounted in front under a hood, and rated at 20-24 horse power. It is well cooled by a belt driven fan and it runs very quietly. The engine and the gearless transmission seem to me so far to be ideal, and the latter outclasses all the conventional methods of gear construction that have been in use hitherto. The speed changes by shifting the wheels across the two discs are easily made, and without the least noise or friction. The power is engaged by the use of a pedal, and the action of these friction wheels is absolutely "sweet" and quiet at any point forward or backward. The car can be started without jar or jolt. The ultimate delivery of the power to the rear wheels is through a jack shaft mounted on roller bearings, with a sprocket and chain on each end to a larger sprocket about the hub.

SMALL TIRES WEAR RAPIDLY.

The results of this new installation after an experience of 1,100 recorded miles, and several hundred miles not recorded, are very interesting. The original solid tires of only 1½ inches size (the car weighs 2,000 pounds and is easily driven 20 miles an hour) soon began to show rapid and excessive wear; at 400 miles the channels began to strike in crossing car tracks, and likewise in going over block pavements; at 700 miles it became imperative to put on new and larger tires. These are wearing better, but they show a tendency to chip when sharp obstacles are struck at high speed. But sections thus accidentally damaged may be readily replaced, and without the excessive cost and greater labor of repairing pneumatics; the guarantee on solid tires is a very liberal one. The claim of the maker of this car that one set of solid tires will last for 11,000 miles will hardly be realized in my experience. That this tire equipment raises much less dust than the pneumatics is unquestionable. Its destructive action on the road, a very serious objection to the ordinary automobile, is also much less. From a hygienic point of view the dust raising proclivity of cars is one of their most objectionable features; from an economic standpoint the destructive action on the road surface is a most serious matter. No adequate remedy is yet in sight for this evil. The Year Book of the Department of Agriculture for 1907, p. 257, gives in abundant detail an account of these twin evils—dust and road ruin and their remedy.

My solid tired car rides finely on country roads, on asphalt and on smooth macadam. Here the pneumatic tire is not missed in the least. But on stony, rough surfaces and across car tracks the fine vibrations are not absorbed and the going must be slower. But slowing down at street crossings is not an unmixed evil. While I have not fully demonstrated the point, my experience has been sufficiently large to incline me to the belief that the solid tire will be an ultimate fixture of the business runabout, such as the doctor uses.

SOME REAR AXLE EXPERIENCE.

My brougham came originally equipped with a floating rear axle, shaft driven and with a differential. It was light, easy running and a wonderful coaster, but in a few months it was worn out. After some correspondence the makers of the car admitted too weak construction, and they also informed me that they had had special axles built, one of which they would be glad to let me have at a cost of $50, stating that these axles really cost more than twice this price. The offer was accepted, the new axle was placed and no attention whatever was paid to it for three years aside from occasionally filling the case with oil. Now the car was running very hard. On pulling the axle apart one set of balls was found to be crushed, and the corresponding half of the axle was almost cut off. On writing for a renewal of the damaged part and enclosing the invoice of the improved axle, the manufacturers informed me that they had built some forty of these axles, but they could not understand the invoice, since R. had paid them $120 for each axle. These people entered the field of auto building early and remained in it but a few years. In their endeavors to make good lies probably the reason for their short continuance in this business, which they soon abandoned to devote themselves exclusively to a former line. There were honest and conscientious men in the business of making automobiles at that early day as well as at the present.

While this particular car gave me an immense amount of satisfaction and pleasure during the four years I drove it, a colleague, who through my influence bought one of the same cars, has never since been able to say a good word in its favor, nor in mine, nor in favor of the maker.

AIR COOLING.

I am perfectly satisfied with this plan of cooling, although my experience has been limited to engines having a cylinder diameter of 4 inches only and the same length of stroke. Simple, efficient and involving little care, in strong contrast with the often ineffective cooling and circulation troubles of the three water coolers I previously owned, is my brief verdict. If it be a four cycle engine there should be four cylinders vertically placed. I have no wish to go back to a double opposed or to a single cylinder horizontally placed engine, or to a water cooled one.

IDEAL OF THE FUTURE.

I am inclined to look for the early advent of a two or three cylinder, two cycle air cooled engine. This will mark a step in advance in the direction of simplification of power generators. The gearless transmission we already have, and I consider it a great step in advance. The side chains simplify and make possible a strong, light one piece rear axle construction without differential. Our ideal car must have a certain and positive source of electrical energy for purpose of ignition. Early in my experience we had low tension make and break systems of ignition, and this plan had points of superiority over the later used high tension system. Then we used batteries. With the multi-cylinders of the present day a low tension magneto in the flywheel ought to be employed. The storage battery is too much subject to trouble to remain a permanent fixture in the car of the future, and the life of the dry cells is too short.

A Suburban Doctor's Experience.

By Charles P. Knapp, M. D.

"There is no such remedy for melancholia as rapid motion in the open air."—*Swift.*

Cost of car, house and extras	$963.65
Expenses of twenty-four months' operating—	
Repairs	258.35
Tires	149.50
Gasoline	95.70
Oil	25.75
Cells	22.70
Total	$552.00

or $23 a month.

Mileage, 10,800 miles.

Former expense for horse, man and trolley fare, average, $60 per month.

Time saved per day, two hours.

Towed home three times (once a shaft broke, owing to defective material; once the car stuck in the mud on a bad, swampy road, when "frost was coming out" in March, and once a loose pin in the cam shaft came out, which stopped the engine).

Accidents.—In order to avoid a team whose driver was asleep I once drove to the extreme right side of the road and blew my horn. The driver awakened suddenly, pulled the wrong line, threw his horse against the car and pushed me into a telephone pole, damaging my radiator. On another occasion I stopped at a patient's house on a thawing day in February, when the ground was covered with ice, and on putting on the brakes I "skidded" into a post and bent the frame. I drove home after both accidents.

Experience has taught me to run my own car, to thoroughly understand it and attend to its minor wants.

Avoid repair shops. Have a good mechanic in your own town "learn" your car, and when necessary come and repair it in your own place. Fit up a good repair room. Have plenty of tools and appliances and yours will be a "horseless age."

My next car will be a four cylinder (present one is a two cylinder of popular make), 25-30 horse power, fitted with magneto and battery; wheel base over 100 inches, wheels carrying 32x3½ tires, shaft drive, with transmission and differential on the rear axle, easily accessible and better, from the point of view of weight distribution; all parts protected from mud and dust by a metal apron, with ample wheel covers to protect the body from mud; rumble seat; weight about 1,500 pounds.

Why the Horse Is Unsatisfactory.

By John J. Shaw, M. D.

I felt many years before automobiles were known to the public that a mechanically propelled vehicle would be a great boon to the medical profession. I am rather fond of horses, but I do not like to see them work. Besides, in our business they have some disadvantages. If you have a spirited horse that will travel satisfactorily he is seldom good at standing; and if you have one that will stand well you have to "work your passage" to get a decent gait out of him. If he is a good horse he usually has a good appetite for green things, and many times when it is necessary to stop at some place there is nothing to hitch to. Perhaps you carry a weight and hitch to that; he soon learns to drag the weight, and sooner or later you come out of a patient's house to find that he has eaten up some fine, rare shrubbery, or skinned the bark off of trees which the town has carefully planted for the joy of future generations. Knowing that your horse is liable to do this kind of stunt, you often feel so anxious about outside matters that you find it difficult to keep your mind on your patient and his needs.

Again, horses have tender skins, and during fly time they suffer tortures from the little pests. If you hitch at such times to a reasonably solid post your horse paws a hole in the ground, and if he becomes sufficiently exasperated quite possibly attempts and perhaps succeeds in lying down in it, somewhat to the detriment of shafts and harness. I hitched once in fly time to a seemingly firm post and went into my patient's house quite easy in my mind. A few minutes later, hearing a cracking sound, I looked from a second story window and beheld my horse going down the street at about 20 miles an hour, and taking the post along with him as a sort of outrigger. He turned a square corner, jumped a three rail fence into a field and whirling short around threw the buggy against an old building. The buggy was nearly new when he started with it; I sold it where it lay for $12. Fortunately nobody was hurt, not even the horse.

A flowing tail is a thing of beauty, as well as useful to the horse, but when you essay to get into the buggy it will hit you in the face, as sure as fate, and after you are in and take the reins you have a constant fight with that tail.

I speak of these little matters because the general public seem to think that the sky of the horse keeper is always rose tinted, with no clouds to depress him. From fifty years' personal experience I know better. Your horse becomes lame, he gets foundered, he develops spavin, he gets heaves, or perhaps colic, and dies. He may even have a fit and break your arm or your neck; in fact, he is an animal, and subject to many diseases and as many moods.

The horse cannot stand upon ice without being sharpened, and with the unexpected icing up of the roads and your blacksmith half a mile away you are in a bad fix; but with an automobile in your stable you can laugh at the ice. The buggy is not exempt from trouble; a wheel may refuse to turn when you are in the woods 2 miles from any house. Or, perhaps, through the carelessness of your blacksmith, a wheel comes off.

Such experiences as these prepared me for the horseless carriage, and I bought my first one in the winter of 1903, a one cylinder machine. I was unfortunate, for the piston head had several sand holes, and the sand cut the cylinder and greatly reduced the power.

The company gave me a new cylinder and piston. I got a good deal of service out of this machine, but owing to a tendency of the water to leak into the cylinder it was never very reliable. I traded this machine for a two cylinder, which, owing to the maker's ignorance of a doctor's needs, did not prove a success for my business.

Next I bought an old one cylinder machine as a speculation, and soon after traded it for a new one cylinder machine of the same make, and containing all the improvements suggested by the long experience of the makers. This was in August, 1906, and at this time began my successful experience with the automobile as a business proposition. It has carried me everywhere that I wished to go. No hill has been too steep nor any sand too deep. Through storm and sunshine, in summer and winter, it has gone on its round of duty.

My expense averages about $1 per week for gasoline and oil. I have bought five new casings, which cost me $82. Two of these were lately put on and one is in reserve. Also two tubes for which I paid $9.50. I stripped the master gear of my differential and that cost $7.05. One new chain, $7.85, and work, $30. I have just put on a new drip apron, which cost me $5. Washing, etc., have cost me $50.

I keep one horse and use him enough to give him exercise, except a part of the time when I have farm work for him. I formerly kept two or three horses, and it cost me $350 a year per horse, not including wear and tear of horse and team. The auto is still doing good work and shows no signs of lessened usefulness. It has saved me an immense amount of worry and bother, and converted into a pleasure what was before drudgery.

Following are my automobile expenses for two years:

Gasoline and oil	$100.00
Four new casings	69.00
Two tubes	9.50
Master gear	7.05
One chain	7.85
Labor	30.00
One drip apron	50.00
Washing, etc	50.00
	$278.40
Keeping one horse two years	700.00

Views of a Nebraska Practitioner.

By W. H. Pallett, M. D.

My experience with automobiles dates back to 1904, when I made my first purchase of a single cylinder, 7 horse power runabout, one of the popular cars of the year. I believe this idea of its popularity originated solely in the minds of the makers, for to me it appeared to have about all the faults it was possible to combine in one piece of machinery. I used this car a year, and then sold it for $300, which was $50 less than half of the first cost; this loss, together with the upkeep expense, made automobile mileage pretty expensive.

My second car was a two cylinder, 12 horse power, with engine under the body; perhaps on the whole a little better car than my first, but just as inaccessible and but little better constructed. Moreover, after running this a year I had an opportunity to sell to good advantage, and I cheerfully disposed of my bargain.

My third car, which I now have, bought in January, 1907, has been, I believe, about as satisfactory as any car I have known as regards absence of mechanical troubles, but the spring construction of both cushions and body are no better for easy riding qualities than you would expect to find on an ice wagon. The motor is a two cylinder, vertical, under the hood, 14 horse power, water cooled; the transmission is of the sliding progressive type, with shaft drive. I ran this car 3.500 miles during 1907 at a total expense of $120.20., as follows:

Gasoline	$45.00
Oil and gear grease	14.50
Dry cells	15.00
Two inner tubes	14.40
Two brake shoes	9.00
Four spring clips	.40
One wheel cup, cone and balls	2.35
One front spring	5.25
One apron	3.50
Spring shackle and bolts	.80
Carbide	10.00
	$120.20

This year, 1908, I have had to put on four new casings at a cost of $98, which will increase the cost per mile for this year considerably. The cost of keeping a horse in this locality, if you care for him yourself, would be somewhere near $100 per year, and depreciation would also be less, but it would be impossible to get the same mileage, taking my work as it comes, perhaps some days only a few miles and the next 35 or 40. As to reliability, I believe a good car is almost on a par with the horse, and I never have any fear of not reaching my patient when I receive a call. Our roads are totally unfit for an automobile during the spring months, with the exception of an occasional day. At these times I depend on livery teams for my country practice.

ADVICE TO BUYERS.

In buying a car I would try to buy of a maker who has had several years' experience; one who is not making radical changes in each year's model, and who has a reputation for furnishing repairs promptly and at a reasonable price. The last may not seem important, but I have in mind one firm who manufacture a popular two cylinder runabout, and if you are so unfortunate as to need a new cylinder or piston you will have to buy both, together with a connecting rod, all this unnecessary junk, although each part is priced separately in their parts list. In the matter of engine location, I would strongly advise having it under the hood; it is there more accessible, and grease and oil are less likely to creep out around the footboard, soiling clothing or any articles you may be carrying. As to horse power, I regard 1 horse power to each 100 pounds of car weight as amply sufficient, provided the car is not geared above 1 to 4 on the high. For a change gear I would prefer the sliding, but this does not agree with the views of all of my acquaintances, many of whom prefer the planetary.

Lastly, insist on a good, long demonstration, not less than 20 miles, over country roads with a non-stop engine, so that you may see how the cooling system works, for there is nothing more aggravating than a motor which overheats, with a consequent pound and loss of power.

Two Points for Manufacturers to Consider.

By N. B. Bayley, M. D.

Automobile runabouts fill a veritable want. To anyone whose business calls him at all times to all kinds of places no instrument of locomotion has ever appeared that renders such service. One runabout can do the work of several horses, is always ready and quite as dependable. I have used one with a single cylinder, 5x5 inch engine for fully three years at a total expense of less than $250 per year for everything, painting included, and also subscription to The Horseless Age. This is cheaper than keeping two horses, or even one, and, besides, what is often as important, one can care for the machine himself. I will not go into details as to expenses, as $250 per year absolutely more than covers all expenses, which can be materially cut down by anyone who is sufficiently a mechanic to do his own repairing.

The only real criticism I have to make on the machine I run is its want of carrying capacity. Recently many makers have obviated this criticism by making more capacious decks or by making "rumble seat bodies." A runabout to be serviceable should have a place for carrying parcels as large as a dress suit case, or, better, two of them, or a small trunk, without the addition of baskets or detachable frames.

Another criticism concerns the seat. The divided seat is an abomination on an automobile, and just as unserviceable as in a carriage. A seat should always be capable of carrying two people comfortably, or three persons in an emergency, as oftentimes happens to be necessary, or two persons and a child. If manufacturers will abolish the divided seat users of automobile runabouts will be grateful and the value of the vehicles will be proportionately enhanced. It seems to me these two points should be considered by all manufacturers of automobiles. I shall certainly consider these requirements in the purchase of my next runabout.

Among the Hills of Western Pennsylvania.

By J. V. Blose, M. D.

In the spring of 1903, after a season's reading of automobile literature, I decided to get an automobile. It was not a difficult matter to decide what I wanted, as far as size of the machine was concerned. My work is limited to city practice, with short trips, rarely over 3 miles in length. A light runabout seemed to meet my wants. I purchased the then popular curved dash car, and ran this car for two years, with quite all the service I had expected of it.

When I review my experience with my first auto I am impressed with the necessity of understanding the gasoline motor. I would advise everyone who contemplates the running of an automobile to spend a few dollars in books and journals treating on the subject. This will be a most profitable investment. Who would undertake to run a steam locomotive without knowledge af its parts? That so many ignorant people are successfully running automobiles today is more to the credit of the makers than to that of the drivers.

The financial side of the use of the automobile is now being widely discussed. I know one owner whose car (a large machine) costs him not less than $75 per month, while the same machine in the hands of another owner would not exceed $10 per month. He is constantly changing his car regardless of expense.

TYPE OF CAR PREFERRED.

As to the car most suited to the doctor's use men may differ to some extent, owing to the desired service, but for use in the practice of medicine, in city or country, I much prefer the small car of liberal power. By this I mean a horse power to every 100 pounds of car. It is interesting how experience brings out practical facts. I recall suggesting to a maker of a popular light car some three years ago the idea of putting an 8 horse power engine in the car instead of the 5 horse power which the company were using, and receiving the reply, "Don't you think that would be too much power?" A car should have power enough to take any ordinary grade on the direct drive. My car has a 14 to 16 horse power motor (4¾x5 inch double opposed), and the weight of the car is 1,300 pounds. With this motor I am able to take most all grades on the direct drive.

As to the number of cylinders, under no conditions would I advise less than two. I don't know of a car of less than two cylinders that the owner would not willingly exchange for two or four. As to the wheel base, the longer it is the easier riding the car. It is very convenient to have a wheel base just long enough to turn your car without backing on the average width of street, i. e., 90 inches; 30x3 inch wheels for all around runabout use seem to me to be about right. As for the choice between the chain and shaft, the latter seems to be gaining in favor. The air cooled motor has been an ideal to my mind, and the two cycle motor also, but both of these have not met with favor in this hilly country. But while the air cooled engine has not done well here, it does in many local cities.

OVERCOME BY FUMES.

I had an experience some five years ago that should interest every one who begins to operate an automobile. Very shortly after I purchased my first car, I was anxious to know all about its mechanical operations. In the closed up barn I started the engine and took a position at the right side and under the car, so as to get a good view of the timer, water pipes, etc. I found myself losing power, and in a very short time I was unable to get up. In my final struggles to get up I fell into a stupor, evidently making some sort of noise, as the ever present "boys" were near the barn and reported to the family that there was something wrong in the auto house. Had it not been for the boys I would probably not have been here to give advice on the use of automobiles. The gas that passes out of the muffler is now well known to be very poisonous. The action of the gas is so insidious that I was unable to get up before I knew what was going on.

ALCOHOL SOLUTION IN WINTER.

In conclusion I want to say a few words regarding anti freezing mixtures. At the beginning of last winter, as a temperature test, I made two mixtures, one for use in the car and the other I left in the container in the coldest part in the barn. The solution was made up of three pints of wood alcohol to five of water. This solution withstood the lowest temperature, which was 12 degrees below zero, without freezing. The other portion was put in the car and replenished with a little alcohol as needed. The only objection to the alcohol solution is the evaporation, which may leave the alcohol content so low that the solution will freeze. This can be avoided by the addition of equal volumes of water and alcohol as evaporation goes on.

Three Years' Experience With an Automobile in North Carolina.

By W. P. Whittington, M. D.

While Asheville is widely known as an all the year health and pleasure resort, I wish for the benefit of those who are not familiar with its geographical situation to give a short description of it and surrounding country, because the character of roads and their grades should play on important part in the selection of an automobile for business purposes. The runabout automobile or two passenger car is pre-eminently the business man's car, and is expected to do service on all kinds of roads and in all kinds of weather. That being the case, one kind of car would suit a level country with well made roads, while a hilly country with badly made roads would require an entirely different car, or one with a great deal more power.

ROAD CONDITIONS.

Asheville is a city of 25,000 inhabitants situated in the mountains of western North Carolina, and has an elevation of 2,250 feet above sea level. In the city proper we have many miles of well paved streets, the material used being cobble stones (only a few), Belgian blocks, vitrified brick and bitulithic concrete. The brick and bitulithic form the larger part of the pavement. The grades of our paved streets run as high as 15 per cent., while there are many short places on our unpaved streets where grades will reach 30 per cent. or more. In the country outside of the city we have about 60 miles of stone roads, with very few grades over 10 per cent. The fords in this county are mostly supplied with good bridges, but when we have to go out of the county we often have to drive through streams that, if all swollen by rains, are impassable. This, however, does not often occur, or at least the streams having a rapid fall do not remain swollen for any length of time. When we leave the stone roads we have "mullato" clay mixed with small stones and gravel, with large stones and even boulders in many places. These dirt roads get wet very quickly, and where there is considerable travel the farm and lumber vehicles cut deep ruts and holes and make travel bad. While the dirt roads get wet quickly they also dry quickly, and a few hours' sunshine will convert a slippery, splashy road into a pleasant driveway. So much for location and roads. I want to state next that I am a physician doing a general practice, and that while my practice is mostly confined to the city I often make trips of 10, 15 and 20 miles in different directions. Being a physician, my business requires the use of my car at night very often.

A DETACHABLE TONNEAU CAR.

On August 9, 1905, I began the use of a touring car with a removable tonneau, which converts it into a runabout weighing 1,500 pounds. This car has two horizontal opposed cylinders rated at 16 horse power and is water cooled. The wheels are 30 inches, with 3 inch front and 3½ inch rear tires. I have used this car mostly as a runabout in my practice, but occasionally have taken short tours with my family and friends. I have driven it about 10,000 miles over all kinds of roads and in all kinds of weather. In the worst frozen or snowy weather, when it was next to impossible to use a horse, my car went over ice and snow with ease and safety. When the roads are very slippery with ice or mud I use tire chains. During all the three years I have used my car I have never failed to bring it into the city on its own power. I have had trouble certainly, but have always found a way out. In Novemebr, 1905, my crank shaft was broken, but I discovered there was something wrong, and ran it to the garage before it was entirely disabled. In 1906 the rear sprocket came off on account of the bolts that held it breaking, and the car had to be hauled about 100 yards to the garage. In January, 1907, the crank shaft gave way again, and I was fortunately within 200 yards of the garage. Once, when I had less experience than now, my car stood out in a very hard rain while I was visiting a patient and water got into one of the carburetors, and not having time to adjust it I called for help and was pulled in. These three times in the three years I have had to get extra power to bring my car home, and these were all short hauls.

WELL EQUIPPED HOME GARAGE.

I have had many of the little carburetor, battery, coil and spark plug troubles, as well as punctures and blowouts. When I was a new user I had to have a mechanic or man from the garage to do nearly all these little adjustments, but now I do most of them myself. I studied my car until I know its anatomy and physiology almost perfectly, and can make a diagnosis and apply the remedy more quickly and perfectly than I can with many of my patients. One of the first things I did when I bought my car was to equip a small garage with such tools and materials as are necessary to keep an automobile in good condition. The larger and more important repairs, of course, will have to be done at the larger and better equipped garages. I have a small vulcanizer, and by the help of my boy, whom I keep for general barn and kitchen work, I do all mending of inner tubes and vulcanize the cuts in the rubber of the casings. I find this a great saving of tires, as it keeps water and sand out from the canvas and prevents sand boils and rotting of the canvas. Patches put on with cement are all right to get home with, and will run quite a long time in winter, but when hot weather comes they will all come off and be the cause of ruining good casings by rim cutting before you can get home. To mend blowouts I find nothing as good and cheap as a piece of an old casing with the outside rubber cut away so as to make it thinner. A tire a size less is best, but an edge can be cut away and make a piece long enough to cover the blowout well. This piece should be tacked on each edge with a few strong stitches to keep the piece of shoe from slipping from over the hole. To mend a shoe when the wires cut through the edge of the casing a piece of thick chrome leather is the best material I have used. This can be sewn in by any shoemaker or harness maker, and will add may weeks to a tire otherwise useless.

TESTING BATTERIES.

In my early experience I had some trouble with exhausted batteries. I got an ammeter and now I watch my batteries, and when both sets get weak and give me trouble I connect the two sets by a short wire to each of the like binding posts on the batteries nearest the switch. This throws them both into series and will double the strength of the weakest battery, at least, and enable one to run home or to where he can get new batteries. This will hardly ever be necessary if we watch the batteries and test them with the ammeter when they begin to fail and reject all that register below 5 amperes. Unless the coils are good and the vibrators well adjusted batteries below 5 amperes are very uncertain and liable to stop you on the road. Vibrators should be kept regulated so as to consume as little current as possible, and platinum contact points should be kept smooth. The carburetors should be kept cleaned out and regulated so as to do the best work with a fully open throttle.

DISPENSED WITH HORSES.

In the early use of my runabout I kept one horse which I used when called over very muddy roads or into some of our mountain gorges. For a year now I have not owned a horse at all, and have paid a very small livery bill. By the use of my car I do not spend more than one-fourth of the time on the road, and, consequently, have more time for my office work, reading and "fixing the machine." Where one has to be on the road a great deal, in whatever business he may be engaged, a light runabout of 16 to 22 horse power is the most desirable means of travel. In the three years' use of my car I have not had a bearing renewed nor the valves ground. My car now has lots of power and can make nearly all of our grades on the high with a full load. One very important point about an automobile is the oiling. The first oiler I had was operated by pressure from the crank case and was unsatisfactory. I now have an oiler with gear pump, and it gives no trouble at all. While I have gotten a great deal of satisfactory use out of my car I believe the business man's vehicle of the future will be a high wheeled, solid tired, friction driven car of 16 to 20 horse power, made light and strong, and either water or air cooled, possibly with the two cycle type of engine.

Beginning August 9, 1905, the expenses of operating my car have been as follows:

August 9, 1905, to December 31, 1906—	
For gasoline, oil and repairs	$227.25
New tires and express on same	112.00
Express on new crank shaft	17.00
Repairing old tires and express on same.	16.80
Batteries	9.10
Total	$382.15
Average per month for sixteen and two-thirds months	22.92
From January 1, 1907, to December 31, 1907—	
For gasoline, oil and repairs	$122.75
New bushings	3.60
New crank shaft, drum and sprocket	31.73
New water tank	6.00
Retreading two tires and express	34.50
One new tire and express	30.27
Total amount	$228.85
Average per month for twelve months	19.07
Expenses from January 1, 1908, to August 9, 1908—	
Gasoline and repairs	$70.32
Tire casing and cover	36.20
New fenders	16.00
New intermediate gears	18.00
Reverse gear	5.50
Express	2.30
Total	$148.32
Average per month for seven and one-third months	20.22
Total for three years	$759.33
Average per month for three years	21.09

The above expenses do not include anything for my own time nor for the expense of keeping a horse or livery bills. I think that $4 per month would very nearly cover livery expenses now, but before I learned to care for the machine properly it would have amounted to more. I would not think of changing from an auto to the use of a horse.

The Runabout to Stay.

By E. A. Heermans, M. D.

In the year 1900 I began my automobile experience. How far back in the past eight or ten years seems to reach, when contemplating automobile affairs! In no other industry is the flight of time so accentuated as in automobile development. The progress has been tumultuous as a cascade since the first developmental stage began. Will we ever reach the deeper waters which are capable of achievement? I think so. At present there are many standard manufacturers who announce no change each year, and now is the time when the inexperienced can invest with the assurance that they are not purchasing an aggregation of experiments.

In the spring of 1906 I bought a 4x4 double opposed, four cycle gasoline runabout, with all metal body, which had so many things omitted which were not necessary that I became quite enthusiastic over it. No water pump to get out of order and menace the cylinders; no fan to be an eternal bother, a multiple disc clutch, and, in fact, all clutches in a prolongation of the crank case and floating in oil. All these things which a beginner would probably be talked out of sank into my soul, and I have used that little machine continuously ever since, night and day, in all kinds of weather. During the first year the expense was so small that I was ashamed to look a livery man in the face. The second year the expenses began to increase, and this year the expense account seems to have settled down to a definite amount.

A POWER TIRE PUMP ADDED.

Worn parts are replaced with considerable regularity, and the tire expense also is a dependable amount. Two years ago I installed a power tire pump, which, during hot weather, has made me grin until I fear my mouth is getting out of shape. I am absolutely certain that by keeping my tires pumped up to the proper pressure I have saved many dollars.

I have not kept an accurate account of my expenses, but my bills for new parts, tires and gasoline indicate an amount almost exactly equaling the expense of a horse and wagon. I have a fully equipped garage, 18x20 feet, with a cement floor and cement walls 3 feet high, and the remaining height of wood, and I am able to da all my repairing, and I really enjoy working on the auto as much as riding.

FORESTALLING TROUBLE.

The economical management of a car consists in forestalling trouble. It is so easy to avoid trouble, and so troublesome to repair a breakdown which might have been avoided. There is nothing mysterious or wonderful about an automobile. Get a full outfit of tools, and be prepared to repair anything from vulcanizing a tire to replacing piston rings or repairing a differential. After having made a repair once it is so much easier to do it a second time. Thus we become familiar with every normal and abnormal sound, and no irregularity, however slight, will fail to attract our attention, for did we not tighten that crank bearing once or twice before for just such a knock as that, and were we not expecting it to occur some time ago? And that popping sound! The cause was discovered before and the trouble easily remedied. The engine, which has been doing nicely all day, suddenly hesitates, gives a prodigious kick, apparently has an inward fit, and dies peacefully and apparently without a regret, and have we not seen this same phenomenon before? And did we not then climb out (oh! the misery of it) into a pool of mud about as thick as molasses, half the length of the block and just 40 feet wide, and which would have been wider if the street had been wider, and after walking round and round the machine for half an hour, suspecting everything which was not the cause of trouble, finally climb into the auto, and -and, finding the gasoline tank empty, thoughtfully walk off to the nearest plumber, half a mile distant, to buy a gallon of gasoline? The only redeeming feature of the episode was the fact that the ubiquitous, iniquitous, infernal small boy was not a factor of discomfort.

HORSESHOE AN EMBLEM OF ILL LUCK.

It requires a "courage of conviction" to boldly plow a sea of mud all day, with the engine puffing reproachfully and the clutches doing their utmost. And then there is before one's mind the fear of a threatened catastrophe in the form of an old horseshoe full of crooked nails, buried several inches below the surface, waiting for the faithful tire to meet its Waterloo. No driver regards a horseshoe as an emblem of good luck. If we care for our own machines we are absolutely familiar with the condition of every part, and we have our strong convictions as to what they can do safely, and can take them through ordeals safely where others would fail.

My experiences with the present style of runabout have made me resolve to never own a horse again. Anyone with a moderate mechanical capability can easily master the intricacies of an automobile. Let him procure a full outfit of tools and an hour a day on the average is all the time that will be required to keep a tireless power at his service.

HOW TO PREVENT BURNING OF CONTACT POINTS.

Like many others, I have been bothered by the burning out and cupping and ultimate sticking of the contact points of the vibrators in the primary circuit. This can be lessened, if not wholly prevented, by placing a drop of thin engine oil between the points of contact. This will immediately cause missing. Draw the corner of a small piece of paper between the points, leaving as much oil as possible without missing. At first a considerable flashing will occur, which will not interfere with the spark. This thin film of oil, though not enough to obstruct the current, dissipates the heat so rapidly that the metal is protected, and a more reliable spark is the result. Keep the oil from the threads of the screw. Renew the oil film every morning. This idea is worth consideration.

Much discussion has been going on for a long time concerning charge distribution in multi-cylinder engines, and many ingenious designs have been offered to produce a uniform mixture, and from the continual flood of designs I would infer that satisfaction has not yet been attained. Are there not other conditions in every multicylinder engine which vitiate the mixture more than a slight variation in the manifold? A multicylinder engine has the bottom of the crank case divided into shallow compartments for the purpose of retaining the lubricating oil for the respective cylinders. This is accomplished only in a measure. When ascending a grade about three revolutions of the crank shaft empties the forward compartments and the rear ones are flooded, and this condition is reversed while descending a grade. These conditions, however, are momentary, and do not disturb the quality of the mixtures, providing the cylinders are set level in relation to the frame, which is not always the case. The cylinders are generally allowed to follow an inclination toward the differential, and the near cylinder is considerably lower than the front one. The result is that the oil aggregates in the region of the rear cylinders, and those cylinders flood, when perhaps the front one will begin to pound from lack of oil. This condition can be proved by opening the pet cock in the cylinder heads after the engine has been standing for a short time. The excess of oil in the explosion chamber of the rear cylinder mixes quite freely with the gasoline vapor as soon as heat is generated and a more or less imperfect mixture occurs.

CORRECTING CYLINDER LUBRICATION.

I have a two cylinder opposed runabout, with one cylinder to the rear of the other. There was a continual difference in the power, the rear one being always the weaker. I have no room here to narrate the experiments I made. I finally criticised the manifold, and decided that mine was not a manifold blessing. A thorough deliberation convinced me, however, that such a slight inequality could not cause such a decided effect. I always found all the oil in the rear division of the crank case, and the rear cylinder was always prone to miss. I then shut off the oil in the direct feed to the rear cylinder, and allowed it to depend upon the splash altogether, with resulting increase of power, and no more misfiring; but the front cylinder soon began to pound as a hill was encountered. I had set the cams and the timer with accuracy, and I was at first puzzled. I finally concluded that the rear cylinder was robbing the other of the oil. I therefore nearly doubled the amount of oil to the front cylinder, and allowed it to feed the other one by splash. The pounding ceased, and my power is surely increased. By this means I get a similar mixture in each cylinder, spark troubles are gone, and sooting is alike in each side. In case of a multi-cylinder engine, each cylinder must be individualized when considering the lubrication, and the oil should be cut off just in time to prevent invasion of the explosion chamber, and every forward cylinder must be fed oil to the point of entering the explosion chamber if possible. In stationary engines this almost unsurmountable trouble does not obtain.

POWER REQUIREMENTS.

Now a final word for the runabout. A tallyho is all right when one is out for a good time, and darn the expense, and a coach and four may have its place with the rich quick; but what does a doctor, or a business man, a pater familias, or anybody but a sport want of anything more powerful than a good team of horses, and a one or two or three seated vehicle? What use has a doctor for a six horse team to pull him and his satchel around from house to house? Yet nothing but a 45 to a 120 horse power machine, weighing anywhere from 3,000, 4,000 or 5,000 pounds, with a speed of 60 to 80 miles per hour, will appeal to a speed crazed automobile suicide.

India rubber is an elastic composition, and we cannot materially change the nature of it. There is a limit to its endurance, and we *must* govern ourselves accordingly. When we load it down with 3,000 or 4,000 pounds the wear and tear increases in something like a geometrical ratio. Why have a runabout weigh more than about a thousand pounds? Four rubber tires can carry that weight satisfactorily, and a speed of 20 or 30 miles per hour is even faster than one can ride comfortably on an ordinary country road. The day of the juggernaut is passing, and the demand for a practical business proposition has come, and come to stay.

Pins His Faith to the High Wheeler.

By Dr. S. Harper Smith.

For practical use the buggy type of automobile for me. I drove low wheels and pneumatics a good many thousand miles in my practice, and I must confess I did not have a great many punctures, but I was always in dread of them, and a person might almost as well have them as to live in constant dread of them. And when they do come it is generally at an unpropitious, devil inspired time that requires a man to have a good firm grip on his religion to keep him from saying things sulphuric that would not look well in print. When the doctor receives a hurry up call to a case of convulsions, or a case where a child is "butting into" this world of trouble, and scenting a $25 fee in the farmhouse on the hill, if he finds a flat tire he is ready to yell: "My kingdom for a horse!" The buggy type is not the machine for the 25 to 50 mile an hour chap; he had better stick to the road locomotive, or get a flying machine and amuse himself dodging stars. An all day rate of 12 to 20 miles is fast enough for me, and when there comes a fellow in a bigger hurry than that I'll shy off the road like a scared mule and let him go by.

One thing I advise every man, viz., never buy a machine that has anywhere about its "innards" one of those cog chains known as the "silent chain." It may be silent all right, but the user thereof does not remain silent very long. Stick to the sprocket and roller chain if you believe in a hereafter.

A "KID LIFTER."

Every autoist knows what a nuisance the "tar-bucket kid" is. I have put on my machine what I call a "kid-lifter." I have no patent on the plan and anybody can use it. I traced the back of my machine with two small wires one-half of an inch apart, so that when a hand is laid on it completes a circuit, but nothing happens just yet. I watch my "bobbie" and keep on fishing. When I think the bunch is about ripe I press a button on the seat and the secondary current does the rest, and the crop of kids drops off like wormy apples. Surprised? Well, I think! Each one looks at the other, wondering how he was struck with lightning on such a nice, clear day.

After seven years' experience with the automobile as my professional steed I have come to the following conclusions: The man who has no mechanical "knack," or who does not know when he is abusing his machine, or who is afraid to soil his hands occasionally, or who is not able to keep a chauffeur, had better not buy an automobile. The man who is the opposite of the above can buy and use one with both pleasure and profit, and do his professional work in half the time it takes with a horse.

My ideal doctor's machine is about as follows: Weight, 800 to 900 pounds; 12 to 15 horse power, double opposed, air cooled engine; roller bearing high wheels; 1¼ inch solid tires; standard tread; sprocket chain drive to and from countershaft; buggy body and top; plenty of package room. With such a machine you can start out knowing that you'll get back free from care, like the sheep of Little Bopeep.

Among the Foothills of the Blue Mountains of Eastern Washington.

By E. H. Van Patten.

For seven years I have been driving a runabout over the hills of eastern Washington and have had some unique experience. I suppose that nearly everyone who began motoring as early as 1902 knows something of the difficulties which were then so abundant. The cars were small, low powered, of poor construction and not well suited to this particular section. When it comes to climbing grades which are from 1 to 7 miles long, and vary in steepness from 5 to 28 per cent., it requires the best construction and powerful engines.

This I did not know at the time, and bought a popular curved dash runabout, thinking that 4 horse power ought to carry me anywhere I wanted to go. I was soon undeceived. The gear ratio was too high for this country, being 3½ to 1, and in order to get more power I was compelled to purchase a new rear axle complete, as the rear sprocket was completely housed within the axle casing. However, when this was done I could climb the hills very well, but could not get more than 15 miles per hour out of the car on the level. The engine was a wonder to hold on to the steep grades after I thought it ought to stop, and in, in fact, the experience with a heavy flywheel and long stroke has impressed itself on my mind so firmly that I can hardly get accustomed to the way a short stroke engine will give up when slowed down.

AIR COOLING ON HILLY ROADS.

The little car did good service for three years, when I sold it to my brother, and am glad to say that he is still running it. However, I had such an experience with the engine overheating, with boiling water, with leaking pipes, with freezing water which had trapped in the radiator, and with fibre gears that I almost felt like giving up the automobile altogether. About that time I learned of the successful effort at cooling small cylinders with air, and jumped at the chance to get a new machine of that character. It came, it pleased and it conquered. I have now driven an air cooled car for four years, having now my second car of that kind, and am more enthusiastic than ever before. However, I also had to select a low gear ratio for the new car before I could make it climb as I wanted it to do. In fact, my experience has taught me that manufacturers have not paid enough attention to the gear ratios sent into hilly countries.

Three to one may do very well where the hills are far between and not long or steep, but in really hilly districts 4½ to 1 is almost absolutely necessary. The hills which can be rushed on the high gear are but playthings compared with what we have to contend with out here. The effort to increase horse power to such an extent that a car will climb a long steep hill on the high gear is an absurd proposition, and reminds me of the blindness of the farmer who, having one steep hill to climb on his way to market, must needs drive four horses where nine-tenths of the time he is not needing more than two. It is a waste of fuel and oil, gives a big repair bill, and causes the engine to run uneconomically nearly all the time, while its first cost is almost prohibitive. The experience gained by such trials as that recently held in Scotland, where so many big cars failed, some of them from too high a gear ratio, together with that growing out of the recent Glidden Tour, ought to emphasize this point beyond dispute. It is absurd to send out cars which are suitable only for city or boulevard driving, and that is exactly what most of the manufacturers have been guilty of in the past. That this will be corrected soon is probably true, and we will then get cars suited to the country to be traveled.

THREE SPEED GEAR NECESSARY.

Three or even four speeds ought to be applied to any car which goes into anything except a perfectly level district. Two speeds are all right in the city where hills do not abound, and the low speed is only used for starting, but for real touring more are needed. The reason is not far to seek. Real hill work cannot be economically done on the high speed, and the lowest gear should be used only for exceptionally steep grades or for starting. What, then, is to be done when a 12 per cent. grade is reached? Shall we use the low speed and throttle the engine down to 4 miles per hour? If we do we are wasting time, oil, gasoline and patience. When one realizes that most of the so called hills may be taken on an intermediate gear much more economically, both as to time and fuel, with less wear on the engine, we see one reason for its existence. I have found that most of the hills in this country are climbed with the intermediate gear, and it is a source of much satisfaction to be able to climb at the rate of 10 or 15 miles per hour rather than to dawdle away time on the low speed. It is also apparent to anyone with experience that the hill climbing gear, or so called low speed, can be still lower in a three speed car than when there are only two speeds. The difficulty encountered in getting into the high after the grade drops away from a stiff climb to an 8 per cent. incline, without the use of an intermediate speed with which to get up momentum, is apparent to one who has used a two speed machine. If, as engineers say, there is a certain speed at which the engine is at its best, why not furnish enough speed changes to always keep up to that notch? I am freely convinced that the European idea is correct in this matter, and that the near future will give us these needed changes.

I am aware that many of our big cars have three and even four speeds, but the runabout, which often has to do very heavy work, is too often crippled just here, and the remedy is so easy of application that one wonders why manufacturers have not given more thought to the matter.

MORE CARRYING CAPACITY.

An automobile of the runabout class will probably not have over 20 horse power at the outside within a few years. When that time comes the rumble seat will probably have become extinct, and more carrying capacity will be furnished than is now available. That is one of the greatest troubles with the runabouts of today. The space which is allotted to baggage is so small that we often see suit cases strapped on to the hood, on to the running boards or any other space which can be made available, to the detriment of the varnish, to the looks and to the convenience of car users. So long as fashion alone rules in the design of bodies, so long may we expect cramped baggage space. The runabout will be used by business men more than by any other class, and should be built for their convenience rather than for style alone. By the time the extra parts, tools and accessories are housed there is very little space for anything save one suit case, and then everything is very much cramped, and if an extra supply of lubricating oil or of gasoline is to be placed aboard it has to be placed under foot, to the detriment of clothing, and much to the inconvenience of the driver and his passenger. Where it is possible baggage now has to be sent ahead by train, in order to insure its being available. This condition ought to be remedied as much as possible, and I believe that it will be soon.

IMPROVED MATERIALS.

The advancement which has been made in the quality of material and workmanship which goes to the making of an automobile has been felt in the runabout class as well as in the touring car. I recently saw a touring car of modern design dismantled and had the pleasure of examining the gears of the change speed box, and to my astonishment I found that the tool marks on the teeth of the intermediate gears had not entirely disappeared, although the car had been run for three years over the long and steep hills of Columbia County. This was the more astonishing as it had never been in the hands of the ordinary repair man, and had been used a great deal. With chrome nickel steel in the gears we hardly hear of stripping or chipping from use, while it was at one time a most common occurrence. The engines of late cars appear to be standing the wear and tear better than the running gears.

As the speed craze dies down the necessity for excessively low wheels will vanish, and we will have more comfort in riding in the automobile than is possible now. I do not think it advisable to use as high wheels as have become the ideal for horse drawn vehicles, but do believe that 36 or 38 inches will become the standard.

DETECTING ELECTRICAL FAULTS.

It has been my experience, and no doubt others have felt the same, that there are times when electric troubles were very puzzling and cause annoyance while on the road. When the car stops it often becomes quite a question as to just what is the trouble, and a careful search has to be made before it can be located. Often several things are tested before the difficulty is remedied, and much valuable time is wasted. I have found a way of expediting the search which will help anyone out of most of such troubles, and it is very simple, as most of such things are. I placed a combined volt and ammeter on the dash of my car, fixing them so that when the switch was turned on it placed the voltmeter across the terminals of my battery, thus always showing its condition. If there is any break in the wiring to or from the battery, or within it, the voltmeter will show no current. If the battery becomes short circuited the voltage will at once show it when an attempt is made to start the car. The amperemeter, being connected across the coils, is used to adjust the vibrators, and thus makes for economy in the use of current, and also shows any disturbance, either in the connections to the timer or in the secondary wiring or spark plugs.

To show how it works I will say that, while on a trip to Starbuck this spring, which is about 20 miles from here, I became satisfied that I was not getting the full power from the engine, and started in to see what the matter was. I soon discovered that the needle of the amperemeter was acting queerly. It would jump clear across the dial, and when I tested each coil separately I found that his occurred only in the coil of No. 1 cylinder. I found that a small piece of carbon had lodged between the points of the spark plug and was causing a short circuit in the secondary. It was the work of a moment to remove it, when the needle at once became quiet. If I had not had the instrument I should probably have had to run home on three cylinders, and as there was a bad hill ahead of me, I might have had to send for help. It has proved of so much advantage that I would not part with it for five times its cost, if I could not get another one. I was not over five minutes finding the difficulty and remedying it. The satisfaction one feels in knowing just how his ignition devices are working, and the close tab he can keep on his reserve battery power, is worth far more than the little current that it takes from the cells. The factory claims that it uses about one hundredth of an ampere when in circuit, and that is so infinitely small that it does not make much difference in the life of the cells. It is a wonder that more of them are not used.

ROAD COURTESIES.

One matter occurs to my mind which has a bearing upon the life of an automobile, and which furnishes food for reflection. It is the fact that most of our drivers are young men, possibly because these young men have more initiative than the older ones and have not developed that conservatism which seems to go with age. May it not be that this has an effect upon the character of their driving? Those concerns which are using the taxicab in our cities say that the old family coachmen make their best drivers, because they are perfectly familiar with the courtesies of the road, and are naturally more cautious than younger men. I believe that in this fact is to be found the reason for much of the dangers of automobile travel. The younger men do not start out with that knowledge of the rights of others which they ought to have, and therefore attempt things which a little foresight would have led them to avoid. The farmer's dislike to the new means of locomotion has undoubtedly been fostered by the unthoughtful, discourteous acts of inexperienced young men. It makes no difference what kind of a rig a man is using, he is entitled to courteous treatment by every one else. I have found, however, that the road hogs are not all automobilists. Some who drive teams are as bad as anyone can be.

Remarkable Tire Endurance.

By Thomas Walkup, M. D.

In May, 1903, I purchased a 1903 model curved dash runabout. It was the first gasoline automobile in Shelby County, Ohio. I received no personal instructions, but read up on the subject, and followed the book of instructions to the letter. Have used the little car in my practice day and night; also for pleasure when the roads were in condition. I wore out and replaced front and rear sprockets the first two years. The little car weighs 1,000 pounds with tanks full, and was equipped with single tube, 28x2½ inch, tires when I got it. I have added five more since, at an average cost of about $16. Out of that number I still have two tires that are in first class condition, while three others are in good running order, but considerably scarred up. What I consider the most remarkable thing in my experience is that I have had but one puncture in all these years. A small piece of copper wire was found sticking in the tire. My tires simply wear out and blow up in the end.

In the Service of a Factory Engineer.

By A Rural Subscriber.

I am driving the same runabout for business purposes only for the fourth year, and I am likely to drive the same for the next four. It is of a model now out of date.

I live in a vicinity that is very hilly; nearly all the streets of the town are steep, some scarcely suitable for horses. When I go out of the village and return home I have about 1½ miles of hill to climb continually. When I first drove the machine I had continual trouble, but since I have learned the different mechanisms thoroughly I have had no trouble, and now I can go where a horse and buggy can't. In learning I examined each piece of the machine and tried to see what each is used for and why made in its shape; if I can improve on any detail I do so as soon as I can. In thus knowing each piece I learn to care for each and better anticipate any likely trouble and facilitate the discovery of the cause of any trouble when it occurs.

The machine is heavy and strong, and with the constant watch I keep on it I cannot see but that it is just as good as when I first had it, except for the tires. The machine has a 5x7 inch cylinder, which is hard to start and crank. The transmission is planetary, makes much noise and scatters much oil. Steering is direct by wheel. Speed changes are made by one lever on the steering wheel. Reverse is by the right foot pedal and braking is by the left. Ignition is by make and break mechanism, and gives little trouble. Cooling jacket water is circulated by a geared rotary pump through a tin radiator into the tank. Tires are 30x3 inch clinchers, artillery wheels with plain bronze bearings.

MORE CONVENIENT THAN A HORSE.

Not so fortunate as most people in physique, and doing the duty in a manufactory anywhere between the day laborer and superintendent and chief engineer, I have found the machine a constant help and comfort. The care and expense of a horse makes it out of question. I owned and used a nice intelligent horse for a couple of years, but the constant care it needed, often at a time when I was tired and needed care myself, together with the expense for grain, hay, bedding and shoeing, makes it, in my consideration, much less desirable than a machine. The absence of cruel urging on on long journeys and under trying conditions, the comfort of caring for myself at the end of a journey or a day's work before the necessity of caring for the conveyance, and the time you save in covering distances make the machine much better than the horse. I think my machine costs only a small fraction of a horse. I regret that I have not kept account of oil and gasoline, but as long as I knew that I could average about 7 miles or more per gallon of gasoline and more than 200 miles per quart of oil, I did not think it important to keep account of these items.

The oiling is by gravity, through tubes to the cylinders and all bearings, from a small tank on top of the engine. Drops are wiped off into the feed tubes from depending pins dipped in the oil. The apparatus is belted to the cam shaft and never gave any trouble, and I have lost only one belt, which was temporarily replaced by a string. I can recall having had a hot bearing only once, when somehow, after an expert had visited me, one of the feed pipes was stopped with waste.

PRIMING ARRANGEMENT ADDED.

The first trouble I had that lasted long and was laborious was difficult starting, which all experts said was in the adjustment of the spark apparatus, but I always noticed that after the expert had finally started the engine and made his adjustment over and over again the spark adjustments were found in their original places. Finally, I had a pet cock tapped into the hand hole cover of the cylinder head, and through it I primed the cylinder with a little gasoline, which remedied this trouble.

The next trouble I had with the gasoline feed. The engine would either stall at slow speed on hills, or race like mad every time when unclutched, so that street arabs would yell at me, "Say, mister, you are shaking your hind wheel off," or else, where I was stalled uphill, you would hear the familiar "Get a horse." I found the carburetor was not automatic. It has only a spray nozzle projecting into the inlet pipe. The level of gasoline in the float chamber governs the amount of spray. The arrangement cannot be adjusted for all speeds, but there is a little priming pump which can be reached through a hole in the floor. By tapping a cap screw into the head of the pump, the screw protruding above the floor, I am enabled to adjust the inlet for high speed and supply the gasoline at slow speeds by pumping by foot.

SPRINGS GAVE TROUBLE.

The springs were very stiff and hard riding, and after breaking both hind and one fore springs a friend made me a present of four pairs of spiral auxiliaries, and they proved a great comfort and stopped further breakage. In connection with springs I might mention that the manufacturer or his agent asked $10 for one rear spring, but a wagon supply house made me one for $2 and another for $2.50, making each five leaves instead of four. The spiral springs were fine after they were fitted, and hung to stay in place, but I pity the man who buys a set expecting to put them on as a tire would be put on.

Up to this time I had done most of the work myself, except on one occasion. This was after the first winter when, after repeated laborious effort, the motor refused to start. The manufacturer sent an expert to my house while I was away, and after some oiling and adjustments left a good bill and word that the machine was all right. The first real repair job was when the transmission ran hot and more noisy than usual, and would drive forward when unclutched. The transmission was so assembled that part of it had to be broken open to take it apart. Some gears were spaced apart by bronze washers, a key was renewed, oil holes were enlarged and oil grooves were provided, and I have had no trouble since. The manufacturer wanted 75 cents per hour for doing the work, and would not do it by the job, so I took the broken casing, patched it with old belting and sealing wax and sent it to the foundry as a pattern for a casting and a machinist finished it in three hours.

BEARINGS MADE ADJUSTABLE.

During the first year I found the crank bearing had no means of taking up wear, so I had it dressed and brass liners inserted, so that from time to time I could "key up" the engine as is done with steam engines. After the second year there was much knocking and more noise in general. I heard that an expert on this special machine was in town, so he spent half a day on the machine, and when he left in the early evening he said everything was all right. I drove him to the railway station and a few miles more. I noticed the machine ran very stiff. Before we started home everything was hot, including the brakes. I found that the expert had lengthened the chain adjusting rods and forgot to lengthen the brake rods. After undoing some expert adjustments and clearing the oil tube I drove home. I found the chain had stretched out of pitch nearly one-quarter inch per foot, and the main bearings had worn out of round. I bought a new chain from the manufacturer direct, and had the bearings shimmed with sheet brass and rebored.

TIRE KINKS.

As to the tires, I have had very good satisfaction with a certain popular make. I never cement patches, but always vulcanize them. I sent to the tire makers for crude sheet rubber, and obtained from them the temperature and time for vulcanizing. I can easily obtain and maintain this temperature by a common alcohol or gasoline torch, Bunsen gas burner or electric heater. I first learned how to patch tubes and seal cuts myself, and then I taught a boy to do it. Now I not only keep all cuts sealed and clean and heal sand blisters, but also patch blow-outs. I do not go to the expense of carrying an extra tire, only extra inner tubes. If I get a puncture I change tubes and place a piece of thin, strong rubber packing between the tube and punctured casing. When I reach home I vulcanize both tube and casing. If I get a blow-out I do the same, and wind a trunk strap smoothly outside the casing before pumping very hard. Wide belt lacing, the gray anhydrous kind, is also very good for the purpose, and, together with a small harness buckle, costs almost nothing. Tube patches can be easily made from pieces of old tubes, which must be of very good quality. Bevel the edges by holding on a piece of wood and grinding on an emery wheel. A boy will make more in an hour than you can use for a year. Keep them in a Mason jar for use. To patch a blow-out I clean the cut thoroughly, preferably dry, not with gasoline. Cut away all ragged edges, flay or score the ragged edges of rubber, then cover the whole cut on the inside with a piece of heavy cotton duck; cement this patch on firmly with vulcanizing cement. Have a shoemaker sew this patch like a quilt clear through the tire. Now fill out the scoring with crude rubber, covering all stitches, and vulcanize. The vulcanizing can be done in place, partly blown up or over a block. This block may be easily made by filling a section of the casing with plaster of paris. Do not forget to dust thoroughly with talc or soapstone powder previous to filling.

FROM BATTERY TO DYNAMO.

My ignition troubles were few and were soon over. The first trouble was with dry batteries. The first new set of six I bought for a reserve gave out after running about 1½ miles. Then I carried a bottle of dilute sulphuric acid as a reserve beside the second set, and when neither set would go I would bore a hole to the bottom of the cell and pour in all the acid the cell would soak in. That would take me home or to the nearest supply house. I soon bought a dynamo and hung it on a flexible bracket to adjust for friction drive; then I obtained a storage battery to go with it. This was all during the first year I had the machine, and have had no trouble since, except at the end of the third year, when the engine kicked back. I found it was due to the wear of the bearing of the spark mechanism, and after making a washer, a brush and screw, it worked all right again. The washer gave me trouble the first trip. The whole spark mechanism was mounted on a bronze plug. The shaft of the hammer went through this plug with a running fit. When this was worn I had to pack it with a washer. This washer I made of steel, and made it a snug running fit. The engine would start all right, run a little while and then stop. I would examine everything and then start again and repeat the same process. I finally traced the trouble to this washer, and found that the bronze plug expanded when heated by the engine .005 inch more than hammer shaft, jamming same. I put the washer on a surface grinder and ground .005 inch off and thus overcame the trouble.

Aside from adjustment to and from the flywheel the dynamo has required no attention and given no trouble. The only time the storage battery gave trouble was after I ran over a big dog, when the battery jumped out of the box and rode on its side the rest of the journey.

SALT SOLUTION FOR COOLING.

The water cooling system gave trouble only in winter when frozen. Somehow I could never drain the system dry, and in consequence there are many soldered places in the system. When you have to do much soldering it is better to wind bare copper wire over the wound first. Last winter I tried forty grains of salt in the water per ounce and neutralized the acidity with sal soda. The solution did not injure anything and stood all last winter's cold. I took a bottle of the same mixture and placed in it pieces of brass, steel and cast iron, part finished and part unfinished. I put the bottle where I could watch it constantly, but where it was more exposed and several degrees colder than the machine. In the coldest weather there were thin crystals in the bottle, but not enough to do any harm. No bad effect was produced on the metals, except on the brass, where the soldered places corroded if partly in air and partly in water. I will use this mixture every winter hereafter.

GUMMED PISTON RINGS LEAK.

Once I was away from home for three months, and after my return the engine suddenly lost all compression. An expert advised a new set of rings, but I found the oil had gummed in such a manner that it prevented the piston rings acting properly.

The second summer I tried buying gasoline by the barrel. I found that the evaporation, carting and the cost of the barrel came to considerably more than the difference between the wholesale and retail price, so I gave it up. The risk of a barrel of gasoline about the ground is something, too. In the fourth year I found all the bearings well worn, and I renewed the main engine bearings, bushed all the steering column bearings, took up the wear of all the steering parts, bushed all the bearings of the rear axle and renewed all the studs and pins that were worn. I am now trying a pair of solid tires. Let me warn anyone against trying to place them on clincher rims.

PRIMITIVE HOUSING FACILITIES.

I am living in a rented house in the country the year round, and have no steam heated garage to keep the machine in. In fact, I have to put up with a dirt floor and a leaky roof, but I get along very well by covering the machine with a heavy duck cover every time it comes in, and I also laid a plank walk on each side of the floor for the wheels to rest and run on.

Though the reputation of my runabout has always been that it was no good at all, I have driven it thousands of miles with two adults and two youths in it, and three times as much with two, and have never had an accident or been towed.

The above goes to show that an automobile, to be a real help in everyday life, does not need to be a luxurious equipage, if a man has some fondness for mechanical things, a little common sense and a good stock of elbow grease, and last, but not least, some independence, so that he does not mind the jeers of either the street corner hoodlum who yells "Get a horse," or the raceabout hoodlum who yells "Get out of my way, you old junk shop."

In conclusion I give you the cost of upkeep for my car for four years, with the exception of expense for oil and gasoline. Nothing is put down in this list for my own work or the materials I used for repairs, as the latter were obtained from scrap:

Maintenance and addition to lamp outfit, including carbide	$10.76
Maintenance and addition to tires	56.61
Maintenance and addition to body, including canvas cover	17.65
Maintenance and addition to engine and running gear, except auxiliary springs	65.30
Maintenance and addition to ignition system, excluding storage battery	22.83
Visits of two experts	16.15
Licenses	18.50
Miscellaneous, including auto literature	10.73

The Auto and the Commuter.

By S. Duncan Black.

In April of 1905 I became infected with the motor germ and purchased a light air cooled buckboard to use between the railroad station and the farm, a distance of about 3 miles, over a route composed partly of worn out turnpike and partly of a country road that is pounded full of holes by heavy cotton mill teams and which runs over a long hill, necessitating a grade of about 18 per cent., freely interspersed with water breaks.

The writer's business being in the city, a daily round trip on schedule time to the railroad, regardless of weather conditions, is necessary from the 1st of April to the 1st of November.

BUCKBOARD STOOD UP WELL.

The little buckboard stood up very well for the one season during which it was used, considering the extremely uneven surface of the roads, the only break of any importance being that of a rear spring and the snapping of the rear axle at the hub while speeding for the train one fine morning over the thank-you-marms, which accident, besides causing my passenger and myself to miss our train, necessitated recourse to the old reliable hay motor and a fence rail to hold up the disabled axle.

On another occasion, the right hand section of the live axle came loose from the differential, allowing its wheel to run out while descending a hill, the only brake being on the differential drum. The machine was absolutely out of control and the only thing to do was to let her go until the axle ran all the way out of the tube and dropped the crank case of the engine down into the road, which brought things to a sudden halt, without serious damage, however.

On another occasion we were caught in a cloudburst, which washed away bridges and flooded the road to a depth of 18 inches. We plowed through this until the secondary wiring became short circuited, and we were obliged to abandon our rig and walk the balance of the way home, which misfortune, however, saved us from running into a stream in the dark where a bridge had washed away.

This little machine was cheap to operate, costing me about 40 cents per week for gasoline and oil, and as all repairs were made by myself my upkeep expenses were practically nothing. After running this machine for one season I gave it a thorough overhauling and revarnishing, and by raffling it off at the local show I received exactly $15 more for the rig than I paid for it.

PURCHASED A TWO CYLINDER CAR.

Thus encouraged, I played the game heavier and purchased a slightly used two cylinder, opposed, 10 horse power, shaft driven runabout or speedster. I soon found that this machine was never intended for country use, as it was under powered for anything except the best roads. I accordingly ordered a 4 to 1 bevel gear and pinion to replace the 3½ to 1 ratio furnished with the machine. This change was made on the farm under some difficulties, as the parts did not fit any too well, necessitating considerable scraping and fitting. I also made and replaced at the same time a ball thrust bearing which was found to be broken.

This change made, I got decidedly better results and was able to negotiate a fair grade on the high and still had more speed than the road conditions allowed.

My next purchase was a leather top and full set of curtains, which made my daily trips much more comfortable in bad weather.

HEAVY GRADE A STUMBLING BLOCK.

I soon found that it was impossible to climb the 18 per cent. grade in wet weather without tire chains, owing to the majority of the weight being carried on the front wheels instead of on the drivers, where it should be. This trouble had never shown up in the buckboard, owing to the better weight distribution.

I also soon learned that it was dangerous to attempt to climb the 18 per cent. grade with less than 3 gallons of gasoline, as the tank and carburetor were so arranged that the grade prevented any flow with a smaller quantity; this trouble was remedied by more direct piping, cutting out about 3 feet of useless pipe, and lowering the carburetor with reference to the tank.

The following winter the machine was taken apart and thoroughly gone over, and the engine, clutch and transmission were found in excellent shape, owing to the three point suspension and having all parts enclosed and running in oil.

Another glaring deficiency was remedied at this time by placing a substantial canvas apron under the engine and transmission, thus excluding the majority of the mud and grit so destructive to machinery. At the same time I built a luggage carrying compartment on the back and touched up the paint and varnishings.

SEEKING COMFORT ON BAD ROADS.

Having thus gotten the machine in pretty businesslike shape, I set about to search for a little comfort, as this machine was a notoriously hard rider, having only half elliptics front and rear, a construction that may be all right in France, but never in this country, which requires the longest possible range of spring action.

As full elliptics were out of the question without putting on distance rods and torsion resisting members (which functions are all performed in a way by the half elliptics), I was about to try the supplementary spirals, when the makers informed me that they had succeeded in obtaining or developing the easiest riding spring ever brought out, so I purchased a pair for the rear, and they were certainly all that could be desired; I never dreamed that there could be such a difference in two springs of practically the same dimensions; but my comfort was not to last, for in a short time they began to take a permanent set and I was obliged to make and put on a pair of bumpers to prevent the body from pounding the differential case to pieces. Coming down on the bumpers at every water break was not very pleasant, and I remedied this trouble by taking one leaf from my old springs and strapping it on top of the new springs near the end of the leaf; this, however, brought back the old hard riding qualities which I am now enduring.

THOROUGHLY RELIABLE.

This machine has now been making daily round trips for three seasons, and is so reliable and dependable that I do not remember missing my train once during that time. The closest call was quite recently, when one of my rear tires picked up a large cut nail, but, fortunately, I was well supplied with a new form of collar button shaped rubberized rivet that is pushed into the puncture in the inner tube and then squeezed together tightly, closing the opening. This method of repairing is much quicker than changing tubes and much more reliable than patches, and goes a long way toward eliminating the evils of pneumatics.

My usual time for this trip is about fifteen minutes, but I have made the run in nine minutes in good weather, and were the road good five minutes would be ample. Under the old régime it required thirty minutes to drive, and someone was obliged to go along to bring the team home and come to meet me in the afternoon. Now I simply run the auto under a shed at the village church and it stays there until I am ready for it.

This machine costs me about 75 cents a week for gasoline, oil and batteries, and this is practically my only running expense, except for tires, one set of which will run me three seasons.

ALL REPAIRS MADE AT HOME.

I have had few breaks, the most serious being the splitting of the bevel driving pinion. Others included the cracking of the driving pinion bearing support casting, the breaking of the rear springs, etc. All of these breaks are directly traceable to the low gear clutch, which, in spite of every possible adjustment and manipulation, persists in suddenly seizing. All of the above breaks were repaired at home, in some cases with new parts obtained from the factory, my car having never been inside a repair shop since I bought it.

Excepting tires my greatest expense in four years has been the erection of a corrugated iron garage, 9½x14 feet, in my back yard, which cost me about $60. I could not afford to own a horse and buggy, for during the six winter months, when I live in the city, and have no use for a team, I would be obliged to board my horse, while, with the auto, it never eats unless it works, and during this period of idleness I make what repairs are necessary for the following season.

SOME IDEALS.

After almost four years' experience over our roads, I have naturally formed some ideals of what a car for this service should be, and I will enumerate them briefly, viz.:

First of all, the wheels should not be less than 36 inches in diameter, and I believe 40 inches would be better, shod with about 3 inch or 3½ inch clincher flat tread tires. It is gratifying to us countrymen to learn that the manufacturers are at last slowly getting away from the silly casters and are using wheels of respectable diameter that will not drop out of sight in every little hole in the road.

Second—The springs should be full elliptic front and rear, hung under the axles, and a drop axle used in front if necessary, to bring the centre of gravity low.

Third—A good four cylinder, air cooled motor, of 18 to 20 horse power, geared about 4 to 1 at the rear axle. Dome shaped cylinder heads finished on the inside, so as to make removal of carbon easy.

Fourth—Planetary transmission built in the same casting as the crank case, forming a unit suspended on three points.

Fifth—Magneto built into and forming part of the engine.

Sixth—Straight line drive to rear axle, with one universal joint and torsion tube.

Seventh—Two sets of brakes, internal and external, on rear hubs.

Eighth—Light steel body with light double rear seat, with baggage under same. Not necessarily a tonneau.

Ninth—Sheet steel pan under machinery, leaving absolutely no machinery exposed.

Tenth—Large light fender and running board, closed in solid to body all the way along.

Eleventh—Front axle placed forward of front end of bonnet, so as to better distribute the weight.

In many of New York's fashionable suburbs the evening trains bringing home the commuters are met at the station by numerous automobiles; in fact, more automobiles than horse vehicles can generally be seen at these stations. While the majority of the cars are touring cars, a not inconsiderable portion consists of runabouts. For such service the town car would seem to be the most suitable type, corresponding closest to the horse depot wagon type.

INTERVIEWS WITH PHYSICIANS AND OTHER USERS IN VARIOUS CITIES.

New York City.

That the automobile has a great many friends in the medical profession is a well known fact, and it is equally true that they have been the kind of friends that "stick closer than a brother" through thick and thin. From the time of the first little steamers the doctors, with an eye to the great possibility opened up of being enabled to make their professional rounds with more speed and convenience by motor vehicles than by horse drawn wagons, have encouraged the new industry by being in the foremost rank of the purchasing public, and by making it their business to thoroughly understand, care for and operate to the best advantage the gradually advancing specimens of the builders' art as these have been from time to time put forth.

So valuable have been the services of the doctors in championing and patronizing the motor industry, and, incidentally, so important are they numerically as customers, that it seems odd the manufacturers have not yet devised a type of car especially suited for physicians' use. The writer has received ample confirmation of his belief that numbers of physicians not yet owners of cars are watching and waiting for the right kind of vehicle to appear, when they, too, will swap feed bills for gasoline charges. What they want is a moderate powered, strongly built, two seat vehicle. No high speed is necessary, but the gearing should render it capable of any kind of work. It must have convenient lockers for carrying everything a doctor requires when visiting his patients. The construction should be of such character that, with proper upkeep, the car would remain in first class condition for at least five years.

The writer has talked this subject over with many physicians practicing on Manhattan Island, a number of whom have owned from three to a dozen automobiles in a corresponding number of years. These men have paid the closest possible attention to the development of the art, taking advantage of every improvement in construction where it promised to give them better service, and cheerfully plodding through all the vexations, troubles and delays which were their lot as pioneer users.

The absolutely unanimous verdict is that they could not now do without the motor vehicle, while doubtless there are physicians who regard their motor cars merely as vehicles to get about in, leaving their entire care to others, the writer has not met any of this class, but has invariably found doctors owning automobiles to be men who have taken pains to familiarize themselves with the mechanisms involved, who evince the keenest interest in the qualities of their cars, and derive pleasure from the operating and care of the machines. In view of the more than ordinary knowledge held, and large experience acquired by doctors who are veteran automobilists, it would seem as though, when manufacturers conclude the time has arrived to produce a motor vehicle particularly suited to the needs of the medical profession, their designers will do well to invite suggestions from members of that profession who are known to have given considerable thought to the subject. while the country practitioner may have requirements unknown to his city confrère, and vice versa, each is of a class of sufficient numerical importance to warrant its being catered for separately in some details, although the design of vehicle for both classes may have the same general characteristics.

Among the detailed experiences of New York physicians who are veteran users of motor vehicles, the following accounts will be found interesting, particularly as typifying the hearty manner in which medical men have adopted and clung to the new mode of making their professional calls:

SOLID TIRES UNSATISFACTORY ON COBBLESTONES.

Dr. J. Edgar Getman, of 240 West 139th street, has been a continuous user of motor cars since 1903, during which period he has had three different makes of gasoline cars. In the early days he was troubled with faulty ignition, but latterly has only been subjected to occasional delays from tire punctures. The doctor considers the tire part of the equipment to form the weakest feature of modern motor construction, and is considering ways and means by which he can attain the best service in this respect. To avoid punctures he tried solid tires for a time, but found, particularly when driving over cobblestones in some of the badly paved streets in the Bronx, that the vibration set up was bad, both for the machine and his own comfort. Dr. Getman believes he may find a solution of the tire difficulty by using cushion tires, and is now giving this subject his earnest atention, searching the market in the endeavor to find a tire of this type which comes nearest to meeting his ideas.

In keeping his hands clean the doctor finds the simple expedient of wiping off with a cloth the parts of the machine which he will handle in operating to be efficient and to obviate the necessity of wearing gloves in the summer.

Dr. Getman uses his car the year round, covering between 20 and 30 miles daily. He finds that the quality of the gasoline procurable is poorer than formerly.

MANY OLD CARS RUN IN PARIS.

While in Paris recently the doctor was struck by the fact of seeing a large number of old cars in the streets, which were operated by their owners apparently with the utmost equanimity, as though oblivious of any consideration that they might be behind the times, but satisfied that their machines were performing satisfactory service, seemingly quite content to roll along beside their friends who had more recent creations. He conjectured that perhaps the construction of these early French cars was of a more enduring character than that prevailing in America in corresponding years, shrewdly adding that the craze for changing last year's car for the new model may not be so strong there as it is here.

NEEDS EXTRA SEATING ACCOMMODATIONS.

Dr. Henry Weil, of 241 West 101st street, started using a steam car in his practice in 1903. He has since then had two different makes of gasoline vehicles. The doctor is now looking for a new car, and intends to get one, either with a tonneau or with a seat at the back, so that he can use it both professionally and in making pleasure trips. Dr. Weil has taken considerable interest in motor car mechanism, and from his knowledge of the subject has been subjected to very little inconvenience arising from troublesome delays of any sort. His principal trouble was with tires in 1906, in which year the makers of the tires he used turned out a notoriously poor product. The doctor has devoted some deep study to the subject of the internal combustion engine, and has directed his attention particularly to improvements in two cycle motors, in whose future he is a firm believer.

Dr. H. S. Bartholomew, of 152 West Fifty-seventh street, says he has found automobiles indispensable in his practice during the past seven years, and it is also his custom to take long pleasure trips with his wife, on one of these occasions going from New York to Boston in a day. He evidently obtains a good deal of enjoyment out of his cars, of which has had three. Regarding the tire question the doctor believes one is liable to encounter trouble only when inclined to save on the initial expense, it being his experience that with good tires there is litle or no trouble; but that if one is induced into the false economy of buying cheap tires, there is no one to blame but one's self if in consequence one is subjected to all sorts of annoyances and delays.

SPECIALLY VALUABLE TO A SURGEON.

Dr. A. B. Johnson, of 12 East 58th street, has been using automobiles in his professional work since 1901, in which time he has had five vehicles. The doctor employs his car continuously, averaging probably 25 miles a day. His practice is entirely in surgery, therefore necessitates prompt response to a call, and he is satisfied that by no other means of transit could he arrive at the patient's side so quickly. Whereas, on the occasion of a call to the New York

Hospital, in Fifteenth street, in the night, it would probably consume half an hour to cover the distance from his house if traveling by street car. Dr. Johnson says he has been able to reach the hospital within six minutes with his motor car, sometimes arriving before the patient has been got ready for the operation. The doctor drives the car himself, and, questioned as to whether handling the steering wheel in any way affected the steadiness of his hand in performing operations, replied most positively in the negative. The doctor does not operate upon the eye, but apart from ophthalmic work is frequently called upon to perform the most delicate operations known to surgery, requiring the utmost steadiness of nerve and hand, and he has never found his motor experiences to militate in any way against the accurate manipulation of his instruments.

CAR KEPT AT GARAGE.

The doctor keeps his car in a garage close at hand, where it is maintained in excellent condition, and always in readiness to start out with a turn of the crank. He wears gloves in driving, but says that in the early days, when he would attend to the car himself, he found it impossible to remove the semblance of dirt from his hands, as the grease would even get through gloves used in handling the parts. Tires have rarely given the doctor trouble when using his car in the city, and he is perfectly satisfied that he could not now get along without a motor vehicle. If horses were required to do the amount of work demanded by his practice their cost would probably be in excess of that incurred with the car, besides proving less satisfactory.

As instancing one advantage of the surgeon's automobile, when of sufficient seating capacity, the doctor cites cases where it has been necessary to take a nurse and an assistant, or sometimes two assistants, with him to the patient's house. He has even taken in his car an operating table in responding to a hurried call to a house in 125th street, where there were not equally prompt means of procuring one in the neighborhood.

Dr. Ernest A. W. Wilkens, of 284 Alexander avenue, has two early model gasoline cars of 1901 and 1903, which, he says, are both still in good condition, although he has not used them much lately, and he is, in fact, desirous of replacing them with a more modern car. The doctor denies that his cars have involved any considerable trouble in their upkeep and repair, and says he has suffered most of his trouble from getting into the hands of incompetent repairmen, who, in fitting a new crank shaft, forgot to make provision for lubricating the bearings. In consequence, after operating a short time, the shaft ran excessively hot, and what the doctor for some time took to be strange inefficiency of the cylinder proved on investigation to be waste of energy in turning the crank in tight bearings. Of course this was not noticeable at starting, when the bearings were cool.

On the subject of tires the doctor says he employed single tube tires at one time, and then had punctures frequently. He finally filled his front single tube tires with an elastic compound, and for his rear wheels adopted double tube tires, achieving good results with this equipment.

Dr. Wilkens is one of the earliest members of the Bronx A. C., and he deplores the fact that the club membership, which formerly numbered over sixty, has now fallen to about twenty. He is hopeful, however, that the club will build up again, as there is plenty of good material for members in the Bronx, and the doctor stands ready to do all he can to resuscitate its early strength and vigor.

Dr. E. V. Brenden, of 212 West Twelfth street, was the owner of an air cooled gasoline car which was destroyed by fire. He, however, fortunately had it insured, and was able to collect the insurance. The doctor has come to the conclusion that the best form of car for a physician is a small runabout, with solid tires, he having been a good deal bothered with delays caused by puncturing the pneumatics on his heavier car, which interfered with his business.

TOOK COURSE OF INSTRUCTION.

Before purchasing his car Dr. Drenden took a course of instruction at the Y. M. C. A., and commends very highly the manner in which persons are there taught to distinguish and comprehend the different parts of automobile mechanism, their various functions and how to care for and operate a car. The only part of the curriculum in which weakness existed was with regard to road practice. Through lack of machines students had very little opportunity to acquire that familiarity with the conditions of practical use under skilled guidance which is so essential a quality to the aspiring owner and driver. Perhaps this deficiency in practice automobiles at the school named has since been remedied, as the period spoken of by the doctor was some years back. At any rate, the doctor was very well satisfied with the training he received. The course included two lessons a week for three months; also a series of lectures during the same period.

PATIENTS OFTEN MOVE AWAY.

Dr. C. J. Mooney, of 44 East Sixty-third street, operates a 16 horse power runabout which he has had for three years, in which period he has covered about 30,000 miles, counting about 20 miles a day in his professional work and many pleasure trips on which his wife has accompanied him. In his touring he has been through the White Mountains, the Green Mountains and quite extensively through the Eastern States generally. The doctor believes that for his combined business and touring service he has about as useful a car as can be had, and he values and cares for it accordingly. When touring he finds ample space behind the seat for an improvised receptacle for baggage and suit cases. Dr. Mooney takes a lively interest in motoring, which to his mind has added a new zest to life. Referring to one of the advantages of the motor vehicle for physicians, he said: "Any physician who has been a number of years in practice in New York finds his patients scatter, and while they may not call upon their old physician for every little ailment, will rely upon him for consultations and in serious cases. Then it may be a hurry call right across or at the other end of town, and the auto affords the quickest means of getting there."

A BELIEVER IN AIR COOLING.

Dr. L. Stieglitz, of 60 East Sixty-fifth street, has had two air cooled cars. The first one gave him a great deal of trouble. As the doctor says, "everything went wrong except the steering gear, and the manufacturer charged heavily for all new parts, including new crank shaft to replace the old one, which broke through being of defective material."

The second car has been in striking contrast with the first, for this, a 20 horse power runabout, is now beginning its third year's usage, having run 14,000 miles in two years, giving the utmost satisfaction. Dr. Stieglitz uses his car every day in his practice, winter and summer alike, except for two or three weeks in the summer, when he has the car thoroughly overhauled. At these times worn parts are replaced from the factory, the manufacturer responding promptly and charging moderate prices. The car receives careful attention at the garage, and by the proper system of repair employed the owner expects to maintain the car in good serviceable condition for a number of years. The expense of upkeep the first year was $1,000, including $40 a month for garaging, which is now less. The doctor believes that by using horses the cost would not be much, if any, less. Under no circumstances would he change back to horses. His garage is only two blocks away, and the car is always ready when he gets there to just crank the engine and start out.

BOTHERED BY SMOKY EXHAUST.

Dr. Stieglitz is a firm believer in the air cooled car for physicians' use, because with this type of motor there is no jacket water to freeze, which in winter he thinks is a very important consideration. The only trouble the doctor experiences is from the smoky exhaust with which the engine is afflicted. This is quite a considerable annoyance on account of the doctor's residence being contiguous to Central Park and his frequent occasion to go in and through the park to reach the West Side, because of the recent ordinance barring smoking cars from Central Park and his inability to correct the evil has become a matter of serious moment to him.

In seeking to correct this fault the doctor has tried all sorts of carburetor adjustments, and has also used different kinds of lubricating oils, but all without success. Just as soon as the engine is speeded up, as when taking upgrades, the exhaust will emit a foul smoke of incomplete combustion. The park police are quite rigorous in the enforcement of the anti-smoke ordinance—and it is a wise regulation on behalf of the public—but until a way is found of completely burning gasoline over a wider range of its admixture with air, or of improving carburetion generally, the doctor, in common with others, will have to suffer by being kept out of the park.

Dr. J. A. Bullinger, of 1031 Madison avenue, is a warm adherent of the motor car for physicians' use in getting about. He has had three cars of two well known makes, using his car all through the year, and finding it serviceable under all conditions of road and weather. In the depth of winter he finds that by placing a solution of glycerine and alcohol in the circulating water this is prevented from freezing. Although the alcohol soon evaporates from the mixture, the glycerine alone serves the purpose, provided it is not put to too severe a test. As the duration of his visits is usually not over fifteen to twenty minutes, the doctor with these precautions has not been troubled by freezing of the jacket water. In the coldest weather he makes a practice of throwing a blanket over the radiator and hood while the car is standing.

Dr. Bullinger believes that the doctors' ideal car has yet to be designed. He said: "You don't want a 40 horse power car, nor yet a large, heavy car. What you want is a light, sturdily built runabout, with a wheel base of 90 to 100 inches, and which will turn readily in the street with one swing. The car should have a removable rumble seat and should be adapted with ample accommodation for all instruments, medicines, bandages and appliances a doctor needs to carry; also a locker in which to keep such clothing as he may require." Such a car, the doctor thinks, could be produced to sell at $2,500, and it should be so built that it could be guaranteed for five years.

The doctor says that he could not now get along without his motor vehicle. That although the trolley cars in Madison avenue are frequent and move swiftly, the automobile is as rapid, is not subject to the delays the street cars have in stopping for passengers, and, moreover, takes him through side streets and from door to door.

OWNED THIRTEEN CARS.

Dr. J. George Sauer, of 1500 Washington avenue, is a most enthusiastic votary of the motor vehicle, having owned thirteen cars in the last ten years, including steamers, electrics and gasoline cars. He is now waiting for the next automobile show before selecting another car.

Dr. F. E. Lawrence, of City Island, adds his testimony by saying that he visits all his patients throughout the year in his motor car. He has had two different runabouts, and finds he can get about expeditiously and with very little trouble.

Of a number of other physicians interviewed no one having given the motor car a fair trial would abandon it for the horse, and, as before stated, all have taken a more or less keen personal interest in the mechanical side of the subject. One doctor met was found to have fitted up a laboratory with tools for making experiments, and had devoted years to working out problems in ignition, and uses his high powered car in testing apparatus pertaining to that branch of the art.

Another physician whose practice in New York is entirely in office consultations keeps a motor car at his home in the country. His wife, who is in a chronic sensitive condition, due to the effects of an internal operation, uses this car, a light steamer, continually, suffering no ill result, because of its easy motion and the lack of vibration, while, as the writer was assured, she would not be able to endure the vibratory action set up in a car whose motive power was derived from an internal combustion engine.

GENERAL VIEWS.

The testimony of New York physicians presented as to the utility of the motor car admits of no doubt remaining that it admirably fulfills the function of a conveyance. The inquiries were made of doctors who have given the automobile sufficient test to know whether it is a good substitute for the horse, and they one and all seem to regard it as the logical successor to the horse. While they may hold different ideas on types of engine, features of construction, tires and various other details, all are agreed that the means of locomotion of the future for their purposes must be by mechanical power. If it be argued that these doctors are enthusiasts, then it must be pointed out that they are practitioners with many patients in their care, and that they have found themselves for years past able to discharge their duties toward those patients, using their motor cars in their daily visits, at least as satisfactorily as by horse and buggy.

Albany, N. Y.

B. E. Marshall, M.D., of 168 Central avenue, bought a four cylinder runabout one year ago last February. With accessories it cost $925. Dr. Marshall said: "That car I've run every day since I bought it, except for a week when it was in the paint shop. I've had but two punctures, and I broke my gas lamp just after I got the machine, but have had no other accidents. I've never been towed home during that time, and have never had to send for a mechanic to make repairs to bring me home. I average 17 or 18 miles to a gallon of gasoline. I've gone between 4,500 and 5,000 miles since I had it.

"You understand, I've been running my machine all winter, but my expenses for repairs were no greater during the winter months. I have run the machine easily through snow a foot deep, in the city and outside of it. Of course, after snow becomes packed going is much harder.

"I consider that my machine is in better condition and runs more smoothly now than the day I got it. I had my piston rings out two or three months ago, and you couldn't see the slightest wear. I've had a mileage of 2,437 on one tire casing, a right forward, and it's probably good for 5,000 miles yet, perhaps 6,000.

"I wouldn't consider a horse and wagon in the city for a minute—or the country, either—at any time of year, unless you can get a worse winter than last winter, which I guess you can't.

"The great point is the saving in time effected, which is very necessary for a physician, and gives one some time for recreation, which the use of a horse would not permit. The second thing is from the humanitarian standpoint. You cannot always leave a horse, and you hate to see him in the cold or tired out. An automobile has no feelings. Another point is that of sanitation. Now most of the street filth is produced by horses. It blows around and we are forced to breathe it in. Undoubtedly considering the mileage obtained and the saving of expenses for a man, if you drive your own wagon, the expense of the runabout will prove considerably less than the maintenance of a horse and wagon.

"The total expenses for maintenance, repairs, new parts and attachments during fourteen months of usage of the machine were at the rate of $25.41 per month, as against from $30 to $35, which the owner figured as the expense of a horse and carriage per month, exclusive of the cost of a stableman or boy. The comparison is not fair, however, as the owner pointed out, because only a small proportion of the above was for necessary repairs and maintenance. Not including gasoline expense the expenses during six months for maintenance were: February, $3.51; March, 25 cents; April, $4.63; May, $4.88; June, nothing; July, $1.65. This yields an average of slightly over $2.48 per month. The six months selected are fair and typical, except that they occur during the last few months of usage, which would be supposed a disadvantage.

Dr. H. L. K. Shaw, of 208 Washington avenue, who had always been prejudiced against a gasoline machine, bought a four cylinder runabout with coupé body last March as an experiment. He declares that it has given such good satisfaction that he has decided to sell his horses and buggies. The total cost he has found a good deal less. Formerly he figured an expense of $25 per month for horse and carriage, $16 to $18 per month for a boy, $5 to $6 per month for horse shoeing and incidental expenses for carriage repairs, etc. The machine has cost since purchase an average of $10 per month for garage care, and $9 to $11 for fuel, oil, etc. The machine has been operated daily from 9 a. m. to 9 or 10 p. m., and has resulted in a great saving of time. The owner has found that he can make calls in half the time as with a horse and wagon.

Atchison, Kan.

For five years or more the automobile has been doing good service for several physicians in Atchison, but only recently has the auto become commercially important here. Atchison is so completely paved with brick that the automobile is now delivering root beer and soda water for one firm, bread for a bakery, meat for a meat market, etc., and as these cars are all low priced runabouts converted into business cars, and all seemingly doing their work well, it is certain that the automobile will play a very important part in a business way in Atchison soon.

"After using an automobile for seven years in my practice, the last three years without the assistance of the horse, I naturally have formed ideas as to what constitutes the most reliable motor for business use," writes Dr. C. F. Howe, of Atchison. "The motor boat is almost exclusively a two cycle proposition; some say because of the cheapness of construction, while others say because of reliability, and I believe both of these arguments should be considered in a commercial car. I have used a valveless car for three years, and with so little trouble and expense that I feel justified in recommending the two cycle motor in business. It cannot get out of order unless it breaks a crank shaft, and I have never allowed that possibility to cause me any worry.

"For commercial use I would recommend a two cylinder, two cycle motor with 5 inch bore and stroke, with motor under hood, shaft driven, with three speed planetary gear. This would be an ideal foolproof motor and gear, both reliable and economical. The flywheel should be extra heavy to insure smooth running of the motor at slow speeds. Such a car can be constructed and sold for less than $1,000, and the price is going to cut some figure in the small commercial car. Any ordinary boy could operate such a car as safely as he pounds the delivery mules."

Detroit, Mich.

Generally speaking, the use of the runabout in a business way has just begun in this section of the country. However, the conditions are such that it needs no prophet to foresee that its use will be rapidly extended.

In spite of opinions to the contrary, street cars are very unsatisfactory conveyances when used for general travel around a city. For going back and forth from the outskirts to the centre of the town they are ideal, but when it comes to reaching other points and for making short cuts in diverse directions cars are very slow and unhandy.

The distances to be covered in cities of any considerable size are so great that a horsed vehicle is an even slower means of getting round than the street cars. There remain three forms of conveyance which are speedy enough to be practical: The bicycle, the motorcycle and the automobile. The first is by far the cheapest and is largely employed by those who can afford to use a good part of their physical energies for propulsion rather than pay for the gasoline to do the work. The motorcycle has come into quite extensive use for carrying messages, delivering circulars and samples, and work of a similar nature where a large territory must be covered at small expense. It is also brought into play to a limited extent for carrying special delivery letters, in collecting mail from boxes in the outskirts of the city, and by salesmen who have an established trade and who do not carry any samples.

There remains a very considerable class whose work takes them over a large district and whose time is valuable enough so that they can afford to use an automobile to economize it. For such of these as only occasionally need to carry a second person and have little luggage the runabout forms an ideal conveyance.

It is scarcely necessary to mention the medical man; he was among the first to make use of the automobile for business purposes and he remains one of its most enthusiastic and successful adherents.

Perhaps the next class to whom the runabout should appeal is the local salesman who has samples to carry. I recently encountered one of these who represented a wholesale shoe house. He had been using a single cylinder runabout for two years, and, as he expressed it, "Could not keep house without it." The machine was fitted with an open box of considerable dimensions, and this was filled with a dozen sample cases, the size of a dress suit case. It is easy to see the amount of time which this salesman saved in calling on a large number of small stores with such a load of samples. For this class of work the automobile is far ahead of anything else, although it is not generally used.

During the past month or so building operations have been booming in this section; this rush of business has brought out the usefulness of the runabout for contractors, architects and real estate men. The contracting firm which carries on a large volume of business always has jobs under way in different parts of the city. Foremen for the different branches of the work must visit these jobs, often several times a day. The runabout gets them there quickly when an emergency arises, and besides saving the time of the foreman prevents the workmen from being idle while waiting for the foreman to arrive and make the decision. Often a smaller contractor will be interested in a number of buildings in various sections of the city, and where these are being erected by sub-contractors must be constantly on the watch to see that the work is done according to specification. As the contractor watches the subcontractor, so the architect in turn often watches him, and in so doing finds it convenient to employ similar means of conveyance. For such work the runabout is rapidly displacing the horse.

Among real estate dealers the runabout is not used so much as the touring car, for in this work it is usually desirable to have considerable carrying capacity. But some dealers who carry on an extensive business find it convenient to have a small vehicle to look up property and to oversee building operations. Up to the present, however, this use of the runabout has been rather limited.

Such florists as specialize upon interior decorations find in the runabout a handy vehicle for meeting customers for consultations, for going from place to place to oversee workmen, and to carry built up pieces of flower work which require quick and safe transportation.

Perhaps the largest user of runabouts in the city from which I am writing is one of the electric lighting companies. They keep from six to eight runabouts in service most of the time, and find them great time savers. They are especially useful in locating short circuits and in supervising wiring crews.

The local "still alarm" company has found runabouts useful to its employees in making their rounds, and also in taking men to any point an alarm comes from.

While for all these varied uses the runabout is proving an efficient and well nigh indispensable vehicle, there are other services for which it has been tried and apparently has not proved a success.

The purpose I refer to is the conveyance of private workmen who do small jobs. There was a plumber in this city who employed a runabout for getting around. The rear was fitted with compartments for his tools and a pipe vise was mounted upon the back edge of this box. I fancy that he found the vehicle too expensive, for I have been unable to locate him of late.

Probably the same difficulty was met by an enterprising knife grinder who used an auto for getting around. He fitted his foot operated grindstone to the rear of the machine, and had a saw vice secured to the tailboard; but he also has disappeared.

I do not doubt, however, that the day will come when the runabout will be economical enough for even these occupations.

Houston, Texas.

Regarding the advantages of the runabout over the horse, Dr. J. Allan Kyle, of Houston, said they were legion. The only disadvantage he had noticed during the several years he had been using the auto was the fact that the wear and tear was expensive where streets were not paved. Dr. Kyle uses his car almost exclusively when visiting his patients. He has used five different cars in succession. All of these cars, Dr. Kyle states, gave good satisfaction. They were discarded because some other car struck his fancy, or because he saw a good opportunity to dispose of his car at a good price. Since starting to use the auto Dr. Kyle has never been without one.

All of the cars with one exception

were of the planetary style of transmission, and this style, Dr. Kyle asserts, is the most satisfactory transmission for a light runabout. A light four cylinder car gave the most satisfactory all around service.

On account of the poor condition of some of the roads near Houston, Dr. Kyle also maintains a horse, but a very small percentage of his calls are made through this means. He finds, he says, that his automobile entails about three times the expense of a horse, depending altogether on the make of the machine, but that it easily accomplishes three times as much as a horse, thus putting this phase of the matter on an even basis.

The light four cylinder runabout cost him approximately $35 per month the year round, including tires, oil and gasoline. He found punctures to be his greatest trouble. "Whenever I can secure a car with tires able to withstand every sort of road and every sort of weather," said Dr. Kyle, "then I shall immediately do away with my horse. Tire trouble, according to my experience, is greatly increased by rainy weather." He travels an average of 40 miles per day the year round.

Dr. Kyle is an enthusiastic member of the local automobile club, and does everything in his power to increase the efficiency of that organization, both from a standpoint of using the car in the transaction of business, and for pleasure as well. He believes there is a great future for what he terms "the business runabout."

Dr. R. W. Knox states that his runabout is manifestly superior to the horse for a variety of reasons. "I find my automobile more economical than the other method of traveling, principally because I was forced to keep two horses in order to attend to my patients. This I found to be a great deal of trouble. Then, again, the auto is a great time saver, making better speed than a horse, running in many instances where a horse cannot go. It stops easier, starts easier, runs easier, stands easier."

A conservative estimate for boarding two horses would be $35, which, of course, would not include repairs on buggy and harness. Dr. Knox's runabout costs on an average $25 per month, including punctures, new tires and repairs of all sorts. It is an 18 horse power, four cylinder car, with planetary style of transmission. "Of course," said Dr. Knox, "automobiling for professional men still has its drawbacks, but I regard these as minor matters and feel sure that the day is not far distant when a machine will be evolved which will be generally used by professional men of all sorts."

Indianapolis, Ind.

Within the short space of five years the runabout has become a commercial necessity in Indianapolis. From three or four physicians who used gasoline runabouts five years ago, more for the advertising to be gained than anything else, there are now upward of 250 runabouts in daily commercial and professional service. To this number should be added fifty or sixty touring cars.

It is estimated that one-fourth of the physicians in the city use runabouts exclusively in their practice, probably 95 per cent. being gasoline cars. According to the State registration list, about 125 local physicians have runabouts.

The runabout was well past its experimental stage before public utility, municipal and commercial uses were made of it. At the present time both local telephone companies, the gas and water company, municipal and county officers, real estate dealers, solicitors, collectors and salesmen are making use of it. A few traveling salesmen working out of Indianapolis have also tried runabouts, but the result has not been fully satisfactory, owing, as a rule, to the selection of low powered cars, which have failed to do satisfactory work over freshly graveled roads and high hills of the State.

FOR THE WATER SERVICE.

Among the first users of runabouts, outside of physicians, was the Indianapolis Water Company, which now has three single cylinder cars in constant service. These cars are used for turning on and off and at times for emergency runs in turning off leaks. The company is planning at present to purchase a gasoline car suitable for repair work. An officer of the company states that the use of the runabouts dispenses with the services of three extra men. Owing to the wide area necessary to cover during the day, it was found impracticable to use horses and buggies. The runabouts are changed about every two years and are cared for in a private garage arranged in one corner of the company's stable. Practically the only expense is gasoline, oil and tires, the latter being heavy. The company states each runabout consumes about two and one-half gallons of gasoline a day.

IN GAS COMPANY'S SERVICE.

The Indianapolis Gas Company, manufacturer of artificial gas, has had two runabouts in service for about fifteen months. The company's plant is in the extreme north part of the city, not easily reached by street cars and one of the runabouts is used by Carl H. Graf, the superintendent, in going to and from the plant from the company's downtown offices. For some months the foremen in charge of the outside work have made good use of a runabout, superintending the laying of mains in different parts of the city. The company does not find that the runabout is cheaper in dollars and cents than the horse and buggy formerly employed, but does find that the foremen can cover more territory, keeping closer watch on the work, hence obtaining better results.

As a rule runabouts are not used in Indianapolis with the expectation of saving money over horse drawn service. The feature that appeals most here is the ability to cover more ground, and in the case of salesmen, giving more opportunity for building up new trade. In this respect the runabout has been found a success.

IN MUNICIPAL SERVICE.

The Board of County Commissioners have been using a car for about one year, but the experiment has not been fully successful, because, as a rule, inexperienced drivers have been employed and the car has not had the care it might have had with a private owner. However, the board has actually saved money on livery hire in viewing roads, inspecting bridges, etc. Another county official who uses a runabout is Harry W. Klausman, county surveyor. He found it more satisfactory to buy a runabout and operate it at his own expense, in his work, than to depend on horses and buggies. The result has been that he has been able to cover at least twice as much ground in a day and has saved time in other ways. Dr. G. A. Petersdorf, county coroner, uses a runabout, which he has in service night and day, during all seasons of the year. In addition to his office, Dr. Petersdorf has a large private practice which he says he would be unable to look after without an automobile. His greatest expense is tires.

It is only within the last year that city officials have made use of runabouts. The Police Department has been using a runabout for about one year. This is used by the captains for visiting patrolmen on their districts at night, and occasionally for making an emergency run. The department also has a gasoline patrol wagon and a steam touring car, so that the runabout is cared for at little expense as a fully equipped garage has been established at headquarters. The runabout saves the expense of one horse and vehicle and the fact that much time can be saved and more territory covered makes its use doubly appreciated.

Blaine Miller, city engineer, has been using a gasoline runabout for fifteen months, this being the second car he has had within that time. At first a $600 runabout was purchased, but at the end of one year it was in such condition that the purchase of a new one was deemed advisable and one of heavier construction was bought. This runabout is used for visiting streets that are being improved, for making surveys, etc., and the cost of its use has been found to be about thirty per cent. less than former livery bills.

Since last spring Fire Chief C. E. Coots has been using a roadster for answering fire alarms. With it he has been able to get under way in about half the time that it formerly required with a horse and buggy, and on long distances has saved from five to ten minutes in reaching the scene of a fire. Drivers who formerly drove the chief's horse were trained to drive the automobile, so that there is no additional expense in that respect. The cost of maintenance is also less than that of a horse and buggy, for the average number of alarms answered from headquarters is about three, and the consumption of gasoline and wear and tear on the car is practically nothing.

FOR TELEPHONE LINE SUPERINTENDENTS.

The Indianapolis Telephone Company and the Central Union Telephone Company have gasoline runabouts in daily service. These are used principally in superintending line work, where it is necessary for the foreman or superintendent to reach several different parts of the city in the same day.

Within the last year a number of agricultural implement concerns have been experimenting with runabouts for their road salesmen. In this work livery bills are usually expensive, as the salesmen visit the farmers direct, necessitating both railroad fare and livery. Among the concerns that have been employing automobiles are the H. T. Implement Company; C. D. Rodebaugh, of the Parsons Band and Self Feeder Company, and the International Harvester Company. These companies report that the use of automobiles, while expensive, has cost less than railroad fare and livery rigs. The J. I. Case Threshing Machine Company has used a runabout for three years in covering Indiana territory.

Real estate dealers have found runabouts convenient for showing prospective buyers property in various parts of the city. It requires less time to take a customer in an automobile than to wait for street cars, transfer, etc., or use a horse. J. Clyde Wolf, Joseph Selvage, John G. McCullough, C. G. Duvall and Charles M. Cross are among local dealers who use runabouts.

EVEN VETERINARY SURGEONS.

Strange as it may seem, the leading veterinary surgeons have been using runabouts for several months for visiting their equine patients. Where even seconds count, it is needless to say that it is possible to make such a call in an automobile in less time than by driving a horse. Dr. W. A. Craig and Dr. Frank F. Jacobs are among veterinarians who make practically all of their professional calls in runabouts.

About five years ago Flanner & Buchanan, undertakers, purchased an electric runabout, which they used until a few months ago for making night and day calls. For some time the car gave very satisfactory service and the expense was less than that of a horse and buggy, but as the car grew old the expense increased. Finally they discarded it—probably the only company in the city to discontinue automobile service. C. M. C. Willis, a colored undertaker, is now using an electric runabout in his business, and states he is having very satisfactory results.

SALESMEN'S CARS.

A short time ago the Central Supply Company, wholesale dealers in plumbers' and mill supplies and tools, determined to give the automobile a thorough test. Accordingly they purchased two runabouts for a city salesman and a road salesman, respectively, and a truck to do their city delivery work. "The truck has met our expectations," said an officer of the company, "but we are not thoroughly satisfied with the experience of our salesmen. On the road we have found that it is cheaper to pay railroad fare and livery bills than maintain an automobile, but we are going to continue it and give it a fair test for some months." The runabout used by the city salesman has enabled him to cover his territory in a shorter time, but the company states the expense has been about the same as that of a horse and buggy. However, the time saved has been a satisfactory item, and the service will likely be continued.

Among the first users of a runabout for city work was the Pierson Cigar Company. This company now has runabouts of two different makes in city service, dispensing with its horse drawn equipment. The company finds the expense of the automobiles to be less than that of the old service.

The A. Kiefer Drug Company, a wholesale concern, is now doing all of its city work with a runabout which has been in service about one year. It is stated that the salesman saves about 40 per cent. of the time it formerly required with a horse and buggy, and has been able to develop more business.

Carman & Fryer, electrical contractors, have had a runabout in constant service for three years. As the company was formerly in the automobile business it does all of its own repair work. The runabout is used for looking up new work, making estimates, contracts, etc., and sometimes for an emergency run.

The G. J. Mast Company, plumbers, have had very good service with a runabout for some years. It is used largely for the convenience of customers, the automobile being sent frequently to take prospective buyers to the company's place of business. In many cases the prospective buyers could not be induced to make a special trip down town to see something new in heating or plumbing but for the automobile.

There are now about 1,300 automobiles in use in Indianapolis. Of this number about 60 per cent. are runabouts. Within the last year or two dealers have taken more interest in the runabout end of the business. Dealers that formerly carried nothing but touring cars now represent one or more lines including runabouts or roadsters.

Milwaukee, Wis.

In Milwaukee, the largest city of Wisconsin, the practical or business use of the automobile is well developed. A surprisingly large percentage of the physicians in Milwaukee are possessors of runabouts. The average Milwaukee physician finds that the light automobile stands him in good stead owing to the excellent condition of streets and roads in Milwaukee and Milwaukee County, and to the fact that a machine is always ready for use. Nine physicians out of every ten say that they can actually maintain a runabout of average durability cheaper than they could keep three horses. Five out of ten physicians claimed that they could operate a machine as cheaply as to keep two horses. Even a physician with only one horse maintained that in the end his machine was cheaper, because of the fact that his service was better, he was put to less trouble, and time, and sometimes a life, was saved.

Dr. W. C. F. Witte, the owner of a single cylinder runabout, which he uses extensively in city and suburban practice, was especially enthusiastic over the business value of his machine. Dr. Witte believes that his machine is not costing him more than $25 per month upon an average. To get satisfactory service he would be required to maintain at least two horses, at a cost of about $30 per month, if he cared for them himself, or $40 per month if he hired them from a livery stable. Added to the fact that he was given better service and placed in a position to enlarge his practice, Dr. Witte says that both he and his friends secure any amount of pleasure from a machine.

In Ohio.

Dr. A. B. Lathrop, of Swanton, Ohio, has been using a light powered runabout in his practice for the last four years. In two seasons he has suffered but one tire puncture, and after a continuous use for two years two of his tires will do for another season. The secret of this excellent record he says is that instead of using the light runabout wheels and tires he had his car equipped with touring car wheels, with 30x3½ inch tires. The country in this vicinity is rolling, there being no severe hills, but plenty of easy grades. The roads are gravel, clay and sand, all turnpiked and well drained.

Dr. Lathrop does not entirely confine the use of his car to his practice, but uses it for pleasure as well, and has run an average of 40 miles per day since he began its use. During his whole experience he has been delayed only once, by the breaking of an oiler belt. Having no belt with him to replace it, and being unable to repair the old one, he disconnected the oiler pipes, and every few miles used a squirt gun to good advantage. This happened on a pleasure run, however, and in his practice he has never been delayed nor had to make an adjustment on the road.

Dr. Lathrop gives a quarter to a half an hour to inspection and looking after adjustments of his car every morning the first thing after breakfast, and finds it more than paid for the time spent by quick trips and safe return. The use of the car gives him at least 30 per cent. more time to look after his practice, and has added 20 per cent. to his income, people realizing that he can get to a patient in less time than it would take for his horse to be hitched up and brought around to his office. Then, again, the pleasure of riding fast on a hot day, when it would be impossible to drive a horse the distance, is a consideration. The doctor never had an accident nor a "mix up," preferring to stop and help frightened horses pass, which also serves to make friends of the farmers.

The cost of maintenance has been very low, as compared to the horse. Repair bills, exclusive of that for a broken chain, which was replaced, have been about $20 for four years. He has run an average of 18 miles to the gallon of gasoline used, while $1.50 per month has been paid for lubricating oil. The tire expense has been only $1 for two years for vulcanizing one puncture. He attributes his good showing to careful attention and study of the requirements of his car, contending it is the little things that counts. "Watch the little trouble and you will have no large ones."

That it's the little things that count in the successful use and operation of a car is the opinion of Dr. Fred L. Bates, of Lima, Ohio. Dr. Bates' car has been in use four years continuously, summer and winter, the first year as a demonstrator and three years in his practice. It is an air cooled car, and today it runs much more smoothly and quietly than many cars that have only seen a fraction of its service.

Dr. Bates controls his motor entirely with the spark lever on ordinary roads and over the city streets, and thereby gets a greater mileage out of his gasoline. (This is contrary to the experience of others.—Ed.) On one occasion recently he emptied all gasoline from his tank and put in one gallon, and with two persons in his car he ran 38 miles, coasting at every opportunity and never opening the throttle except when absolutely necessary.

Before reading up and studying his car, Dr. Bates used to have all tuning up done at the shop, a thing he found to add very materially to his cost of maintenance. Now, however, his car never enters a shop, unless it requires machine work done. While relying on the shops the car was never in condition when wanted. On only seven different occasions has it been necessary to hire a horse to make his calls during the last year, and then when the roads were so muddy that a horse could hardly get through.

The time spent in looking after the car is no greater than that spent in caring for the horse, and one does not have to be so prompt as in feeding, watering and cleaning the horse, and the car will go the route in one-half to one-third the time required by the horse, leaving one-half to two-thirds the time to new business and study. When the doctor kept a horse he would many times take the street car rather than bother to hitch up, which added to the cost of transit. When making night calls, while using horses, he always called a cab rather than get out and harness a horse and hitch it up, and then unhitch, unharness and, if muddy, rubbing down the horse's legs and thoroughly drying it, while with the car it's simply turn the crank, make the trip, turn off the switch and close the door of the auto house. The cost of maintaining a car is about equal to the horse if one cares for the horse himself, while the time required to look after the horse is greater and slower transportation, and if a man is hired to look after the horse the cost of horse keep would be 'way to the bad.

Providence, R. I.

Dr. Dorran B. Cox, of Riverside, R. I., has within the past three years had considerable experience with horses alone, two horses and an electric runabout at the same time, an electric and a gasoline runabout at the same time, and latterly with a gasoline machine alone. It is his belief, based upon his actual experience, that he can do twice as much work in half as much time, and with greater comfort, in his gasoline automobile than he could in any of the other vehicles he has tried.

"When I first settled here in Riverside," said Dr. Cox, "I had three horses and a man to drive me around. It was necessary to keep all three animals because of the hard work I had to do. In the fall of 1905 I bought an electric runabout, about 4 horse power. I established a private charging station in my stable, at the rear of the house, and got my power from the street railway company. This eliminated one of the great sources of trouble with an electric machine. I was always sure of being able to fill my batteries, whenever they ran out while I was at home. Sometimes, however, I was miles away when they ran down, and of course I was in a good fix then.

"I sold one of my horses when I bought the electric. The other two I used when the snow was on the ground and when the machine was out of commission. The electric was not a good long distance snow plower. I guess I used the machine and the horses about even. After a year with this combination I decided to sell the two horses and buy a gasoline runabout. I got a 7 horse power runabout, and used it in conjunction with my electric one. This combination I used for a year, and in the spring of 1908 I sold the electric and kept only the gasoline machine.

"With my gasoline car I have had no trouble to speak of, and can plow through 2 feet of snow easily in the winter months. Last year I had to hire a horse and buggy just two weeks out of the whole season, on account of very heavy snow storms, which filled the roads. For practical work I find that the gasoline runabout is less expensive as compared with either the electric runabout or horses. There is not the bother of the electric, nor the fatigue which must necessarily follow a long ride with a horse. Many times I have returned from behind the horses with a backache and in wretched condition.

"As to my expenses, they are very light, and I figure that I have to pay only about $10 a week for the upkeep and repairing of the car. All my small repairs are done by a man who lives within two or three doors of me, and who is an expert. I pay this man $3 a week all the year round to keep the machine in repair. Of course, where I have breaks in the machinery I pay for the new parts extra, but the $3 in general covers tire punctures, grinding valves, and other such work which requires labor only with very little material furnished. This $3 I have included in my average of $10 a week for the upkeep of the machine. Washing the car I pay extra for, whenever it becomes necessary. Once in a great while I have to send it to a garage to have some serious damage rectified, but not often. By having the car cared for by the week as I do, I believe I keep it in perfect condition all the time.

"A year ago last winter we had a great deal of snow, but with the exception of the two worst weeks I used the runabout all through. I have actually smashed the mud guards off plowing through drifts, but the car went through them all right. Only once did I have to shovel out, and that was a funny thing. I was going on a 7 mile call, and came to a backwoods road, which had not been used for several hours. I could see faint tracks under the layer of snow, 18 inches deep. These tracks I followed, and all of a sudden I found myself running over the side of the road into over 2 feet of snow. The man who made the tracks before me must have also run into the drift. After walking a short way I came to a house and borrowed a shovel. The man came out and helped me, and soon we had the car out and upon the road. Coming back I got off on the other side of the road very near the same old place because I tried to dodge it, and again I had to shovel.

"When I maintained both the electric and the gasoline runabouts I allowed a total cost of between $1,000 and $1,200 a year for expenses. Now that I have the one I think I must be saving at least two-thirds of that amount. I had one funny experience with the electric machine which taught me the lesson not to leave the connecting plug in the car when out of it. The car was in my private garage in the rear of the house one day, and my boy was playing near it. The garbage man came around, and, as my boy tells me, said he could run the blamed thing. He got into it, and as I had left the plug in, the machine started when he jerked over the lever. It cost me about $100 to get it repaired after he had tried to dig out the side of the garage. We have never seen that garbage man since, and I don't blame him for not coming around again.

"To keep the water in my radiator from freezing in winter I mix about one-third wood alcohol with it. During the winter I use only about 5 gallons of alcohol and I have no trouble whatever even in the coldest times.

"An electric car is a very easy running machine, but I find that it is not as serviceable to a physician as a gasoline car is. For instance, you may have charge enough in the batteries to go 20 miles, say, and get a call which will take you 30 miles. You either have to charge up first, which takes time, or hire some other vehicle. That is, of course, provided you can't charge up at the place where you are going.

"My single gasoline machine I find gives better service than any or either of the other combinations I have tried. I have approximately two more days a week at home than I had before, because I can do my outside work in half the time I had to take before. This gives me considerable time for office work, and to spend with my family. I enjoy greatly using the gasoline machine, and do not expect to get any other kind. When I get back from a long trip now I do not have that tired and exhausted feeling which one must get after driving behind horses on a long journey."

Richmond, Va.

The gist of statements made by a number of business men, users of light automobiles, is to the effect that even in hilly Richmond the runabout is a necessity to the busy man with many calls to make during the day, and, in the end, is a saving in money over the horse. A physician of large practice, an insurance man, or others who have much ground to cover during the day, once having used the runabout never again turns to the horse.

Otis M. Alfriend, secretary of the Virginia State A. A. and of the Richmond A. C., in speaking of the matter of expense in maintaining a runabout says:

"I have a 12 horse power runabout of the progressive type of transmission which I have used since July, 1907. I average 30 miles a day with the machine, and despite the cobblestones and many hills of Richmond, and the miserable roads of the surrounding country, I find that it takes but little more money to keep my machine in repair and too operate it than it would to keep a horse."

This statement in itself is practically that of half a dozen other users of the automobile who were seen in Richmond and interviewed upon this subject.

"To arrive at the cost of maintenance of an automobile," he continued, "many things must be taken into consideration. If it is housed in a garage, of course the owner must pay the garage man's profits. I keep mine in the stable at home, and it is of my own experience of which I shall speak.

"As an insurance agent I have many calls to make each day, and I find that with my runabout I can cover the field in two-thirds of the time it takes with a horse and buggy. I thus can save three hours a day, or, in other words, I lengthen my business hours by three hours of efficiency without undergoing the added physical strain. This is a big item, and it is hard to estimate just what it is worth in dollars and cents.

"Gasoline costs me about $5.50 per month, and lubricating oil about $1.62. A man to wash my machine once a week costs $4 a month. For storage batteries and for dry cells I pay $2 a month. This makes my ordinary operating expenses, exclusive of a few cents paid for a chemical preparation to keep the water in my tank from freezing in winter, about $13.12 per month, or $157.44 per year.

"Tires always prove uncertain quantities. No man living can tell just how many or how few he will need in the course of a year. I sometimes use one a month and sometimes can manage with one a year. With my present machine I spent during the year $75 for tires. This is a bit steep, and I do not expect to buy so many next year. Carelessness or traveling over bad roads in day or night, a hundred things, in fact, may account for the loss of tires. The greatest need now is for tires more durable, but no heavier than those now on the market. The man who can invent a suitable tire has a fortune awaiting him.

"But to return to my subject. Allowing $75 for tires, we have the cost of maintaining my runabout $232.44 per year. It would be impossible for the owner of a horse in Richmond to get through on less than $240, for stable hire here alone costs from $20 to $25 per month.

"About five months ago I had my machine thoroughly overhauled, every crack and crevice being examined by a competent machinist, and every bolt and screw tested. This is necessary at least once a year, and will add about $15 to the general expense account. Little adjustments, many of which I could have made myself, during the past year cost me $10.

"Most men, when they purchase an automobile, are fairly familiar with its mechanism, and many little expenses which I have included above would have been entirely unnecessary, for the repairs were easily made, and if I had cared to lie flat on my back for a few hours I could have done the work myself. The frugal and industriously inclined enthusiast may easily save himself many dollars.

"No especial care was taken of my machine during the past year. The country roads in this vicinity, as I have said, are fearful. In the city steep hills and an abundance of jagged cobblestones put an unusual strain upon a machine."

Tabulating Mr. Alfriend's expenses for the year, we have:

Gasoline	$66.00
Lubricating oil	19.44
Washing car	48.00
Charging batteries	12.00
For dry cells	12.00
For tires	75.00
Overhauling (once a year)	15.00
Incidental adjustments	10.00
Total	$257.44

In Syracuse, N. Y.

"You may think I am putting it on a little thick, but it is a fact, nevertheless, that I can do four times as much in the same space of time with my automobile as with a horse. I have used a car two years, and I could not get along without it." This statement was made by William J. Burns, a leading contractor in Syracuse. "It is possible for me," added Mr. Burns, "to visit all of my work in the city three times a day, where with a horse I could not get around more than once a day. I use a two seated car most of the time, for the reason that I often want to carry workmen from one job to another."

Dr. A. J. Campbell is of the opinion that there is only one way for a physician to get around in either the city or country, and that is by means of the automobile. Dr. Campbell has used both a gasoline and electric runabout for three years, both winter and summer, and he declares that the cost is one-third that of maintaining a horse. Dr. Campbell declares that the scheme is not only practicable from the viewpoint of economy, but that it saves much time.

Dr. Albert E. Larkin, of No. 509 East Genesee street, has used a runabout for business purposes five years, and he declares that he would not go back to a horse under any circumstances. Dr. Larkin has figured out the cost of operation at $1 per day. He said that this is about the same as for the horse and wagon, but that the advantage comes in the easy performance of one's duties, together with the ability to make more visits.

J. A. Seitz, who is engaged in commercial photography, was one of the first men to use the automobile for business purposes, and he sums the situation up thusly: "Great! Don't see how a man can do business any other way."

Dr. I. Harris Levy is using a runabout for the third year, and he declares that it is practical in every way. "I would not return to the horse for the world," said Dr. Levy; "the runabout is very convenient and gives little trouble."

Fred. N. Van Patten, a prominent real estate broker, says that the runabout will not do for real estate brokers any more than a horse and carriage, for the reason that prospective buyers impose upon the brokers in order to get a nice long ride. "I had to give up the horse in business because too many people wanted to go for a ride with no intention of buying a foot of property, and the same thing applies to the runabout. I have purchased a motorcycle for one of my outside men, and that is satisfactory."

Dr. Harry C. Webb, Charles R. Jones, of the manufacturing firm of Frazer & Jones; H. H. Franklin, of the Franklin Manufacturing Company, and M. W. Kerr, sales manager for the Buick Company, are among the other devotees in Syracuse of the runabout for business.

That the runabout has come to stay and to grow is the general opinion of business men and automobile dealers in Syracuse. The rural mail carriers in this vicinity and the farmers have not taken hold of the automobile, but are giving the matter attention. A few Onondaga County farmers have pleasure cars.

Contractors and physicians use the runabout car in Syracuse more than any other two classes of professional or business men.

Some argue that the automobile is much cheaper than the horse, while others say "even if it does cost more at the outset one can make a lot more money owing to being able to do twice the work."

Herbert F. Smith, a commercial photographer, is enthusiastic over the automobile for business. He uses a two seated car, being often obliged to carry two or three people besides his apparatus in going out to do work. Mr. Smith said: "The practicability and utility of the automobile in my business—commercial and newspaper photography—are apparent. This is the fourth season that I use the automobile, and I use it to a considerable extent in winter as well as summer. The use of an air cooled car simplifies my winter work. We have to be in shape to go anywhere about the city and surrounding country for a distance of 20 to 30 miles at a moment's notice. This applies particularly to newspaper work, as I find that newspaper people are very exacting when getting photographs with which to illustrate their news items, and time is an important factor in getting them. It is often a case of 'beating the other fellow,' and no matter what the weather conditions are or the time of day or night, no excuse is accepted for failure to obey orders. Quite often the places to be visited are some distance from railroads or trolley lines, and the ability to reach such places with the automobile is a great factor.

"The use of the automobile in commercial photography, while not so important as in newspaper work, has also its advantages. Most commercial work is done in factories, residences, etc., which are some distance from the studio. The automobile allows the keeping of engagements promptly and on short notice, besides saving time in covering a number of engagements every day. This puts us ahead of the competitor who is without a car and saves both time and working force. Being somewhat of a mechanical turn of mind I take care of my car myself, finding time nights and mornings for this work. I also act as my own driver, and get much pleasure out of it in this way, besides saving expense. I find considerable time to enjoy the machine with my family and friends, and altogether it is a profitable and not an excessively expensive investment."

In Washington, D. C.

"Without doubt Washington is the home of the small car," stated a prominent physician. "All of the streets with the exception of one or two short ones where there is a steep grade are asphalted and the average width is 60 feet. This makes it ideal for the automobilist. There is so much to see in this city, and the street car service, while good, not reaching every part of the city, many people whose means is somewhat limited, but who still have enough to enjoy some of the luxuries of life, have purchased small cars to go about the city and enjoy the points of interest. Men, women and even children may be seen at any hour of the day or evening guiding a small car, and even now and then a big one, through the thoroughfares."

The home of the nation's capital is a social centre, and to be in society it was formerly necessary to have a carriage when making afternoon calls. A majority of the people here are in the Government service, and it is a known fact that the Government is not any too liberal in the way of emoluments. With every Government position above that of a mere clerkship there is connected a certain amount of social obligation. Carriages cost money, and, besides, you must have the attendants, a coachman and footman. Of late people have awakened to the fact that the runabout is a nice way of paying social calls. At first it was the electric that was the popular car here, but as the gasoline car became better known it was but a short time until the electric was relegated to the background, though there are a large number of them still in use. The ladies still confine themselves largely to the electric, but according to a dealer in the city this year will see a great many of them driving a gasoline car instead.

A physician who has an extensive practice in the city, in speaking of the advantages of the automobile over the horse as a means of visiting his patients, said: "For my part I would not go back to the horse under any consideration. I have now been using an auto for nearly four years, and while I find it expensive, still, when I consider the time that I save in going from point to point, and the amount of ground that I can get over in a day, I claim that it is a money maker for any man in my calling. My average mileage is about 50 miles a day, and I cover it all in a comparatively short while. My office hours in the morning are until 11 o'clock. Then I step into my machine, which is always ready, and visit those patients that are nearest to my office. This usually takes me until about noon. On my way back home to lunch I stop at the hospital and see whatever patient or patients I have there. From there I go home, eat lunch and am in my office until 3 o'clock. At this time I go out again and visit the patients. This time those that are at a remoter distance. By this I mean patients scattered over the city. Many times I have to go 3 and 4 miles out in the country, and sometimes even further, but it is always a pleasure for me to travel from point to point. It gives me a chance to be out in the air, and the excitement of running my own machine affords me relaxation from the duties of my profession.

"Right here let me say one thing that the automobile has done for the practitioner of medicine. It has enabled him to retain those patients that formerly resided in the vicinity of your office, and upon whom you were called to attend, but who have since moved to other sections of the city. Formerly, when they left your neighborhood you would advise them to call in some physician who resided in the vicinity of their new residence, and perhaps, if they asked you, one would be recommended. It was explained to them that though you would like to retain them as your patients, they resided at too great a distance and that it would be almost impossible to respond to a sick call without jeopardizing some other patient. Things are different now. I can go out, get in my machine and reach the remotest part of the city within 25 minutes, pay the call and be back home again in the time it would formerly take me to make the journey one way. This has enabled me to retain my patients after they remove from the locality in which they were residing when I was first called in. The amount of my fees from cases of this kind alone have more than paid for my machine.

"As to what it costs me a year to run my machine I cannot say, but I imagine somewhere in the neighborhood of $700. My figures, however, are not to be taken as an average, because I am not particularly careful in turning corners, etc. Besides my car is out in all kinds of weather, and the only time that it sees the garage is when I take it in to have some repairs made. In this respect, however, I am very fortunate, for in the two years that I have been using the present one it has been in the shop but twice for repairs, once when I had a new cylinder put in and another time when I collided with a wagon and sprung an axle. When I first took to using the auto I bought an electric, but after one summer discarded it, because it would not do my work. After going about 40 miles I would have to have it recharged, and upon two or three different occasions I had to leave it in the country and come back to town on the cars or hire someone to drive me in.

"I have already said that I would not go back to the horse. Suppose, for example, I have an urgent call at 2 o'clock in the morning. My coachman has gone to bed. You know that the colored people generally reside at some distance from where they are employed. I get up, dress and go to my stable, fumble around a minute or so, and finally get a light. Then I must find the harness, put it on my horse and then hitch him up, and all this has consumed perhaps ten minutes or more. Then I start on my journey. Eight miles an hour is a good rate of speed, but already I have lost ten minutes of time which I must make up. I reach my patient's house finally and get out, hitch my horse and go in. From fooling around the stable there is more or less odor upon my clothes, which I carry into the sick room. This is in some respects an offense, for a physician must always consider the patient above all else. Now, with my machine I am there in half the time; in fact, would in nine cases out of ten have been there while hitching up the horse. For all I have to do is crank it and go ahead; besides at night it is always standing at my door. The horse could not be left there."

MOTOR RUNABOUTS IN THE R. F. D. SERVICE.

Mechanically Propelled Vehicles for Rural Mail Service.

By F. E. Watts.

While the matter has attracted comparatively little attention among city dwellers, and has received scant thought from automobile manufacturers, the growth of rural mail delivery has been very rapid. At the present time the service covers a large part of the United States, and nearly 40,000 men are daily carrying mail over country roads which vary from macadam highways to obscure trails.

To get an idea of what the service is like, I have visited a considerable number of these carriers and have talked with them regarding their routes. It appears that the number of families which they serve depends largely upon the nature of the roads and how far the houses are apart. In this part of the country (lower Michigan) the usual distance seems to be from 25 to 26 miles, while the number of families varies from about 100 to 150. I remember one carrier, who, by the way, used an automobile to convey his mail, whose route was 26 miles in length. He delivered mail to 110 boxes, which served for 115 families. Another carrier, starting from the same town, had a 25 mile route with 130 boxes, which represented 145 families.

ROAD CONDITIONS.

As I have said, the road conditions vary from the best to the worst; but generally speaking, the roads over which the carriers must go are bad. This is especially true during the fall and spring, when many routes are so muddy as to be almost impassable to ordinary vehicles. In the northern part of the country snow must be reckoned with during the winter months. I remember a case several years ago on one of the first R. F. D. routes, located in a northern New England State, where a single snowfall of about 4 feet, with occasional well packed drifts 12 feet high, rendered the roads impassable to vehicles. While the roads were being broken out the carrier covered his route on snow shoes. Of course, under such conditions as these an auto is useless, the same as a horse, and there are often weeks during the winter when the snow is too deep for any wheeled vehicle to be used successfully. The snow is too firm for a wheel to push through and not solid enough to bear its weight. No doubt similar conditions prevail in northern New York, northern Michigan and some of the Western States.

In most parts of the country, however, the roads are passable in summer and winter, and the spring months are the worst; possibly March is the worst month of the year upon the majority of the routes.

LOADS NOT BULKY.

While the average carrier may serve perhaps 500 people, the amount of mail carried is not usually large. It is not bulky enough in most cases so that it cannot be stowed away readily in an ordinary horse drawn buggy. In this connection, however, it is well to bear in mind the imminent possibility of the adoption of the parcels post and the probability that this would multiply the bulk of mail carried several times. The carriers are fully alive to this possibility.

The conditions which must be met in rural mail service may then be summarized as follows: A small daily mileage over uncertain roads, mostly bad, with a small load. Numerous stops where the vehicle must often be started under unfavorable conditions.

ABSOLUTE RELIABILITY NECESSARY.

It will be seen that given a 25 mile route with 100 boxes the average running distance would be only a quarter mile, if a stop were made at every box. But as this would be only likely to occur during the holiday season the usual average would be greater, ranging from three-eighths to one-half mile.

CONDITIONS FAVOR THE HORSE.

The conditions we have enumerated are somewhat favorable to horse drawn vehicles, and these are used in the majority of cases. Still, while the nature of the work is such as a horse is well suited to, it is rather severe, and the horse used for this service is short lived. Twenty-five miles per day is too much for any horse, and all of the carriers keep at least two horses, using one every other day. Many of them keep a third horse as a substitute for occasional emergencies. While, as before stated, the horse is generally satisfactory as far as doing the work well is concerned, he is found to be rather expensive. One carrier told me that he had used one exceptionally good horse for four and a half years, but that it had cost him $400 during the past year to keep a horse for the other half of the work. This high cost was caused by one animal being disabled from dislocating a shoulder while stepping in a rut. But he found that the average horse did not last long over the heavy going.

Being dissatisfied with the expense of horses, it is natural that the carriers should consider the use of motor vehicles. This movement has only just begun, so there is little accurate data at present upon what such autos as have been put in service are doing.

CARRIERS FAVOR AUTOS.

As a class the carriers favor autos and are strongly considering their use, but three reasons have prevented them from purchasing, viz., high prices for reliable machines, fear that the cost of running would be higher than for horses, and the fact that many carriers think they have been the victims of misrepresentation by carriage makers, and fear that automobile manufacturers will swindle them.

The average mail carrier has only a moderate income, and is a man of small means, so he does not feel that he can afford to pay more than from $400 to $600 for a car. Up to the present there have been few if any cars suitable for his work that sell at these prices.

SAVING IN TIME.

Where cars are being used they seem in the main to be giving good satisfaction; they appear to be as cheap or cheaper than the horses they have displaced, and cover the route considerably quicker. The usual 25 mile route is covered by a horse in about six hours, with a car the time is reduced to from four to four and a half hours. I have heard of one instance where a six hour horse trip was covered in two hours with an auto, but this was over exceptionally good roads.

Many carriers are looking favorably toward the motorcycle, and where road conditions are right it is undoubtedly a very useful vehicle. It can carry a small load 25 miles a day probably cheaper than any other conveyance. Reasonably good roads or side paths are necessary, however; they may be hilly or uneven, but too deep mud, ruts or sand renders the motorcycle impractical. I am informed that quite a number of carriers who have used them have not found them satisfactory, and that many are advertised for sale. This can mean but one of two things: that the road conditions were not right, or that poor motorcycles were purchased.

TENTATIVE SPECIFICATIONS.

Let us consider what kind of an auto will probably be most satisfactory for this work. It is evident that what is needed is a strong and simple machine, with low speed and good pulling power—one which is capable of being started easily many times in a day and which can travel bad roads.

A thoroughly jacketed, water cooled, opposed motor of about 15 actual horse power, heavily built and having a stroke of not less than 5 inches, should provide ample power to meet these conditions. It should be connected to a change gear having not less than three speeds, by an exceptionally large multiple disc clutch. A good friction drive merits serious consideration. Connection to the rear wheels should preferably be by enclosed side chains. Wheels should be from 32 to 36 inches in diameter, and since the highest speeds will be under 20 miles an hour solid rubber tires should be employed. Where the roads are sandy an extra set of wheels with pneumatic tires should be provided for use during the summer months. The wheel base should be from 80 to 90 inches, and the tread must, of course, correspond with that of the farm wagons used in the vicinity.

The body may be plain, but it should provide considerable carrying space, preferably enclosed. Some carriers seem to think that a closed body is a necessity, while others consider an open body all right. The steering gear should be almost perfectly irreversible. Spring suspension should bring the body as low as may be, with sufficient clearance for the muddiest weather, so that it will be easy to get out and in.

EXTENT OF THE POSSIBLE MARKET.

The rural letter carriers, then, are a body of men each of whom has transportation work enough to keep two horses busy. This work should be done much more cheaply and quickly by suitable automobiles. There are enough carriers, some 40,000, to make a market worthy of serious consideration. A recent news item is to the effect that one company will specialize in this field and will manufacture only cars suited to R. F. D. work. It is very possible that others may do the same, for I am certain that within the next ten years the majority of rural letter carriers will be using autos, and there will be many more carriers than at present, for if you can show the workers in any line of industry a method of doing their work cheaper and easier and in shorter hours, they are certain to adopt it.

But the vehicle to succeed must be fully capable of meeting all demands likely to be made upon it. Most of the carriers are very intelligent men with a minute first hand knowledge of the conditions to be met, and they are not likely to be talked into buying a machine which is not capable of doing the work. The man who earns the money he lays by through hard daily labor is not apt to spend it hastily, at least not for anything which he understands the uses of. So while the R. F. D. market is a good one, it is strictly a daily bread proposition and not a fancy field.

From a Michigan R. F. D. Man.

By J. H. Ayris.

The car I have been using on my route of 25½ miles since April 15 has an air cooled engine, friction transmission, and has 26x2½ pneumatic tires. I have learned enough to know that the auto is the coming means of transporting the rural mail, but a perfect rural mail car has not yet been placed on the market. The carrier needs a car which will travel sandy and muddy roads at the rate of from 5 to 10 miles an hour, and from 10 to 20 miles an hour on good roads. He does not want speed so much as power and endurance.

His car must be strongly built, as simple as can be constructed, and all parts must be accessible. There may be some mechanical impossibilities in the car I am about to describe. If there are I hope they can be overcome, and some good manufacturer will build cars especially for the rural carriers, of which there are nearly 40,000 now, of which a large percentage are waiting for a car of the right kind to come on the market at a price that a poor man can afford—that is, about $400. The manufacturer will tell you that cars cannot be built for that sum, but it is quite possible that the time will soon come when it will be possible.

I will give you my idea from my experience with an auto in the rural service of an ideal car for the carrier. The engine must be water cooled, because the water cooled type has many advantages over the air cooled. An air cooled engine cannot be properly throttled down while the car is standing still and the engine running. A carrier has many stops to make, varying from one to five minutes, and it is very disagreeable to have an engine running at about 500 revolutions per minute; it is also a great waste of gasoline. You can get a great deal more pulling power out of a water cooled engine of the same bore and stroke with less speed than you can from the air cooled type. It will stand up longer, for the reason that runs slower and does not get so hot; it will burn out fewer spark plugs, and is easier to control.

In an air cooled engine you must use a grade of cylinder oil which will cost about 70 cents a gallon; in the water cooled engine an oil at 20 to 25 cents will do good work.

J. H. Ayris in His Runabout.

The engine should be of not less than 10 horse power, of the two cylinder opposed or four cylinder vertical type. It should be placed in the front of the car under a hood, where it will be accessible.

The wheels should be not less than 36 inches in diameter, of the Sarven or artillery type, with solid rubber tires of suitable size to carry the weight of the car. The axles should be strong enough to stand the jar of the solid rubber tires without crystallizing.

Chas. F. Hetrick and His Car.

The car should be arranged with very long, easy springs, and should have plenty of wheel base, and have the seat placed well back toward the hind axle, which will balance the load and give the operator better chance to steer the car. It should be equipped with a friction drive, as no other drive can stand up under the constant starting and stopping in all kinds of bad places. The carrier is compelled to stop his car in small ditches, sand banks and mud holes, make a delivery and start out again; furthermore, a friction drive is the easiest drive an engine can be "hooked to."

The car should be driven from a jackshaft to both rear wheels by a roller chain of sufficient size to give plenty of wear. Don't have a front sprocket with less than twelve teeth, as your chains will not last if you do. The body should be plain and should have all the space in the rear of the seat boxed up for carrying parcels and tools.

Mail Delivery by Runabout in Ohio.

By Chas. F. Hetrick.

In the spring of 1907 I decided to try the use of an automobile in delivering the mail over my route. So accordingly I set about to locate something for a trial, at least. I found a light second hand curved dash runabout of the 1901 type and began its use. I had had no previous experience or knowledge of an auto or gasoline engine, but soon learned to operate mine with ease and despatch.

My route covers 25 miles of clay and stone roads over a rolling country, with two hills 20 rods long with a grade of about 12 per cent. This I must travel with a load varying from 85 to 125 pounds of mail, besides myself. My car is fully equipped with top, lamps, tool kit, but no extra tire.

Some portions of the clay road are very slippery after a shower, but I have never been bothered by this. My worst trouble has been tire trouble, the sharp stones on the stone part of the road having been the principal cause. Still, I have never been delayed for a minute, though I have twice ran home with a flat tire. I have reduced my time for the 25 miles from seven and eight hours with the horse to three hours with the auto, and on a hot dry day it was a shame to drive a horse the distance in eight hours through the dust and heat, while with the auto the hotter the day the quicker the trip, with greater comfort.

My cost of maintenance has been small, exclusive of tires, and my only tire expense has been $29 for two new tires. I have kept careful account of the cost. I ran the auto eight months last year, and find that it is one-third cheaper to maintain than horses, and not near the bother. Still, since I can't use the car (or haven't tried to at any rate) for four months of the year, I still keep two horses, which I turn out to pasture during this time, but whose keep I charge against the auto simply to be just. However, last year I sold one horse in the spring for $20 more than I paid for it, horses being higher in the spring when I am ready to sell or when I need them no longer than they are in the fall when I must buy, so I can (or rather did) work this to advantage.

Then, again, I had several offers to let my team out to hire by the week, which would have been a source of revenue that would have paid my auto expenses. The cost of operation per month is:

31 gallons of gasoline at 14 cents........	$4.34
2 quarts of oil at 19 cents..............	.38
Machine repairs..........................	.60
Pasture for horses.......................	2.00
Total	$7.32

I have not included $29 for tires; this I add to the first cost, and interest on the money invested, together with the cost of maintenance, can be placed at $7.50 per month, which is at least one-third cheaper than horses; but even if it were to cost as much or a little more than the horse I would still say "the auto for me."

Tests of Runabout at R. F. D. Convention.

Perhaps no question has more interest to those engaged in the rural mail service than the means of transportation over their routes. Heretofore, and now, the routes are covered by means of vehicles drawn by horses. The routes are about 25 miles in length, that being the distance determined by the Government, and the different counties are laid out in districts so as to make the uniform length as near as can be 25 miles.

The service has proven a great strain upon horseflesh, the work usually using up two good horses in from six to nine months, and this has been a heavy drain upon the resources of the carriers, who are but illy paid for the work they are obliged to perform in all kinds of weather.

During the annual convention of the Michigan Rural Mail Carriers' Association, held at Jackson, Mich., July 21 and 22, the automobile was put to practical use by six of the rural carriers of that city, and the displays of autos by the Steel-Swallow, Buick and Jackson companies proved of great interest to the several hundred carriers attending the sessions of the convention, being a distinct feature of the meeting. One Steel-Swallow, two Buick and three Jackson cars were employed by the rural carriers on the morning of the 21st, and in ever instance the tests proved highly successful.

A. C. McIntire, of Route No. 6, went over his territory in exactly one hour twenty-eight minutes. It usually takes from 7 o'clock a. m. to 2 o'clock p. m. to get over the 25¾ miles.

The average number of families served by one of the Jackson carriers is 125; the average number of pieces of mail carried each day is 300.

"The farmers are great on daily papers," said one of the carriers. "Nearly all of them take one daily, and some take three or four. On Route No. 4 there are only four families that do not take a daily."

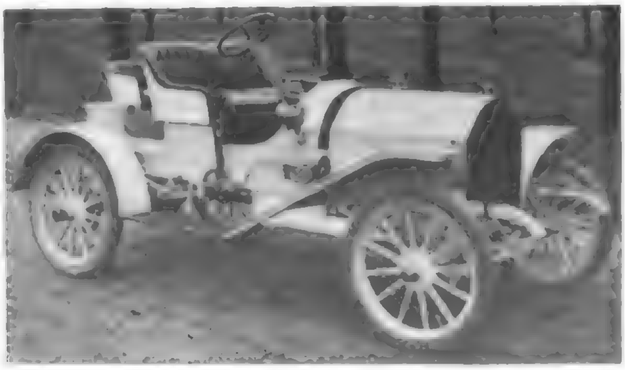
Several of the rural carriers were taking their vacation and the "subs" were not interested so much in hearing the addresses at the State convention, but the regular carriers were all bent on getting back as soon as possible, and the autos proved to be faster than horses.

Auto Stage and Rural Mail Route.

The functions of an automobile stage line carrying passengers and express matters are combined with a rural free mail delivery route by D. B. Harvey on the run between San Diego and Escondido, Cal. The distance between the two points is forty miles along the main road, but the mail delivery forces the machine to make at least ten miles extra. Harvey has become an adept in placing the mail into the boxes "on the wing," simply slowing the car down without stopping, though the necessity of decreasing the speed at the foot of several steep hills in the mountainous region makes heavy demands on the engine. Besides supplying the ranchers along the route with their mail, the stage has to make two stops, at Poway and Bernardo, to make up the mail for points beyond. The automobile leaves San Diego at 8 a. m. and returns at 4 p. m., after staying three hours in Escondido. The horse drawn stage, which requires a full day to make the journey one way, is still in service but will probably run only during the winter months in future.

A rural cail carrier at Armada, Mich., who informs us that he has not yet an automobile, but has read an automobile paper nearly three years and expects to purchase in the near future, gives the following specification of his ideal car for rural mail carrying work: A high wheeler with side wire tires, of 18 inches road clearance and rather lighter than most runabouts of that type; the motor to be a two (or more) cylinder, air cooled, of at least 12 horse power; friction drive; no machinery below axles, except sprockets.

STEEL SWALLOW CAR USED IN TESTS.



JACKSON CAR USED IN THE TEST.

INTERVIEWS WITH BUILDERS AND CONTRACTORS.

Providence Builder Won't Exchange.

John O'Donnel, a builder and contractor of Olneyville, an outlying portion of Providence, is enthusiastic about the use of a runabout in superintending his work. He has had considerable experience with automobiles, the present runabout he is using being his fourth since 1905.

"I formerly kept a couple of horses for use in my business," said Mr. O'Donnel, "but later I tried automobiles, so I know the difference between the two. A horse surely could not do the work now being done by my little runabout.

"In 1905 I purchased a 10 horse power light machine at a moderate price. During that year I must have driven at least 8,000 or 9,000 miles in the car, and never had any great amount of trouble. Most of the repairing the car needed was done by myself. All I had to buy was the parts and I put them in myself. When the spring of 1906 came I sold the runabout and bought another, with a 22 horse power engine in it. This proved entirely satisfactory, but nevertheless I changed it the next year for another new one. I drove 10,000 miles in the second car I owned. My 1907 machine was a 24 horse power light runabout. I was enabled to travel all over the State, superintending the jobs I was then engaged in, and also had time to solicit new business out of town. The machine made good speed, and it was easy to run 20 to 30 or even more miles out into the country to look for a building contract.

"On account of being able to repair my own car, I found that gasoline, tires and oil were the principal items of expense. My tires wear as well as could be expected. I cover at least 40 miles a day throughout the year, as an average. My business calls me all over the State and into Massachusetts and Connecticut, and sometimes the roads are in very poor shape. The car is a light one, however, and I have had very little bother getting about. Even in the winter I can plow through the light snows we have here.

"My latest runabout, the one I am using now, is also a 24 horse power machine, fitted so that I can carry light baggage on the rear if I want to. I also have a touring car now for long trips and for pleasure driving with my family. Most of my driving is from one building to another to see that the work is progressing properly and is going as it should. I can make the rounds of the contracts withing 20 miles of the city easily in a day and have some time to devote to the office end of the work, besides. When it becomes necessary I run out to the suburban jobs and look them over, and it is not an unusual thing for me to go 40 miles off for that purpose in the machine.

"In soliciting new contracts I find the machine a great help, because it saves so much time. When I was using horses to run about with I had to keep track of the mileage and not overwork the animal. That never bothers the owner of the automobile. All we have to see to is that we have enough gasoline to carry us through.

"Just to illustrate what I have done in the machine, I'll tell you of a little stunt we did one day. We had a contract down the river and wanted an extra tip cart on the job. All the horses were down there, and there was nothing to do but tow the tip cart behind the runabout. I got a pair of extra wheels and fastened them under the shafts of the cart to take most of the weight off the runabout, and lashed the whole to the back of the runabout. Maybe we didn't make a showing as we went through the city streets into the country roads. It was a hard trip for the little machine, as the cart was a heavy one, although empty. We made the journey in safety without any breakdowns in an hour and fifteen minutes, which I don't think very bad for the load we were towing.

"My machine gets the hardest kind of running, over all sorts of roads, in and out of fields, and in all kinds of weather. It isn't every machine that will stand that kind of running, but mine does remarkably well. The upkeep of the car is nothing compared to the work it does. As compared to a horse, it is far superior if you have a lot of work for it to do. I can't say exactly that an automobile is cheaper than a horse under all circumstances, but if you figure in the work done and the time saved and the bother eliminated, I should think it was at least as cheap and more convenient. If you have enough work to do, then it is cheaper than a horse for the same work.

"The caring for an automobile is less than for a horse. Besides, the feed for a horse amounts to quite a lot, and if you board it out it is about $5 a week, at least. I like to drive a horse for pleasure, but when it comes to getting the actual work out of the thing, the automobile is much better."

Washington, D. C., Contractors Find the Runabout Handy.

A Washington contractor, speaking of his experience, said: "I guess that I have used a horse about as much as anyone, having been in this business for years. I am at present engaged in a number of undertakings that are scattered about town, and I must visit them all every day or two to keep in touch with the work. I used a horse first, and then got the idea that I could make better time with the street car, but often the car did not run within four or five blocks of where I wanted to go, and then I had to walk this distance, and after a man walks a half a dozen blocks a dozen times a day, he is rather tired when night comes, especially if in the meantime he has climbed over scaffolding and up and down ladders. Finally I went back to the horse and as I had a good one, felt well satisfied. But after driving him about six months, I noticed that now and then he would go lame. At first I was at a loss to discover the reason but finally a farrier solved it for me. He said that the horse's front feet were "going back on him." The constant pounding upon the hard pavement made his feet sore at first, and then the trouble went higher up in the leg and affected the cords and tendons of the legs. I disposed of this horse and then bought another, but in a short time I noticed that he was troubled in the same manner. Had in mind to buy another when a friend of mine, a real estate dealer, happened to stop at the office one day to see me about putting up a row of houses for him. I noticed that he drove a small gasoline car and after we had discussed the plans and the cost he suggested that we go out and look at the property together and perhaps we could decide upon some change for the better in the present plans. He took me out in his car and on the way I got talking to him about it. He told me all of the advantages of it and how much ground he could cover in a day and how much more beneficial he found it in his business than a horse. Almost before I knew it we had reached our destination, looked over the ground and were back to my office. From this time on I became interested and began to look into the question. I figured that if it was useful to a real estate dealer an auto ought to be of value to me. After considering the matter for a time, I finally bought a car and with a few lessons learned enough to run it. Since buying the first one I have had two others, and now I would not be without one. My business has increased and I find that I can give more time to my office work than formerly, besides having a few moments to spare in enjoying life. Not only do I run the car but my wife and daughter use it now and then."

Among Cleveland Contractors.

R P. Burnett, general contractor, Society of Savings Building, Cleveland, Ohio, has been using an electric runabout every day since November 1, 1907, using the car as a means of conveyance for himself to the many widely scattered jobs that necessitate his presence. The car has been in constant service, summer and winter, even last winter, when the traction company was unable to operate on account of weather conditions. Mr. Burnett gives as his reasons for having selected the electric in preference to gasoline or steam cars, its cleanliness, convenience of starting, ease of operation, absence of freezing danger in the winter months. The average cost per month, including tires, power, repairs, washing, etc., has been $23. The daily average mileage has been 40 miles. Pneumatic tires are used, and in the ten months during which the car has been in operation it has been necessary to replace two tires, which, owing to faulty construction, went to pieces shortly after the car had been put in commission. One tire on the car at present has traveled 3,400 miles and has the appearance of being able to run as far again.

A. J. Bause, plumbing contractor, Cleveland, Ohio, is using an '08 model of a popular cheap runabout in his business, which necessitates covering considerable territory, calling at different buildings on which his employees are engaged, scattered in the various sections of the city. He also uses the car to carry a workman or two on occasional rush jobs, where time counts for much. This car was purchased in March of the present year, Mr. Bause having had a heavier car prior to this. His reason for discarding the heavier car was the excessive tire expense. With his present light runabout he states that he covers from 60 to 75 miles daily over all conditions of roads. Twenty dollars will easily cover all mechanical repairs that have been necessary, which have all been of a minor nature. Oil costs him 25 cents a gallon, about 3 pints being the average daily consumption. Gasoline of a very cheap grade is used, costing but 12 cents a gallon, and 4 gallons a day are used. Mr. Bause states that he has given the car just about as hard usage as it could be given, as he is generally in a rush to get to his destination, and that it would be impossible for him to personally supervise one-half of his present business without the use of the automobile.

S. G. Rittenhash, of Camden, Me., bought a second hand runabout last spring and has used it every day since. He is a general contractor. Some days he does one hundred miles. The machine has done the work of three horses. He goes over the roughest roads in the New England States, which are very hilly. He uses about thirty-five gallons of gasoline a week, and figures that the fuel consumption is about 50 per cent. greater than it would be on level roads. Only minor repairs have been required. He has done over 4,000 miles so far. He has done more business this year than the two before.

Milwaukee piano dealers say that the automobile solves the problem for the average music dealer who not only relies upon the city trade but endeavors to cover the entire State. Edmund Gram, representative of the Steinway and other pianos in Milwaukee and the State at large, is the owner of a car which has paid for itself at least ten times, according to Mr. Gram. The well known music dealer takes great pleasure in acting as chauffeur for one of his salesmen and traveling over wide territories.

Interviews with Insurance Men Using Runabouts.

W. G. Fraser, of Fraser & McIntyre, insurance men in Houston, Tex., is the proud possessor of a 14 horse power, double cylinder runabout, which he uses from morning till night. Mr. Fraser declares that the horse can in no way compare with the runabout, either for business or for pleasure. "My car serves every purpose to which a horse could be put," said Mr. Fraser, "and some others besides. It is the most practical vehicle for the man who has to travel over a great deal of ground, either in soliciting business or in making collections, saving time, worry and expense, the three items which are uppermost in the mind of every business man.

"I formerly used a horse and buggy, and when I was told that a runabout would prove a handier and cheaper investment I'll admit I was inclined to doubt it. But one trial convinced me, and I have been running my auto to the entire exclusion of the horse ever since.

"I have never paid out a cent except for the most trivial repairs, and my car has now been in use nine months. The only suggestion I have to make regarding the automobile as a business proposition is that something will have to be done eventually to make the puncture of tires less frequent, and I have no doubt but that this will one day be entirely eliminated. Unless you can confine your business operations to the pavements—and there are few business men who can do this—the puncture proposition is the one worry of a motorist's life. Some sort of hard rubber that would not puncture would, it seems to me, be more practical for the business man's runabout."

Mrs Fraser states that the cost of maintaining his machine is considerably less than that of maintaining his horse. He travels, on an average, 20 miles per day over all sorts of roads and pavements, and states that his runabout is standing up nicely under the strain. He thinks, however, that what he terms the "buggy" style of runabout will eventually replace all others for ordinary business purposes, and that then the auto will practically replace the horse for all practical purposes.

D. D. Cooley, of the firm of Childress & Taylor, Houston, Tex., also has a two cylinder runabout with which he is very well pleased. "I have had my car over two years now," said Mr. Cooley, "and the only difficulty I can find is the tire problem. I believe that the day is not far distant when the buggy style of auto will replace all others for business purposes, and that the final solution of the tire problem will be in favor of hard rubber. Solid rubber will, of course, lend itself readily to the buggy style of machine, and this, I believe, is one reason why that type will gradually gain in favor.

"Regarding the auto as compared with the horse, the former is by far the better mode of traveling, and the expense is no greater, and when you figure that your auto can do in a day perhaps three times the work of a horse, you can readily see where it will prove the more economical." Mr. Cooley's car costs him on an average of $20 per month the year round. He is a firm believer in the autoist's adage, "every man his own repairer," and with the aid of his son, can fix anything. He sends to the factory for missing or broken parts, which are fitted on by himself.

In Use by Kansas Farmers.

The light automobile as a conveyance for the farmer has come into general use in Kansas, where the more prosperous of the wheat and cattle raisers average as many motor cars proportionately as the wealthier classes in any Western city of average population. At least two firms are doing a flourishing business in the big wheat State, furnishing light motor cars at a moderate cost to rural communities.

Along almost any Kansas road, particularly in the central portion of the State, the spectacle of a farmer in overalls and the broad brimmed hat of the fields, driving his motor car along the road, may be seen every day. Many of them make trips as far as Kansas City, and even Denver, in these cars.

The automobile has been a particular blessing in this region of big farms, distant neighbors and scattered towns. Distances formerly regarded as a day's drive are covered in an hour or two, farmers spend more time in the towns, and the latter profit in proportion.

A few weeks ago a genuine event happened to Abilene (whence Abilena) in the Kansas wheat belt. A circus came to the town. In the rear of the parade, pressing the calliope hard, were seven or eight farmers and members of their families in motor cars. Several were runabouts, but two were big, high priced touring cars. One of the lighter cars held Isaac Page, a retired wheat raiser with a big farm and money.

"It took me just forty minutes to come twelve miles from home," said Page, "I'll bring the rest of the family in for the night show. In the old days it used to take me more than two hours to drive in. Now I come every time I want a bar of soap. The automobile is the best investment I ever made. It has saved me money aside from the convenience."

The Paxton-Eckman Company, South Omaha, Neb., manufacturers of a stock powder, have placed an order for six runabouts for their salesmen with a Minnesota concern. The cars will be fitted with solid rubber tires.

INTERVIEWS WITH REAL ESTATE DEALERS.

Providence, R. I.

After trying three runabouts within a period of three years, and having success with them all, Robert L. Walker, of Providence, R. I., a real estate dealer, with a large suburban business, purchased a fourth, and is equally satisfied with that machine.

"As a business proposition," said Mr. Walker, "I find that the runabout is just the thing for a real estate dealer. You can cover a great deal more ground than in any other way, and you can accommodate more customers or prospective customers. And the more prospective customers you treat nicely and quickly, the more real customers you make out of them.

"I used to have a pair of horses, up to the spring of 1903, but I bought a small runabout then, to try it in business. It was an 8 horse power gasoline machine. For a year, or until the spring of 1904, I used it practically all the time, having in the meantime sold my horses. The machine saved me a great deal of time, and fortunately I did not have any breakdowns. My expenses were very light, and I don't believe my repair bills would come to more than $3 a month.

"In the spring of 1904 I got another machine of the same make, only a 10 horse power one, and sold the old one. I found the higher power advantageous as my business increased. There was no trouble with the machine, but the next one I bought was of a different make. This was a 10 horse power car also. My present machine is the same make as my third one, but is 14 horse power. I am thoroughly satisfied with it.

"This is now my second year for the last machine, and I see no reason for getting a new one, as this is in nearly perfect condition. I have had but one puncture since March, a period of six months. Several years ago I built a private garage for myself, and so am saved the expense of maintaining the cars at a public storage.

"I believe that most of the trouble in keeping a machine in good running order is due to improper or insufficient oiling. In the two years I have had the present runabout, I have kept the same gears in, and to-day they show no signs of wearing. One of my main bearings, however, wore out, and this spring, when I had the car thoroughly overhauled, I had a new one put in.

"A car should run from five to six years with proper lubrication, barring breakages and gross neglect or ignorance. Of course, the stock the car is made of counts a great deal in the wear, but assuming you get the best stock, the lubrication is the principal feature to look out for.

"As for expenses, I can't give exact figures, for I haven't kept them. On an average, however, I spend about $3 a month for repairs. I buy about ten to twelve gallons of gasoline a week, at 11½ cents a gallon. Lubricating oil costs about $20 to $25 a year by the barrel. I find that I can average 25 miles to a gallon of gasoline, and I average 250 miles a week easily.

"I use the machine every day, excepting Sundays, in my business. There are two months in the winter, when I go South, that it is idle, but I have tried it enough in snow to know that I could use it then if I wanted to do so.

"As an example, here is a run I made one day. I left Providence and went to Worcester, then to Boston, through the Fens and Middlesex Fells, and back to Providence. That is a distance of about 135 miles, and I did it on a little over five gallons of gasoline. You may be surprised to learn that the gasoline consumption was five gallons, but I ascribe it to the way I drive, and the way I manipulate the sparker and the throttle. A great deal depends upon the operator, as to how much gas you will use up in a given distance."

In Southern California.

During the last two years a two cylinder, 18 horse power runabout has been replacing the horse and buggy formerly used by C. F. Gilchrist, a Los Angeles, Cal., real estate man who makes a specialty of suburban property. During the period of its operation the little runabout has been in service twelve months in the year, and the results obtained through its speed and wide radius have been invaluable to the owner. The suburbs of Los Angeles extend far into the foothills of the Sierra Madre on one side, and to the shore of the Pacific on the other; the territory covered by Gilchrist's operations is almost 50 miles in length, with a corresponding width, and before the purchase of the runabout Gilchrist was forced to make use of both electric and steam lines, with the attendant delay and enforced loss of time. Since the acquisition of the motor car Gilchrist has been able to reach his holdings at a moment's notice, at any hour of the day, and the three seats of the runabout have been fully sufficient for the transportation of prospective purchasers. The cost of operating the runabout has been 35 per cent. in excess of maintaining a horse and buggy, but the saving in carfare, and especially the saving in time, has by far outweighed the increased cost. By the aid of the runabout Gilchrist has been able to keep in closer touch with the situation in widely scattered portions of the territory than ever before, an important factor in a city filled with the keenest kind of real estate men whose competition is exceedingly sharp.

The summer is spent by Gilchrist at Santa Monica, a coast resort 20 miles from Los Angeles, but the runabout has reduced the time between the two places to less than three-quarters of an hour. With a large and ever growing number of business men Gilchrist drives to Los Angeles every morning, and returns every evening in his automobile. The rapid transit provided by motor cars has helped in a large measure to make the outlying suburbs of Los Angeles desirable places of residence for well to do families, with the result that the realty dealers reap the profit.

After trying both the horse and the automobile in his real estate and renting business, T. C. Smith, of Ocean Park, Cal., has come to the conclusion that the light touring car is the ideal medium of travel for the peculiar demands his business makes. During the year ending August 31 Smith has driven a four cylinder, 30 horse power touring car, which he acquired second hand, paying for the machine partly in real estate, and he says that he would not return to animal drawn vehicles for the best horse in the world.

Ocean Park, the city in which Smith does business, is a summer and winter resort on the coast of southern California, about 18 miles distant from Los Angeles. During the height of the summer and winter season the demand for cottages is extremely heavy, and in showing his customers the places on his rental list Smith finds his automobile much superior to a horse. With his motor car he can take larger parties, take them farther and show them more cottages than with a horse in the same time, thus enabling him to serve more applicants daily than his competitors, without employing additional help. The automobile also is an excellent advertisement for his business, many prospective renters applying for his services in preference to those of other firms simply for the pleasure of the automobile ride. During spring and winter, when the renting business is dull, the machine can be stored in the owner's private garage without running up bills for feed and care, as in the case of a horse.

During the year Smith has been making use of the automobile the expense, not counting depreciation and interest on the investment, was nearly double the expense of keeping a horse. For the feeding and care of his horse Smith used to pay $17 a month at the livery stable, with $3 more per month for shoeing and sundries. The operation and maintenance of the automobile during the year has cost him an average of $37 per month; of this sum $8.40 was the average monthly expense for gasoline, $3.75 went for oil, $4.20 for batteries, repairs and adjustments, and the balance was charged to the tire account, the largest single item in the list. Though the expense was nearly double the maintenance of horse and surrey, the work performed was three times greater than the services rendered by a horse. While the extreme limit of distance for a horse is 25 miles a day, the automobile was often called upon to do 70 and 100 miles per day. It adapted itself closely to the demands with the changing seasons, and its use is in a large measure responsible for the prosperity of the owner.

In Houston, Tex.

O. M. Carter, president and manager of the Houston Heights Company, is operating a single cylinder runabout, using the machine in and out of the city for purposes of business at all times of the day. Mr. Carter considers that he has a very durable machine, with plenty of power for going everywhere, and that, as far as he is concerned, it is infinitely superior to the horse in every way.

"With my runabout I can go anywhere at any time, regardless of the condition of the roads, and the fact that I do not have to worry over the attention which a horse requires would alone be sufficient to make me favor the runabout as a means of transacting business were there not other features every bit as convincing in its favor. My car costs me on an average $30 per month the year round, including tires and repairs of all kinds. The only trouble I find is in punctures. It is my intention to experiment with a new style of tire." Mr. Carter averages at present about 15 miles per day on a conservative estimate. During the time he has had his car he says he has not spent over $20 for repairs, outside of tires. The single chain transmission Mr. Carter finds very satisfactory. On the whole, he is well pleased with his machine.

Found Car Too Expensive.

C. Edward Barney, a real estate dealer and auctioneer in Providence, R. I., found that his 7 horse power runabout was a complete failure as a business proposition. "I got my machine April 2, 1907, and sold it August 4, 1908. That covers a period of just sixteen months, and the net expense of the car during that time has been $1,800.98, exactly," said Mr. Barney. "The whole trouble was that I bought a cheap machine, when I should have bought a good one. I am going to try another make very shorty, and I hope to have better luck than I had with the old car. My expenses were simply enormous. During the first few months I was always sending the machine to the repair shops to have something or other fixed. It costs a great deal to do that, and I believe you often pay more than it is worth. When I bought the machine I was a novice. That fact alone probably accounts for some of my breakages. Some of the repairs were due to accidents which I am responsible for, but many of the breakages were faults of the car.

"All sorts of things happened to me, and one day I broke down on the road about 4 miles from nowhere. It cost me nearly $8 to get back and to get the car towed to a repair shop. Many times I figured in slight accidents, due to not understanding the machine. I paid $750 for my car, and since then have paid several times the cost getting it patched up and monkeyed with. What I should have done, and what I advise any man to do is to buy a good car in the first place. It is much better to buy a second-hand first-class car than a first-hand second-class machine.

"When I first got the machine I paid $15 a month storage at a down town garage. I find, however, that it is a great deal cheaper to build your own private garage, if you have the room at your home or near your office. The incidental expenses don't amount up to so much if you have your own place, and then, of course, you save the $15 a month. After storing my car for six months I set to work to build my own garage near my home. It cost me quite a little sum, but I figure it was a benefit and a saving to me. It is also expensive if you let the garage people fill your gasoline tank and charge you so much per. If you buy your own fuel wholesale and do your own filling you will find that it is considerably cheaper, and I believe more satisfactory, because then you know just how much you have put into the tank. I once got caught out and ran dry of gasoline. Of course that wasn't a pleasant experience.

"I should say that my average run per day is about 25 miles, although I have gone 50 miles many days in a busy season. I take prospective purchasers of a piece of property out to view the place. If my customer wasn't satisfied with the first place we went to, we turned to another place, and it was then that I appreciated the automobile. There is no getting around that you can do a lot of work in one. With a horse you couldn't do any such things as I have done in the runabout. The machine does save time, and that factor is its chief advantage to a man in my business.

"Suppose, toward the end of a day, a customer wants to look at a place 10 miles out. Ordinarily I would say, 'Come around in the morning.' Having a runabout, I can tell them to jump right in, and inside of a few minutes we are there. The chances are that a car wouldn't connect near the place, and we might have to wait half an hour for one of them, anyway. Still, despite its great advantages, it is not a paying business investment. That is, I say that about the machine I just sold. Perhaps the new one will prove differently, and I certainly hope so."

Among Milwaukee Realty Men.

Real estate dealers, in their peculiar profession, find the runabout especially valuable, according to Milwaukee dealers. "Nothing compares with the aid of an auto to take the prospective customer to inspect a piece of property and land the deal while the iron is hot," says one leading Milwaukee real estate man. W. Russell Wehe, Gottschalk Bros., Walter Shroeder and L. A. Dearholt are a few of the Milwaukee dealers who say that if they couldn't get others, they would not part with their machines for the finest piece of property in Milwaukee county. From $25 to $50 per month is given as the average cost of maintenance.

In the Lumber Business.

Milwaukee lumber dealers are finding that the runabout is solving many problems. The average city lumber dealer does not like to confine his business to city trade alone, but endeavors to hustle a bit in the surrounding country districts, and here the automobile becomes a real factor. Even about the city many dealers claim that they would not be without their machines. The lumber business has been rather quiet during the present season; competition has been strong, and to secure the business the dealer has been forced to be upon the spot. The runabout for manager or salesman has clinched many a bargain, say some of the lumber dealers who use their machines to a practical advantage.

G. M. Maxson, secretary of the Cooper & Maxson Lumber Company, of Milwaukee, owns a 12 horse power runabout, which is daily increasing his lumber sales. Mr. Maxson recently made a 64 mile trip with his runabout upon only 4 gallons of gasoline in five and a half hours, and this over hilly country roads with a heavy load in the machine. The sale of lumber which he made at the end of the journey netted him enough to keep his machine for several months. Mr. Maxson estimates that the cost of maintaining his machine is about $200 for a season of eight months, or about $25 per month. W. E. Cooper, of the same company, uses a light touring car to round up the sales and in making his daily trips between his suburban home at Wauwatosa and his office.

J. J. Johnson, president of the Johnson Lumber Company, is so sure that the automobile is a necessary factor in the lumber business that he is the owner of two machines, a 30 horse power runabout and a touring car. The runabout is given over to his two sons, George and William, who act as city and county salesmen for the company. J. J. Johnson believes that the cost of maintaining the machine is more than that of keeping a horse, but the profits resulting from the continual and timely use of the machine are enough to support "a barn full of horses."

The Hilty Lumber Company, retail, wholesale and manufacturing lumbermen of Milwaukee, are the owners of a single cylinder runabout, which is giving them ample satisfaction. Thirty dollars per month is given as the cost, while the machine is doing the service of four horses.

Not less than twenty-five of the officers of the B. F. Goodrich Rubber Company, at Akron, Ohio, use automobiles, and the company has established a garage in which the cars are stored daily.

THE USE OF RUNABOUTS FOR MISCELLANEOUS PURPOSES.

Great Benefit to a Painter.

We would simply have to drop a considerable portion of our business in outlying districts of the State if we should have to give up the use of the runabout we now use. Horses are not able to do the great amount of work we would be obliged to put them to in conducting our suburban business. We have a great many contracts all over the State, and some in Massachusetts and Connecticut, and it is necessary for us to get around to the jobs about once in at least two or three days to see how things are progressing. It would keep several men and as many horses busy doing the work one man now does, if we did not use an automobile to carry us about. And, besides that, we can do our supervising more satisfactorily this way than we could the other, with horses, because of the more frequent visits.

This is the second season for the runabout we are now using. Altogether we have spent just $28 for machinery repairs. That figure seems small, but, nevertheless, it is a fact. The car has answered our demands very satisfactorily. Patr of that $28 was for a pump which we wore out the first year and the rest was for taking down the engine and reassembling it.

My runabout is a 20 horse power car, selling at a popular price. That does not make it a cheap car, however, and I will say now that I think it would be worse than having a horse to have a machine that you couldn't depend upon. We can and do depend upon ours all the time.

The car is used almost entirely in carrying myself or my partner to the various jobs we have on hand, although we often use it to carry our painting supplies from one place to another. For that purpose I have built a special flooring which I can put on the back over the ordinary rear finish of the runabout. This makes a level surface about a yard square, plenty large enough for all we have to take, as a rule. There is one seat, holding two persons.

One day this year I wanted to get a large box, weighing about 600 pounds, from my shop to another place about 6 miles away. There wasn't time to get a wagon, and so I put it in the rear of the runabout. It certainly was a heavy load, but we managed it. I would not try it again, however, unless it became absolutely necessary, as the weight is too much for any small car. We sometimes carry ladders under 15 feet long, too.

USED AUTOS THREE YEARS.

Up to 1905 we kept horses in the business. At that time we took a notion to get a runabout and try it, and we got a 10 horse power inexpensive machine. This we fitted up practically as the one we have now, as far as the back arrangement goes. Then we started out into the suburban districts of the city after new business. Being able to travel fast and far in a day's run, we managed to land several jobs that other contractors in our part of the city thought were too far out of town.

In the fall of 1906 we bought the machine we now operate. It has proven not only a good substitute for a horse, but has been an actual advantage to us, for through its use we have enlarged our business quite a little.

I recently made what I call a remarkable record in my little car. During thirty-one consecutive days, excluding Sundays, I drove over a route of 60 miles each day without having the slightest trouble. This was when my family were down the bay for a month in the summer. During those trips I carried the trunks down to the summer house and back again, and besides moved the family themselves, giving them a good ride in the bargain.

As to expense, I believe it is a fair thing to say that the automobile, considering the amount of work it does and the short time it takes to do it, is cheaper than a horse. My expenses have been light, although the machine has had the roughest of treatment. Although I cannot give exact figures in all cases, my expenses have been approximately as follows:

Year 1907, repairs	$28
Year 1908, so far	none
New tires on June 11	
Gasoline, at 11 cents per gallon, year	$165
Oil, per year, one barrel	25
Average cost of car per day, everything	2
Average mileage per week	350
Gasoline consumption, per week, gallons	30
Mileage, per gallon, gasoline	12

Now, as compared to the keep of a horse, of course, we had to pay $5 a week for the animal's board and $2 a day for a driver. Then we had to pay for the shoeing, and that is a comparatively heavy expense. Once in a while we called a veterinary surgeon, and more expense was entailed. Then, again, it was not possible to drive the horse more than 25 or 30 mils a day on an average.

A GOOD DAY'S WORK.

How would a horse stand a day's work like this? One day last week I ran out to Centreville, 6 miles from here. Then I made another trip there later in the day with supplies. I made two trips to the centre of the city, 3 miles each way. We have a contracting job out in Pontiac, and in the afternoon I went out there, 10 miles each way. Over on the East Side we have still another job, and I had to go over with some stuff. That is a trip of 5 miles each way. And to cap it all, I went about 4 miles extra about the city. That totals up to 70 miles for one day's running.

Our machine is as sure as any horse ever was, and we never have to think about overworking it. We can leave it anywhere we want to without tying it, and unless someone comes along and runs off with it it will be waiting for us when we get ready to go out. Besides, it won't shy at any old thing it sees.

I would not shift back again to a horse, because I could not do so and keep a great portion of the business. There is so much of it in the outlying and suburban districts that we couldn't possibly get to visit the jobs more than once a week with a horse. As it is now we can go almost at will to any or all of them, and as a general thing run to the nearer ones every day and the others every two or three days.

We give the machine the hardest kind of usage, and it stands it very well. The roads are in many cases bad, but the majority are in good condition. We seldom travel faster than 20 to 30 miles an hour, the former being the average speed with any load in the machine. We have had very little machinery trouble, and the spark plugs have not been out of the cylinders since June 11, and that is near three months. It would surprise you to know all the hard knocks the car has passed through without any trouble.

As for soliciting new jobs, I find the machine much better than a horse would be, because it saves time and makes distance a secondary thing to be considered. We can run 'way out into the country after a small contract that would be almost too small to attract a man who had to go to a lot of trouble to chase it up and land it. In that way directly the runabout has been a great advantage to us.

The car has a wheel base of about 94 inches, is a two cylinder car, and was bought because it was inexpensive. We have never regretted the choice.

In a Painters' and Contractors' Business.

The Weber, Lind & Hall Company, painters and decorators, 1612 Euclid avenue, Cleveland, Ohio, purchased a second hand runabout of a popular four cylinder type in April of the present year. The body of this car they have remodeled, having removed the turtle back and put in its place a box body extending 6 feet on the rear of the driver's seat. The car is used for the purpose of carrying paints, wall paper, etc., to different outlying sections of the city. Irons are placed on the sides of the body, which are used to carry 18 foot ladders and also paperhanger boards. The loads carried average from 500 to 800 pounds. The car was bought as an experiment, and Mr. Weber states that though he is confident that he would have secured better results had they purchased a new

WALL PAPER
PAINTERS & DECORATORS

A Painters' and Decorators' Runabout.

car, still, all things considered, they are well satisfied with the results obtained. In regard to operating cost, in comparison with the horse drawn vehicle, Mr. Weber states that the average cost per month, including tires, gasoline, repairs, etc., has been $26.85. The daily average mileage in both busy and dull seasons has been approximately 35 miles. Had there been a demand for greater mileage it would have been possible to obtain it, as during the dull season the car was idle more than half the time. The upkeep on the horse drawn vehicle of this firm has been, all items included, about $24 a month, but when a horse has made a trip to East Cleveland and return, a distance of about 16 miles, carrying an average load he is about played out for the day. In conclusion Mr. Weber stated that after once having used the car in their service they could not dispense with it.

A Hardware Delivery Runabout.

A most remarkable record in the cost of operation and maintenance of a runabout used for the delivery service of a hardware store has been made by H. C. Mayer, of Venice, Cal., who for the last three years has driven the light machine at a total average expense of $6.65 per month exclusive of depreciation. After thirty-six months of hard work the machine is still as good as new in its essential parts, and the owner expects to get five years' more service out of the car. He bought the runabout, a 12 horse power, two cylinder one, in May, 1905,, paying $850 for it. Since the day of the purchase the machine has been in use practically every day. Mayer removed the boards covering the rear part of the body and thus gained space for the goods to be delivered. A maximum load of 750 pounds can be carried on the runabout, but on most trips the load does not exceed 300 pounds. The owner's store is located in a small town of about 4,000 inhabitants, and the distances to be traversed are not long. To make up for the shortness of the runs the number of deliveries made daily is more than one hundred, and the mileage averages twenty-five per day, six days in the week, with pleasure trips from fifty to one hundred miles on Sundays. In consequence of the greater speed of the runabout, the machine can reach every part of Venice in a much shorter time than a horse drawn vehicle, and customers do not have to wait for their turn on a regular delivery route. Within a few minutes after the order is turned in the goods are on the way and the runabout returns to the store ready for the next order that has to be delivered. Were a horse drawn conveyance in use, the driver would have to wait until a number of orders had accumulated in order to be able to get around without working his horse to death. The runabout has only one drawback; heavy hardware, such as iron pipes, heavy ranges and bulky ice boxes, cannot be transported on the light machine and must be taken care of by a teaming firm. But this drawback is offset by the difference in the expense of keeping a horse and of the operation of the runabout. In Venice the current rate for boarding a horse at a livery stable is $17 per month, while shoeing and repairs to the wagon would bring the total up to $19 per month; by feeding and taking care of the horse himself the owner can reduce the expenses to $11.50 per month. Against this amount stands the record of the runabout for three years at $6.65 per month. Of this sum the largest part is for new tires and tire repairs, which average $3.90 per month; gasoline, at 17½ cents a gallon, accounts for $1.50; oil costs 40 cents and batteries 30 cents per month, while repairs and sundries have cost an average of 55 cents per month for three years. All the repairs necessary during the period of service consisted of a broken truss rod, a broken spring, a new timer and the replacing of platinum points worth 50 cents. During the six months ending July 31, the repair bill amounted to 25 cents.

The owner is inclined to ascribe the record for low cost of maintenance to the fact that he makes all minor adjustments himself and does not take the machine to a garage at the smallest sign of trouble. He considers it a mistake always to be hunting for trouble, maintaining that the diagnosis of the repair man will always indicate a serious disease needing immediate and costly attention. Mayer but rarely inspects the engine and has not cleaned it for months, though he keeps it well supplied with oil. Perhaps a better reason for the low cost of upkeep is the fact that the owner, who knows his car and its engine thoroughly, invariably drives the runabout in person and never allows an inexperienced person to handle it; careful driving and handling is half the life of a motor car, and careful driving is probably the cause of the infrequent and low repair bills.

In the Implement Business.

The runabout as a business getter has been tried and not found wanting by Hollinger & Dorr, implement dealers, of Fremont, Ohio. In October, 1907, this firm purchased a high wheel buggy and have had it in actual service every day since with good results. It is the firm's experience that the buying public approves of the use of the auto. On three separate occasions this past summer this firm has landed large orders simply because they were able to cover the ground quickly. The parties giving these contracts acknowledged they gave the orders to Hollinger & Dorr because they used the auto, contending they would be better able to look after their wants at all times than the man who did not use an auto and in case of a break down of their machinery, a call by telephone would be quickly responded to. Hollinger & Dorr, besides doing a general implement business, handle threshing outfits, buggies and gas engines, and drill water wells, and the use of the auto, according to Mr. Dorr, has added at least 10 per cent. to their business. Then, too, in the setting up and starting of machinery its worth can not be calculated. It can be used for transporting tools and supplies of a light nature required in such work, and enables a man to oversee several jobs which are in widely separate fields or localities. One of their most satisfactory trips, Mr. Dorr says, was to set up a manure spreader for a farmer some eight or nine miles out in the country. The route included about six miles of clay and gravel and two and one-half to three miles of pure clay mud some five inches deep, and at the end about eighty yards of mud, water and manure through the barnyard at least fifteen inches deep and churned into a soft heavy mass by stock tramping around in it. There was not room enough in the lane where they had stopped to turn around in, and the farmer wanted to get his team to pull them back through the yard to a place where they could turn, but Mr. Dorr simply backed his car into the barnyard and while in the worst of it, turned the car around and went on.

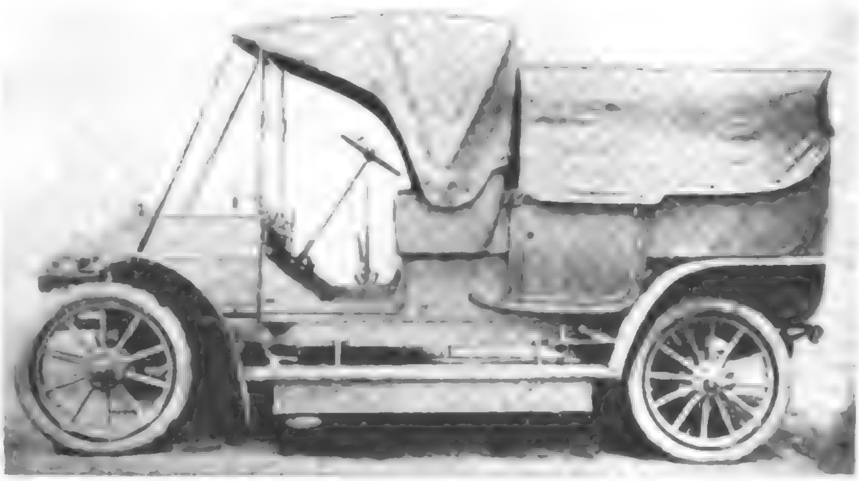
The country in which this car is used is rolling, with clay, gravel and broken stone roads. There are three or four hills of 18 per cent. grade or thereabouts and from one-eighth to one-quarter mile long. The car has 38x1⅛ inch cushion tires.

RUNABOUTS IN THE SERVICE OF TRAVELING SALESMEN.

Novel German Car for Traveling Salesmen.

The photos herewith represent an automobile specially designed for the traveling salesmen for a copying machine as used by many large firms. This sample could otherwise be carried only by freight and a number of workmen would be required to carry it from customer to customer. With the power vehicle the matter becomes extremely simple. The salesman has the machine and trunks loaded on his motor car and travels from one city, town or village to the next, visiting the various shops without any outside help.

Several of these machines were ordered recently by a large German firm of stationery goods from the Neue Automobil Gesellschaft, of Berlin. As can be seen from the illustrations, there is a double door in the rear through which the copying machine can be loaded or unloaded, after a tailboard has been let down on two supporting struts. All this can be done by one person and no chauffeur is needed. The sample machine can be demonstrated to customers right on the car, and the latter is ready for continuing the trip within a few minutes after the demonstration has been concluded. The car can also be used as a four passenger touring car by removing the canvas top, closing the door at the rear and putting the two seats in the right place after the copying machine has been removed. The engine is a two cylinder vertical one, and develops 8-14 horse power.



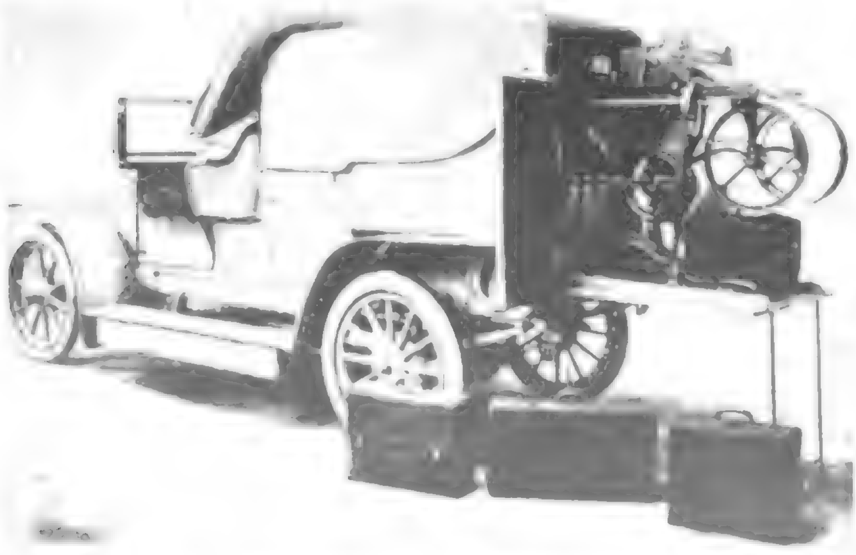
Salesmen's Car, Closed.

Experiences of a New York Salesman.

By R. D. Robertson.

As a subscriber to your very valuable publication I should like to state my experience with a four cylinder runabout which I bought in July, 1907. Up to date I have driven the car about 5,000 miles, with no repairs to the power plant and without any weakness developing in the construction of this trusty little machine. I have never been obliged to "get a horse" or use a tow rope. I bought the machine to use in my business, i. e., selling ribbons around New York, and I find that I can save about one-half a day on the days I use it in the business.

And now as to the cost. I can run with three people in the machine, at a 20 mile clip (a speed at which my machine seems to work most economically, as far as gasoline consumption is concerned), and use a gallon of gasoline for every 20 miles. I took a 1,200 mile trip last summer, and kept an accurate expense account. Part of the time I had two passengers besides myself. It cost us 1.76 cents a mile on a basis of two persons in the car. The trip was made from New York to Bucksport, Maine (via New Haven, Springfield, Boston, Portland, Lewiston, Augusta and Bangor). I came back from Boston to New York in thirteen hours, including all stops. The trip out was made in four days. I bought the machine to save time in my business and for pleasure use at night. It is admirably adapted for both purposes. I bought this particular car because I believed it represented the greatest value for the money in the market, and the fact that it could climb about anything in the line of hills on high speed—that is, it has plenty of power. I have had my speedometer up to 42 miles per hour, but find that the machine is very apt to fly off the road on account of its light weight. Thirty miles an hour is a very pleasant and comfortable rate with this car. I cannot give tire cost, as the tire manufacturers gave me three new shoes for others which wore out after 3,000 miles riding. As I said before, it will cost less than 2 cents a mile to run. I have just two complaints to make regarding features of construction, and these are minor ones. The commutator should be placed in an upright position, and there should be a clasp to hold the emergency brake in position. I made a ratchet which slides on the brass strip and engages the emergency brake at right angles. This is easily kicked in place and holds the car on the steepest hill. On the performance of my machine a number of my friends have bought cars like mine.



Special Salesmen's Car, Open.

Quite a number of instances of successful use of runabouts by salesmen have come to light recently, notably that of covering western Canada by W. G. Bale, as related in a recent issue of The Horseless Age. The automobile is, of course, most advantageous for this purpose where railroad connections are poor, which applies practically to the whole West

In the Service of a Librarian.

By Henry J. Carr.

This informal narration merely tells how one man (and his wife) found health, recreation and business service through the use of a little one cylinder automobile. At less trouble, too, saying nothing of greater enjoyment, than would have been experienced with a horse under the same circumstances, and at possibly less expense of maintenance, even if a larger investment was necessitated.

In 1904, after having enjoyed my first ride in an automobile, my attention was called to a little 5 horse power "motorette," made in Buffalo. It had a one cylinder De Dion type high speed engine, placed vertically near the rear axle, which was water cooled by thermo-siphon circulation, and lever steering was employed. The frame was of tubular construction, mounted on four elliptic springs, and the whole weight was about 750 pounds without load. The vehicle had been used but a few months and run about 500 miles by its owner, who desired to obtain a larger car of the same make. Looking the machine over, we rather liked its carriage resemblance and light weight, and, after my wife had tried a little ride, we bought it. Including a new buggy top and apron it cost us $550 in cash. This was early in May, 1904, following my one initiatory ride already mentioned.

FOR BENEFIT TO HEALTH.

Busied as a professional man, past the turn of fifty, and leading a somewhat sedentary life, I was suffering considerably from indigestion, as well as not "holding my own" in general health. Therefore it seemed that I might do well to take care of the "auto-buggy" myself, and, keeping in the outer air as much as daily duties would permit, see what benefit I might derive from the new work and exercise. I found a neighboring barn owned by a doctor, who had given up his horses and taken to using an auto, and obtained privileges in it along with his machine.

Following the business habits of early life I kept, from the outset, a daily "log" of mileage and use made of the car; also a detailed account of all expense of operation and maintenance, so far as cash outlay was required. Referring to these records, I find that from May 9 to December 31, 1904, we ran that car 1,356 miles, of which 970 were in the city or immediate vicinity, and 386 in longer rides in and about this and adjacent counties, 40 miles being the maximum of any one day's trip. (I say *we* advisedly, since my wife was companion in all rides in the country, and for possibly more than half of the daily city use.)

Automobiles then were more of a novelty here (eastern Pennsylvania) and comparatively few people had been in one. So I made a point of inviting acquaintances, and occasionally others, to ride wherever I happened to be alone or going their way, and the log book records names of more than 100 persons taken for longer or shorter distances. There is less occasion for such "missionary" acts nowadays, probably, and yet, were it done more frequently, perhaps an increased interest and a kindlier feeling respecting the automobile would be fostered.

EXPENSES.

Outlays for the motorette in 1904 (twenty-nine weeks of actual use) aggregated $136, including barn rent, shop work not done by myself, fuel, lubricants, new parts, tools and some road tolls. The machine being so nearly new, shop work and new parts did not cut much of a figure that season; nor did I take any account of my own time on it, considering such mainly in the light of recreation. My health, too, was so effectually built up that from the first two months onward I became robust and free from stomach ills; and ever since then enjoyed excellent health and full strength so long as I had steady use of the auto. Equivalent benefit has been derived by my wife, also, through the rides and consequent out of door life, and the continual saving of strength by using the vehicle for errands, and going and coming from shopping and visiting, etc.

In 1905 the car was "laid up for the winter" from January 2 to March 27, and rested in the barn during July and August while we were traveling in the Western States. Otherwise it was in rather steady use up to December 28 (thirty-two weeks in all), largely for town purposes, but with some minor country trips, as in the previous year. The total mileage of the year, however, was but 1,084, and the expense account, on the same basis as in 1904, was $152.00. Shop work was nearly the same in both years; but new parts and some tire repairs added to the maintenance cost.

Tire features also made a decided increase in the next two years, despite the lessened mileage in each, including one new tire casing (28x3). By dint of changing about from front to rear, and due attention to relining and vulcanizing when necessary, the four tires originally on the car, together with the new one, served to carry us through to the present time, and but three new inner tubes have been required. So much for having a light car, with effective springs, although the wheel base and tread are but 58 and 44 inches respectively. And, too, moderate speed in driving may have some credit, since the usual running has been done at from 8 to 12 miles an hour only, with a possible occasional maximum of 15 to 18 down hill and under very favorable circumstances. An average of 10 miles an hour has been attained in country trips, up hill and down.

For the seasons of 1906 and 1907 the motorette was in less active use, since we had indulged in the extravagance of a three cylinder touring car (two cycle engine). The operation of the later averaged two-thirds as much per month as the motorette for a whole season, but that is "another story." Even so, the mileage of the motorette in 1906 was 898 (in twenty-four weeks), at an expense of $179.21, and in 1907 it was 766 (in twenty-eight weeks), for $212.48. During 1908 (sixteen weeks to the end of August) it has been run 420 miles, with $94.78 charged against it. It is now undergoing a second (only) general overhauling of the transmission, few things being required to make that good. The engine is working admirably, with as much power as in the first years, and the machine seems to be good for considerable further service, except as to one wheel, in which the wire spokes are breaking; while the tires probably ought to be renewed by next season, if not sooner.

AUTOMATIC INLET VALVES BREAK.

Other effects of increased age and wear and tear are apparent, of course, such as rattle in rods and levers for steering and the brakes, etc.; likewise the top and fenders, and some other woodwork lack pristine freshness. Automatically operated inlet valves have been one source of trouble and cost, no less than nine having broken; some of them did not endure an average of 100 miles each, though one ran over 2,000, and the one now in has lasted for 432 miles. The original exhaust valve, cam operated, is still in service. Time lost because of making repairs has not been great, on the whole, averaging but three weeks each season, and partly due to waiting for new parts from the manufacturers.

The detailed table appended affords a basis for computation of costs per mile run, and comparison of some other features of operation. Casual examination of the figures will show how small a factor is the cost of gasoline and lubricants; while, in this case (though not shown in the table), expenditures of $45.70 on valves (including new ones, repairs and grinding in), and $19.70 for spark plugs (some of the latter not really necessary but bought as a fancy or for trial), are incidents that do count. Speaking of spark plugs, the best results were attained in this machine from mica insulated ones, of reasonable cost.

Now, it may be pertinently asked, what did we gain through the little runabout that might not have been realized by means of a horse and buggy?

It is only just to say, in the first place, that I was brought up with and for some years accustomed to both ride and drive a horse or horses. And also that personally I still have a great liking for horses, and had experienced many regrets that in this city I could not advantageously keep one for use. Boarding it at a livery would be neither convenient nor satisfactory to us, and the necessary daily care and attention, if kept in a home barn, too burdensome and unremitting to be undertaken by me while in present professional position.

NEEDS LESS ATTENTION THAN HORSES.

Because of customary absence from home for several weeks of each year, and the nat-

TABLE OF COSTS, ETC.

Year	W'ks in Use	Mileage.	General Expense.	Barn and Road.	Gasoline.		Lubricants.	Batteries.	Tires & Tubes.		Punctures.	New Parts and Tools.	Shop-work.	Total for Maint'ance	For Depreciation.		Average Per Mile.	
					Gals.	Cost			New.	Repairs.					P. C.		Mt'nce.	Dep'cn
1904	20	1,356	$25.25	$30.10	103	$23.45	$3.05	$1.55	$4.75	$8.70	4	$22.50	$16.15	$135.50	20	$111.00	10c.	8.20c
1905	32	1,094	18.25	36.65	82	15.85	2.00	3.20	5.80	10.55	12	43.65	16.95	152.90	25	111.00	14	10.15
1906	21	894	16.80	23.30	70	12.00	4.40	2.00	29.50	14.00	4	44.73	32.48	179.21	30	100.00	20	11.18
1907	28	766	27.70	52.10	65	13.15	4.00	3.00	4.00	21.80	4	60.60	25.23	212.48	30	70.00	27½	9.14
1908*	16	442	9.25	18.35	40	7.80	1.05	1.00	......	5.60	3	19.70	32.63	94.78	30	49.00	22½	11.06
Totals	120	4,534	$97.25	$160.70	360	72.25	$14.50	$10.75	$43.95	$60.65	27	$191.18	$121.14	$775.37		$441.00	17.14	9.75

* To end of August.

ural drawback of inclement weather conditions in some seasons, it is not likely that we should have made materially greater use of a horse and carriage (if one had been similarly relied upon instead of the auto) during those same years. Certainly not with like comfort and convenience and as little worry; while practically no care, except due shelter, and but little general expense were entailed during the weeks of non-use, which would not have been the case with a horse. The machine will stand quietly by the street curb, or in a nook of the highway or yard, all day long (if passersby will but let it alone), yet be ready to start off in a moment when wanted. Its "hostlering" from day to day requires but little work at any one time, and that usually can be attended to at the convenience of the user. Some more and extra work, in the way of good upkeep, may be essential now and then, it is true; but, in the long run and mile for mile, my comparison of experience has been that the small runabout has scarcely needed one-quarter as much attention as the keeping of a horse would require. Respecting the features of possible continuous service, long rides and trips far beyond the endurance of a horse, to say nothing of pleasure as well as celerity, I will not undertake to argue. They are all factors which enter largely to the credit of the automobile.

DEPRECIATION IN VALUE.

To its debit, however, there is one very serious matter to be considered, and that is the annual depreciation in value. The markedly extra cost of automobile use arising from that factor is scarcely realized by most persons at the outset; but it should not be overlooked when weighing the merits and demerits of such service. Except when measured by actual sale, valuation of depreciation is to some extent a matter of judgment, and may vary with individual circumstances. From my experience with two machines of different makes I am led to believe that, as to the average, moderate priced car, not less than 20 per cent. of the purchase price should be charged off at the end of the first year's ownership. Even a larger per cent. of loss in value may be sometimes entailed because of change in styles, or the car ceasing to be further manufactured. The per cent. of subsequent depreciation in years after the first will usually be quite as much or more, each season, until, as in the case of an old machine, practically no sale value remains. All such shrinkage should be counted (even interest on the investment, perhaps) when figuring the actual expense of auto use; and I am satisfied that, as yet, those receiving a salary of less than $2,500 a year had better not participate in the "auto game" unless happily possessed of other income or resources.

Very likely the foregoing record is neither exceptional nor particularly notable, and furthermore it relates to a machine not made in recent years or which would be likely to find purchasers if it was on the market. In conclusion, while the writer (and his wife) might like to have a new and reasonably larger runabout to take the place of this, which has served them during these nearly five years, they have not yet found just the kind of machine to their notions or in which they care to invest. What we desire may be made after a while (and I feel confident that it will), and very possibly it will be just the article that thousands of others in not too dissimilar circumstances would also like, if the price is kept within the reach of medium pocketbooks.

Some Experiences With a Voiturette.

By Piersoll Sargent.

It was not more than two years ago that the writer, having had a successful trip through Norfolk, Suffolk and Lincoln, England, upon a well known voiturette of French manufacture, decided to bring one of the same make over to the United States. The gasoline consumption had been quite low upon the English trip, so had the oil consumption, and the tires stood up finely, the weight being properly distributed. Mechanical troubles were limited to the replacement of the frivolous little oil cups that held about a teardrop each, by stanch brass grease cups of several ounces capacity, and the constant adjustment and cleaning free from chips of an inferior type of roller timer. The outlook was fine from a mechanical and financial standpoint, so a G—— voiturette, fitted with a double cylinder 10 horse power motor and four speed sliding gear arrived in New York early in 1907, and finally, after much signing of names and interchange of coin of the realm, came into the hands of its purchaser.

Of the first two months there is little to say, except that everything went finely. The roller timer of ill repute was replaced by a snap off contact model, and the voiturette was fitted with a leather mud apron which extended beyond the change gear box. The car was so far suited to all tests to which it had been put, and its uniformly consistent running nearly converted a friend engaged in horse breeding to motor using. Accordingly we decided to make a trip up into the Blue Ridge Mountains via Philadelphia, as we had never gone by any other way than the roads in the Blue Book. Accordingly we left New York one bright day, running the voiturette aboard a ferryboat bound for Jersey City, just behind a large wagon loaded with carboys of chemicals, sulphuric acid among them. About halfway down the river one carboy developed a crack, and the "oil" ran out into the gutter of the wagon way, trickling overboard by way of the scupper holes at the stern. This stream attracted the attention of an individual standing near the stern who promptly put his finger in, and as equally promptly yelled "fire." The whistles blew, the crew went to fire quarters and a dozen officious hands were laid on the voiturette to shove her overboard, the lay mind immediately associating fire with the motor car. We protested, first by words and finally by blows, for the crowd was pushing the car against the gates. Above the noise rose the shout of the driver of the carboy wagon, telling the crowd to take care of the spilled acid. A police launch then came alongside, as well as a tug with fire lines out, and the "fire" was found to be imaginary, to the disgust of all hands. After leaving our names, etc., with the police, the boat entered the slip, and after the chemical wagon got well ahead we drove up the runway and out onto the cobbles of Montgomery street, reaching Newark via the Turnpike after a good run, broken only by sections of "pockmarked" road in Harrison.

After taking stock of accessories, etc., to see if all were there the clutch was let in and the party proceeded toward Trenton, the car running sweetly all the while. Just after passing Iselin a bumpiness was noticed in the right steering wheel, and investigation showed a ripped shoe and its accompanying blowout. As there were no demountable rims fitted, the next fifteen minutes were occupied in removing the damaged tire and placing a spare one, which had a studded tread. The voiturette then was driven on through Hightstown, finally reaching Trenton.

The next morning the road to Philadelphia was taken, the customary stop for changing the license plate to the red and white Pennsylvania "tag" being made on the Delaware River Bridge at Trenton. Near Bristol, Pa., a group of cyclists suddenly emerged from a "blind turn," with the result that, despite the application of both sets of brakes, one rider ran full tilt into the voiturette, landing in the lap of the passenger, and damaging the front wheel of his cycle. Despite the fact that they were on the wrong side of the turn, and had not rung their bells or indicated their presence in any manner, the cyclists were wrathy and threatened to punch our heads, but the sight of a Colt's automatic in the pocket of the passenger's "duster" cooled them down, so that after cursing us for several generations back they retired to the side of the road, and we proceeded, reaching Philadelphia about 12 o'clock. The afternoon was devoted to sightseeing around the Quaker City, the voiturette being the object of great interest and much questioning whenever opportunity offered.

Returning to the hotel at sunset the voiturette suddenly began to drive "hard," and the clutch to slip repeatedly. Upon stopping it was found that, owing to the rupture of the oil lead to the front bearing of the change gear side shaft, this bearing was beginning to "seize." The gears were disengaged..and the car pushed to the side of the road, where, with the aid of a bucket of water, the bearing was cooled. The oil lead was then repaired in the following manner: A piece of the gauntlet of an old driving glove was cut out, and after placing the broken ends of the lead in their proper relation, the piece was wrapped tightly around, and bound with a single layer of copper wire. Above this, and running parallel to the axis of the lead, "splints" made of cedar wood from a lead pencil were applied, copper wire again being used as a binder. The whole repair was then taped over, and after lighting the lamps the car was driven to a garage for the night. The next morning the garage man volunteered to braze the break, but after learning his methods of brazing we drove to a coppersmith's and had a collar shrunk on, the collar being made of copper tubing whose internal diameter admitted of the operation being performed. No trouble was experienced during the remainder of the trip from this repair, which to all purposes was as good as the original lead itself.

The motor, which had thus far been going well, now began to show signs of not developing its full power. As the voiturette went over the roads toward Reading the motor worked with difficulty, and finally died in front of the cemetery just before entering that city. After about an hour's futile examination, accompanied by plenty of theorizing, a friendly motorist took us in tow to the garage. There another examination was made, ignition found correct, mixture unchanged, valves in good condition, no leaks visible. Finally the valve caps were removed, and the motor was tested for timing according to the very indifferent French manual accompanying the car, when it was found that the inlets did not open until the piston had reached the admission-outward-dead-centre. Upon opening the valve gear casing the secret was out. The half time gear on the inlet cam shaft was keyed to the shaft by a very shallow key, which was evidently badly tempered or made of soft metal, and as the cams had sharp profiles, this key had gradually sheared through, but had allowed the gear to slip slowly with reference to the shaft, instead of ceasing to drive immediately. A deeper keyway was cut in both cam shaft and gear, the operation upon the former being performed by means of an emery wheel upon a flexible shaft without removing the cam shaft from the motor. A Woodruff key was cut off to fit, and after timing the motor and replacing the casing we were again on our way.

Outside of tire trouble, due to the builder fitting tires suitable for macadam roads, the voiturette experienced no functional disorders for over 30 miles. As in the dark ages of motoring such a circumstance was an indication of trouble to come, so with the voiturette upon the mule tracks which are miscalled "roads" in the coal regions. Just after passing Cressona, a small town near Pottsville, a sharp crack announced that the trouble had arrived, the frame immediately settling down forward on the left side. Examination showed that the pin of the spring shackle had torn loose, breaking the shackle link and allowing the frame to settle on the end of the spring. The usual curious crowd gathered around the voiturette, and from a small boy we got the information that the blacksmith was only "a piece up the road," but that he had gone to a funeral and his assistant couldn't speak English. The car was therefore driven gently to the shop, where the assistant was encountered, but being a Russian we were unable to talk to him. He, however, forged a new shackle about twice as thick as the broken one, and fitted a deep rib down the back to further strengthen it, using the sound shackle link as a pattern. Upon our tendering him a handful of various coins, he picked out a quarter and a dime and quietly placed them in his pocket. We then reassembled the shackle and spring and rode away.

Arriving in Pottsville, we fixed up the car for the night, and after supper started for a walk about town. The streets are very steep, as the town is built near the crest of the mountain, and on passing a cross street we found a prominent country lawyer endeavoring to start a 16 horse power planetary geared car up the street upon the high gear, while his family sat patiently on the rear seat. The operation involved a great deal of cranking and was unsuccessful until we suggested the use of the low gear and no family aboard, which resulted in the car ascending the street without trouble. The next morning the lawyer was driven out in the voiturette and the same street was taken on the third speed at a good pace, but the cost of the car was considered excessive and the car "too complicated."

Leaving Pottsville about 7:30 in the morning, we started toward Reading over the old route by which we had come. Reading was reached in good time, but before reaching Douglassville it started to pour, and pretty soon got quite dark. At a short turn in the road we miscalculated and went over the bank, going down about 9 feet into the backyard of a house near the railroad tracks, which run some distance below the road level. The result was the utter destruction of some fine vegetables in the yard and the breaking of some tubes in the radiator, which struck a large stone, one of a series placed in the yard to outline the vegetable beds. The owner of the house was absent, but his two children watched us from the windows and readily accepted the money we tendered for the damage done. After stripping off the flanges from the injured tubes we patched the breaks up with pieces of rubber shoe and tire tape and crawled into Pottstown. Here the passenger declared he had had plenty of motoring and left for New York. The writer stayed over night and next morning drove toward Philadelphia alone. The remaining drive was accomplished with few incidents, these being tire replacements —not a pleasant job with regular rims and in the rain and mud. At Philadelphia the car was cleaned and shipped to New York in a crate. When the bills came in the writer found that the trip had cost about 32 cents a mile, including gasoline and oil. This was considered very high, so when a doctor in Philadelphia was willing to exchange his two cylinder runabout for the voiturette the exchange was made.

The writer attributes the high cost to the fact that the car was "undertired," a great method of saving expense in building for the manufacturer. The tires fitted were 810x90 mm. all around, but it was thought with the light weight of the car that these would be amply strong. The doctor has had 105 mm. tires fitted, and at last reports was running about with very little expense under that head.

About five years ago a patent was taken out in France for a "smoke preventer," based on the following curious phenomenon: If a horse hair or a silk thread be specially treated in a bath of soda, and then dried in a certain manner, it will elongate if placed in contact with smoke. This property was utilized to close an electric circuit and ring a bell. The curious part of it was that the inventors themselves were unable to explain the cause of this phenomenon, and could not even offer any suggestions. It would be most important if this smoke preventer could be applied to automobiles. Among other things, it would prevent trouble with the police.

The Runabout in School Work.

By F. J. Roller.

I sometimes wonder why more men in the work of school administration do not make use of the runabout in their daily business, which calls them to many buildings widely scattered throughout a city or over many miles of highways if looking after rural schools. The aim of this article is to furnish data possibly interesting to schoolmen in particular and the motoring fraternity in general, showing why, for economic as well as other reasons, I prefer the automobile to the horse street car or railroad train. Now, for some of my data and experience.

June 21, 1905, I purchased a runabout of popular make at a cost of $720, which included leather top, a complete outfit of curtains and a dos-a-dos rear seat to throw on when one wants to offer accommodations and carry four or even five passengers.

BUILT A BARN.

On the rear of the lot with my dwelling house I had built an auto barn, 14x14, of which I was the "architect." The completed structure built to my plans cost $140. The building I put 2 feet above the ground, which allowed a pit in the centre 4x5 feet, which was readily uncovered for use by drawing out the loose boards. This pit is of great value when one needs to work under the machine. The barn has sliding double doors at one end, with a single door and window on one side and one window on the opposite side. There is no window at the rear, which is west. This arrangement takes care of the problems of ventilation, storm, light and of sunshine (which is very hard on tires). Shelving about the walls makes place for accessories, while a workbench conveniently placed is a valuable adjunct.

Let the auto barn or garage builder now note my next and last point in construction. I connected a sufficient length of wire to my dwelling house circuit so as to have a drop light in the barn. This electric bulb with its wire guard has 20 feet of loose cord so as to be carried to every part of the barn, in and out, and about the machine for close inspection by day or emergency work at night.

From the day of purchase to the present time I have kept a detailed and accurate account of every cent expended in the maintenance of the car. When I now give this expense by years for the past three years, let it be noted that the gasoline horse is on call for duty summer and winter, sunshine or storm, over dusty roads, mud or pavement, ice or snow—all which has bearing upon the expense account.

Following is my expense account from June 21, 1905, to June 21, 1906:

Gasoline	$20.07
Oil and grease	2.65
Batteries	4.00
Rubber cement	.35
Calcium chloride	1.85
Repairs	9.40
Miscellaneous	1.60
Total for first year	$39.92

Of the $9.40 spent for repairs $8.40 was for soldering the radiator, which, through my own fault, was allowed to freeze in October before I put the non-freezing solution in the circulating system. With the solution made to show a specific gravity of 1.215 the liquid is safe from freezing in any low temperature we are apt to have in this climate. The car may stand for any length of time in the street with the thermometer below zero and you find everything right when you are ready to start.

The second year, for twelve full months' service, the total expense was $39.85. The third year's expense, $53.30. Total expense for the three years of continuous service, $133.07. So far I have my friends who drive horses beaten more than a mile on the expense account, and think that the machine requires much less time and care than the horse. The prompt and speedy service is, of course, such as no flesh and blood horse could give.

As I advance into the fourth year of service for the car I have no thought of being able to hold expenses down to the average of the past three years, as tire replacements are beginning to come.

REASONS FOR LOW EXPENSE.

I am sometimes asked why my expenses are so low as compared with the enormous outlay of some of my friends who drive all kinds of cars. I will endeavor here to give some of the reasons. First, I take care of my own car, and this work is really enjoyable and profitable recreation needed to give a physical balance to my daily employment. Then I would recommend to the amateur that he study his car both theoretically and practically until he knows the machine—until he knows not simply what it does but why it does it.

Another suggestion I would make is to keep a machine at the point of highest efficiency all the time. Go after the first symptom of looseness, a strange sound, a knock, an irregularity of action of any kind, instead of heedlessly disregarding these symptoms of distress until the abused machine at last reaches the limits of mechanical endurance and balks, with a job made necessary for the machinist.

My observation has been that it is better to use too much oil than too little, and never to go on the supposition that the moving parts are properly lubricated, but to see that they are. There is no excuse, however, for the blue smoke and fumes of unconsumed carbon emitted by many machines whose drivers either do not know or do not care to properly regulate the oil supply to the cylinders or crank case.

Every operator of a gasoline car should have a pocket volt-ammeter so as to do no guessing on the strength of batteries in times of doubt. I have often found that some cells will become dead while others are still active. By throwing out dead ones and grouping the less active cells into one battery, and carrying another set of full strength, the weak ones may be run down until one gets the full measure of service out of all.

The past year my machine developed a peculiar metallic click, which, while apparently doing no harm, would be annoying to anyone who prided himself upon a quiet machine. Through a series of fourteen investigations I found at last that it was the driving chain which, while still strong, had stretched entirely out of pitch. I would advise to take the measurement of a number of links and one will see whether he is inviting toothless sprockets and disaster by allowing a chain to run as long as it will hold together. A chain is often worse than useless long before it is apparently worn out.

POINTS ON CARE OF TIRES.

All agree that the tires are the chief item of expense in maintenance. The proper care of tires will add wonderfully to their life. Promptness in giving that care at the time when first needed is an important factor in the problem. Never let your tires stand needlessly in the hot sun. Keep tires well inflated, but this may be overdone if driving on a hot day, and especially over paved streets. When the machine stands for several days idle in the barn or your home made garage trundle it to a different position occasionally, as this rests the tires. If from home for a week or two jack up the machine so as to take the weight off the tires. The small amount of work required to do this, if you have ready appliances and home made axle rests, will repay you well in better and more lasting service. Tire cuts and threatened blow outs should be given immediate attention. Buy a vulcanizer and repair your own glass cuts and damaged tires at once, and you will save the expense of many a big job for the rubber works professional man. Any tire cut that is deep enough to let water or dirt reach the fabric will soon ruin the tire if not attended to immediately. I find that this vulcanizing work is quickly and satisfactorily done in one's barn without removing the tire, unless the fabric has been cut through. After a little practice one finds that he does not need to lose thirty or forty minutes sitting constantly by the vulcanizer and watching the thermometer to keep the right temperature and guard against the fatal mistake of excess heat, but that while this heat is being applied he can give the thermometer sufficient attention and at the same time be using his time in doing many other odd jobbs about the car. On returning recently from a seven weeks' tour into Michigan I had occasion to apply the vulcanizer thirteen times, but now I have my tires in good shape for the fall rains and wet season that will soon be here. The vulcanizer will often pay for itself in a few days.

For leaking pipes when a soldering job cannot conveniently be made at the time I have used discarded linen string neckties smeared over with white lead to wind repeatedly and tightly around the pipe. This, when followed with a layer of twine or wire, makes a job that will last for years if desired.

SOME USEFUL HINTS.

An engine will run best and at the same time most economically on a certain amount of gasoline. Find that amount by tests and experiments. On returning from my Michigan outing I made the something more than 60 miles from Cleveland to Niles, over country roads with many hills, on 3 gallons and 1 quart of gasoline. The machine weighs 1,400 pounds, and carried two passengers, two heavy satchels, one extra tire, and a full equipment of curtains and tools.

When the leather work about your machine needs some dressing you will find one of the best preparations to be simply unsalted butter.

In case of any overheating, if a water cooled car, and the stream of water is diminished, look not only for the things that would naturally obstruct the flow, but look for air pockets in the circulating system. This often occurs when unthinking motorists fill an empty circulating system without seeing that the cocks are left open until all the air is expelled.

Last, let the automobile be used as a substitute for the horse rather than for the passenger locomotive, and driven sanely. It then proves to be an invaluable aid to either business or pleasure, or rather to both business and pleasure, for there must be both in proper combination to bring out the best in any well ordered life.

That the popular priced runabout may appeal to others besides the man of moderate means is proven by a report from Syracuse, N. Y., to the effect that Alfred G. Vanderbilt has just bought a $900 roadster from M. W. Kerr, a dealer of that city. Mr. Vanderbilt owns six foreign cars, all of high power.

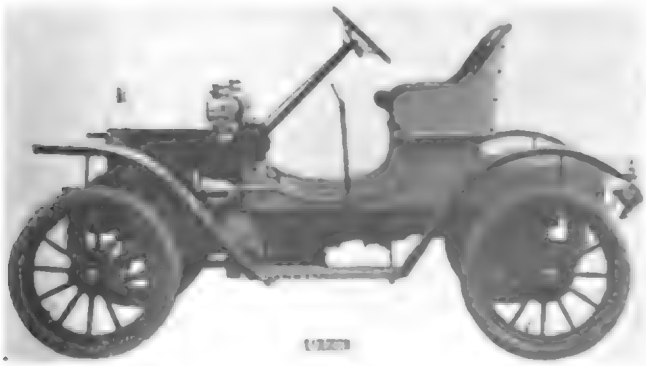
PNEUMATIC TIRED RUNABOUTS.

THE BRUSH.

This car, according to the manufacturers, the Brush Runabout Company, Detroit, Mich., is designed to give low operating cost and reliability at a sacrifice of some of the speed obtained with more expensive machines. It is driven by a single cylinder, four cycle, water cooled engine, set vertically under the hood. This motor is 4 inches "square" and runs with little vibration at a wide range of speeds. Speed changing is by a completely enclosed two speed planetary, with multiple disc clutches. This gear is selectively operated in such a manner that the pull of the motor furnishes the power for holding the clutches in engagement. Final drive is by side chains, running on good sized sprockets. Axles and frame are of wood, specially treated and trussed. The spring suspension is a combination of helical springs, set well out toward the wheels, with shock absorbing radius rods which hold the axles in alignment and dampen the spring action. This arrangement allows of the weight of the car being carried very near the wheels so that the axles stresses are greatly reduced and permits of a large spring deflection. Expanding brakes are applied to the rear wheels. They are actuated by a wedge mechanism, which makes them perfectly double acting and utilizes the momentum of the car to keep the brakes in engagement once they are applied by hand. This car is designed for either solid or pneumatic tires. The pneumatic equipment consists of 28x3 inch clincher, while the solids are 32x2 inch. The wheel base is 74 inches, while the tread is either 56 or 60 inches, as specified. The weight is about 900 pounds.

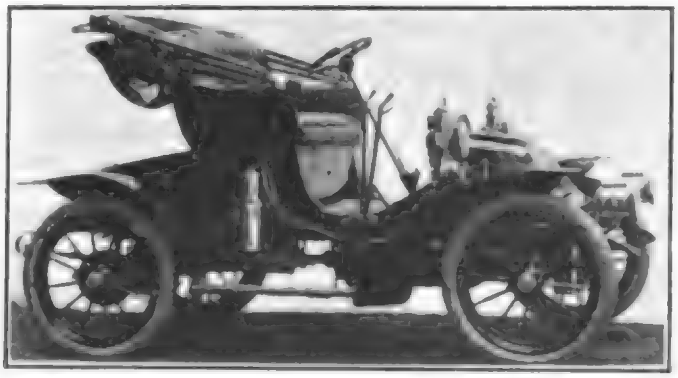
THE CADILLAC.

The Cadillac Model S, made by the Cadillac Motor Car Company, Detroit, Mich., retains the same constructional features that have made it so well known. The motor is a single cylinder of 5 inch bore by 5 inch stroke, and rated at 10 horse power. The cylinder is fitted with a separate head and water jacket. The valves are in the head and are actuated by push rods through rocker arms. The crank shaft is a nickel steel drop forging and runs in two interchangeable, babbit bushed bearings, which can be easily replaced if necessary without disturbing the crank shaft. The carburetor is of their own manufacture. The ignition is by high tension jump spark, with coil and switch on the dash. The secondary wires are not grounded, but run direct to the Cadillac double spark plug. Lubrication is by a belt driven force feed, four lead lubricator. One lead goes to the piston, one to the connecting rod and crank pin bearing, and one to each of the two main bearings. Speed changing is accomplished through a two speed forward and reverse planetary mechanism. Final drive is through a single chain to the live rear axle. The front axle is a steel tubing with drop forged ends and trussed. The rear axle is a steel tubing and is equipped with roller bearings. The wheels are of the artillery type, the rear wheels being secured to the live axle ends by keying and slotted nuts with cotter pins. The front wheels run on adjustable ball bearings. Both front and rear wheels are equipped with 30x3 inch tires. The frame is pressed steel, mounted on semi-elliptic springs at the rear and a single cross spring in front, secured to the axle through a rocker joint. Steering is by wheel through rack and pinion. The brakes operate on the differential drums and are double acting. The wheel base is 82 inches and the tread 56. Control is by two foot levers on the footboard, one hand lever at the side and spark and throttle lever on the steering column just below the wheel. One of the foot levers has a ratchet locking arrangement, and operates the brakes. The other one operates the low speed forward. The side lever operates the reverse by pulling toward the rear and the high speed forward by pushing forward. This car is equipped with or without rumble seat or with a victoria body.

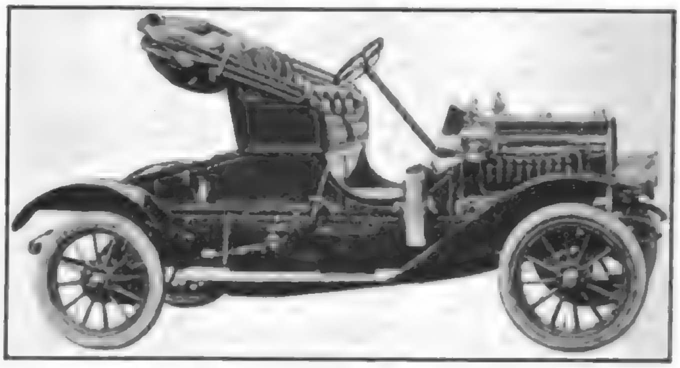


BRUSH RUNABOUT.

CADILLAC MODEL S.



Autocar Type XV.



Rambler Model 47.

THE AUTOCAR.

The Autocar Company, of Ardmore, Pa., are manufacturing a runabout known as Type XV. The motor is of the two cylinder, opposed, water cooled type, located crosswise in front under the sloping hood. The bore is 4 inches with a stroke of 1 inch, and the motor is rated at 12 horse power. The cylinders are cast with integral heads and water jackets, with the mechanical exhaust valves in pockets in the upper side of the combustion chamber and the automatic valves in the heads. Cooling water is circulated by a gear drum centrifugal pump, with a tubular radiator in front under the frame. Lubrication is by an automatic sight feed oiler located in front of the dash under the hood and supplemented by a port actuated pump, by which oil can be injected into the crank case for the splash lubrication. Ignition is jump spark, with a two unit spark coil and storage battery, and reverse dry cells. Power is transmitted through the regular Autocar type of floating ring, metal to metal clutch, to the sliding change speed gear case, which forms a unit with the engine, enclosing the flywheel and clutch. The change speed gears give three speeds forward and reverse, and are operated progressively. Final drive is by Cardan shaft, fitted with two universal joints, the rear one of the sliding type to the live rear axle. Universal joints are protected by dustproof cases, which are packed with grease. The rear axle is of tubular construction, with driving shaft running on roller bearings. The wheels are secured on the squared ends of the driving shaft. The front axle is a seamless drawn steel tubing with forged yoke ends. The wheels are of wood, artillery type, and fitted with 30x3 inch pneumatic tires front and rear. The frame is of pressed steel, supported on semi-elliptic springs in front and scroll type full elliptic springs in the rear. Steering is by wheel through bevel gear and sector. Two sets of brakes are fitted, an internal expanding emergency set and an external contracting service set, both operating on the rear wheel hubs. The control is by two pedals, for the clutch and the service brakes, respectively; two side hand levers, for the change speed gears and the emergency brakes, respectively; hand grips incorporated on the rim of the steering wheel for the throttle and the spark, respectively. The wheel base is 80 inches, with a tread of 54 inches.

THE BUICK.

The Buick Motor Company, Flint, Mich., manufacture a popular priced runabout, known as Model 10. The motor is a four cylinder, water cooled type, with 3¾ inch bore by 3¾ inch stroke, and is rated at 18 horse power. The cylinders are cast in pairs, with integral heads and water jackets. Ignition is by jump spark, with a single coil and secondary distributor. Ignition current is supplied from a storage battery. Lubrication is by a mechanically driven force feed oiler. A two speed forward and reverse planetary change speed mechanism is used, with a cone clutch, the final drive being by Cardan shaft to the live rear axle. The frame is of pressed steel, channel section, with a sub-frame on which the motor is supported. Semi-elliptic springs are used in front, with full elliptic in the rear. The front axle is a seamless drawn steel tube with forged ends. Wood wheels of the artillery type are used, fitted with 30x3 inch Michelin tires. Two sets of brakes are fitted, an external contracting brake on the transmission and two internal expanding brakes operating on the rear wheel hubs. The wheel base is 88 inches, with standard tread. The control is by foot levers for the slow speed forward and reverse, one side lever for the high speed forward and throttle for the emergency brakes. The engine is controlled by spark and throttle levers on top of the steering wheel.

THE RAMBLER.

Thomas B Jeffery & Co., of Kenosha, Wis., are manufacturing a two cylinder runabout, which will be known as Model "47," for 1909. This is practically the same car as Model "37." The motor is of the two cylinder opposed, water cooled type, located under the body. The bore is 5 inches, with the stroke 6 inches, and the motor is rated at 22 horse power. The cylinders are cast with integral heads and water jackets, with the mechanically operated inlet and exhaust valves located side by side in a pocket in the upper side of the combustion chambers. Cooling is by the thermo-siphon system, with the radiator in front. High tension ignition is used, with a two unit coil and storage battery and set of dry cells. To the side of the crank case is bolted the two speed forward and reverse planetary gear housing, which thoroughly protects all parts from dirt and allows an oil bath. Final drive is by single chain to the live rear axle. The frame is of pressed steel, supported on semi-elliptic springs in front and full elliptic in the rear. The front axle is of tubular construction, with forged yoke ends. The rear axle is of the tubular live axle type. The wheels are of the wood, artillery type, fitted with 30x3½ inch pneumatic tires front and rear. Two sets of brakes are fitted, a contracting hand brake acting on a drum of the change speed gear, and two internal expanding brakes on the rear wheel hubs. These brake levers are so interconnected that when applied the clutch is drawn. The control is by three pedals, one of which operates the reverse and the other two operate the brakes. One side lever controls the low and high speeds forward. Spark and throttle levers on top of the steering wheel control the motor, and an accelerator pedal for spurts. Two styles of body are used, one giving accommodations for two and the other with a rumble seat in the rear. Both styles are hinged in the familiar Rambler manner to give easy access to the transmission. The wheel base is 102 inches.

THE MITCHELL.

The Mitchell Motor Car Company, of Racine, Wis., are manufacturing two styles of runabouts, one style seating two persons and the other three. The motor is a four cylinder, vertical, water cooled one, placed in front under the hood. The bore is 4 inches and the stroke also 4 inches, and the motor rated at 20 horse power. The cylinders are cast singly, with integral heads and water jackets, the inlet valve being in a pocket in the side of the combustion chamber and operated direct by a push rod. The exhaust valve is over the inlet valve and is operated by a push rod and rocker arm. A mechanical belt driven eight lead oiler forces oil to all the important parts of the motor. Ignition is by jump spark, with a four unit coil and batteries, but the engine is designed for the attachment of a magneto. Power is transmitted through a cone clutch to the change gear box, which gives three speeds forward and reverse, operated selectively. Final drive is by propeller shaft to the live rear axle. The frame is of pressed steel, supported on semi-elliptic springs front and rear. The front axle is an I beam drop forging and the rear the tubular live axle type. The wheels are wood, of the artillery type, fitted with 32x3½ inch tires. Two sets of brakes are used, the service brake of the external contracting type and the emergency brake of the internal contracting type, both sets acting on the rear wheel hubs. Steering is by wheel through worm and gear. The wheel base is 92 inches, with standard tread. Control is by two pedals for the clutch and the service brakes respectively; two side levers, the inside one of which controls the change speed gears and the outside one operates the emergency brakes. Both brake levers are interlocked with the clutch. Spark and throttle levers just beneath the steering wheel control the engine, the hand throttle being supplemented by a foot accelerator pedal.

THE FORD.

The Ford Motor Company, of Detroit, Mich., are making two models of popular priced runabouts, known as Models "M" and "S," which differ only in the finish, Model S being what the manufacturers term "an edition De Luxe of Model N." The motor is a four cylinder, water cooled type, with cylinders cast in pairs, with integral heads and water jackets. The bore is 3¼ inches with a stroke of 3⅛ inches, and it is rated at 15 horse power. The valves are side by side in pockets in the side of the combustion chamber. A gear driven centrifugal pump circulates the cooling water. Lubrication is by splash, oil being fed to the crank case by a mechanical oiler, which also lubricates the ball joint on the Cardan shaft. High tension ignition is used, with a four unit coil and dry cells. The fan spoked flywheel in front creates a cooling air draught through the radiation. Power is transmitted through a two speed forward and reverse planetary change speed mechanism, which is supported in a frame which is bolted to the engine, thus insuring alignment. Final drive is by Cardan shaft, fitted with one universal joint immediately behind the change gear case, to the live rear axle. The frame is of pressed steel, supported on a crosswise semi-elliptic spring in front and full elliptic in the rear. The front axle is a straight I beam section drop forging, with integral spring shackle connections and fitted with ball bearings. The rear axle is of tubular steel construction, live axle type, fitted with roller bearings and held in alignment by the well known Ford system. Both front and rear wheels are fitted with 28x3 inch pneumatic tires. Steering is by wheel through Ford planetary gear system set in a casing immediately below the steering wheel. Two sets of brakes are fitted, a contracting type on the transmission, and an internal expanding on the rear wheel hubs. The control is by three foot levers, operating the transmission brake, rear hub brakes and reverse, respectively; a side lever, which controls the low and high speeds forward, and spark and throttle levers just below the steering wheels. The wheel base is 84 inches, with standard tread, and the weight complete about 1,075 pounds. The Ford Company is also making another model runabout and touring car, which is known as Model T. It embodies some quite radical changes in construction. The motor is a 20 horse power, four cylinder, water cooled model, with a magneto as part of the flywheel. The Ford characteristic transmission is used and the frame is supported on two semi-elliptic springs set crosswise, one in front and one at the rear. This car will be fully described and illustrated in our next issue.

THE MAXWELL.

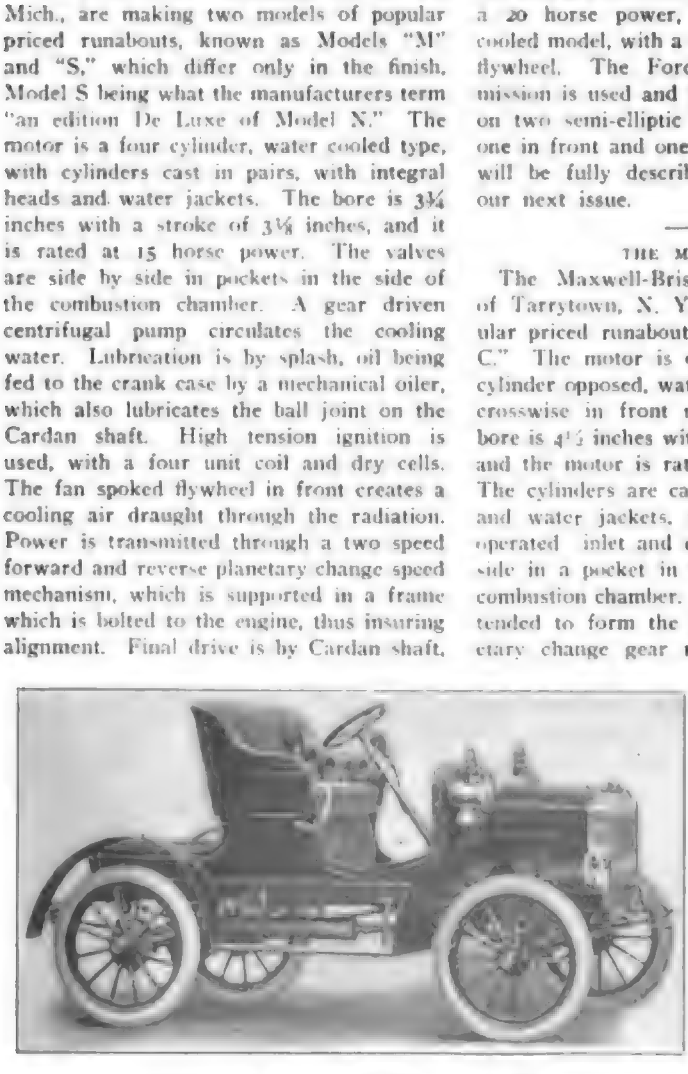
The Maxwell-Briscoe Motor Company, of Tarrytown, N. Y., manufacture a popular priced runabout known as Model "L. C." The motor is of the four cycle, two cylinder opposed, water cooled type, located crosswise in front under the hood. The bore is 4½ inches with a stroke of 4 inches and the motor is rated at 14 horse power. The cylinders are cast with integral heads and water jackets, with the mechanically operated inlet and exhaust valves side by side in a pocket in the upper side of the combustion chamber. The crank case is extended to form the housing for the planetary change gear mechanism, the whole being supported as a unit on three points with the flywheel in front. Cooling is by the thermo-siphon system, the air draught through the honeycomb type of radiator being created by the fan spoked flywheel. A compression oiler on the dash forces the oil to the engine and change speed gears. Ignition is by jump spark, with a two unit coil and two sets of dry cells. Power is transmitted through the two speed forward and reverse planetary change speed mechanism by Cardan shaft, equipped with two universal joints, to the live rear axle. These universal joints are self oiling, the hollow interior being filled with oil and the centrifugal force forcing the oil out to the yokes. The frame is of pressed steel, supported on semi-elliptic springs in front and rear. The front axle is a seamless drawn steel tubing, with forged yoke ends. The rear axle is of the tubular type, the driving shafts running on roller bearings. The wheels are wood, of the artillery type, fitted with 28x3 inch pneumatic clincher tires, the front wheels running on adjustable ball bearings. One set of brakes is fitted, of the external contracting type, acting on the rear wheel hubs. The control is by two foot levers for the reverse and the hub brakes respectively, one side lever for the low and high speeds forward, and spark and throttle levers mounted on the steering column below the steering wheel. The car has a wheel base of 72 inches, with standard tread, and weighs complete about 1,150 pounds.

THE ATLAS.

This is a two cylinder, two cycle runabout manufactured by the Atlas Motor Car Company, Springfield, Mass. The car retains the same characteristic construction of the 1908 cars which were described in The Horseless Age of December 11, 1907. The engine has two vertical cylinders with 4½ inch bore by 4½ inch stroke, is water cooled and is located in front under the hood. Three-quarter elliptic springs are used front and rear. The wheels are 30 inches and fitted with 3½ inch Diamond tires on Marsh detachable rims. The wheel base is 90 inches, with the standard tread.

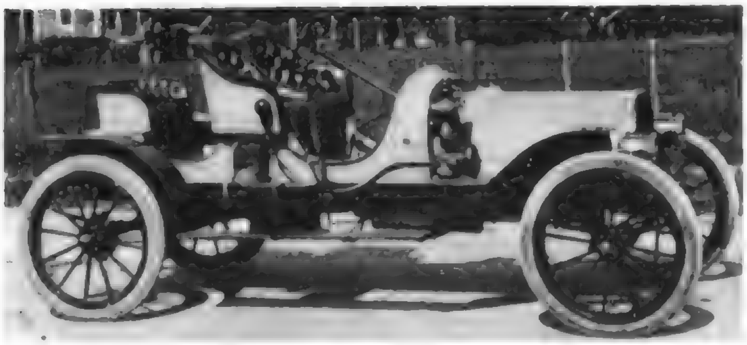
THE MIDDLEBY.

The Middleby Auto Company, Reading, Pa., manufacture an air cooled runabout (as well as a surrey on the same chassis).

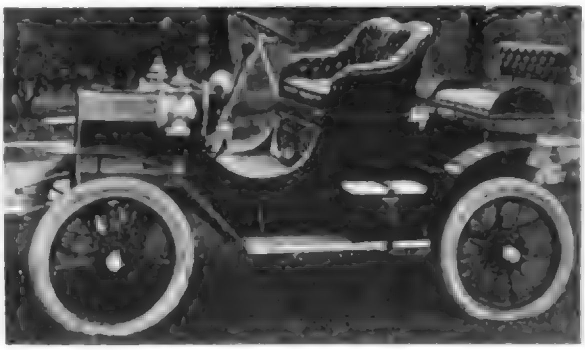


Maxwell Runabout, Model L. C.

Atlas Runabout.



Cameron Runabout.



Ten Horse Power 1909 Reo Runabout.

The motor is air cooled, of four cylinders, with a bore of 4 inches and stroke of 4 inches, rated at 25 horse power. The cylinders are cast separately, with mechanically operated valves. Two exhaust valves to a cylinder are used, the main one opening when the cylinder is within nine-sixteenths of the end of the power stroke. The secondary exhaust and inlet valves are in the cylinder head. The crank shaft has five bearings, which are bushed with Parsons white metal. High tension ignition is used with batteries and a four unit coil. A bed is cast with the crank case so that a magneto can be easily installed if desired. Lubrication is by a gear driven mechanical oiler. The cooling air draught is created by a belt driven fan in front and the fan spoked flywheel. A leather faced cone clutch is used, with springs beneath the leather to permit of gradual engagement. The change gear box affords three speeds forward and reverse, operated progressively. Plain bearings are used in the change gear case, bushed with Parsons white metal. Final drive is by Cardan shaft, fitted with two universal joints, to the live rear axle. The frame is ash, with angle iron cross pieces to support engine and transmission. Full elliptic springs are used both front and rear. The front and rear axles are both fitted with roller bearings. The wheels are 30 inch, fitted with 3½ inch tires all around. Two sets of brakes are used, an internal expanding and an external contracting, both sets operating on the hubs of the rear wheels. The control is by one pedal for the clutch and another for the internal expanding brake. One side lever operates progressively the change speed gears and the other the emergency contracting brakes. The wheel base is 108 inches, with standard tread.

THE CAMERON

The Cameron Car Company, Beverly, Mass., are manufacturing three models of runabouts, which are known as 11-14 and 15. The motor of Model 14 is a four cylinder, air cooled, of 3⅞ inch bore by 3½ inch stroke, rated at 20-24 horse power. The cylinders are cast separately, with valves in the head. The crank shaft is a drop forging and runs in three plain bearings bushed with Parsons white bronze. This bronze is also used for connecting rod and cam shaft bearings. Lubrication is by splash, a gear pump maintaining a fixed level in the crank case. The oil tank has a capacity for about 325 miles. A double ignition system is used, with Remy high tension magneto. An internal adjustable cone clutch is used, through which the power is transmitted to the Cardan shaft, thence to the change gear case, which is integral with the rear axle. The Cardan shaft has a single universal joint. The change speed gears afford three forward speeds and reverse, operated selectively and gives a speed of 45 miles per hour on the high gear. When changing gears they are first slid opposite one another and then rolled or clashed into mesh full face on instead of being slid into mesh endwise. The frame is of oak, with steel truss rods and manganese bronze and members. It is supported on three-quarter elliptic springs in front and full elliptic springs in the rear. The front axle is a seamless drawn steel tube, with drop forged ends. The rear axle is of the floating tubular type, with the change gear case as an integral part of it, equipped with annular ball bearings. The wheels are 30 inch, fitted with 3 inch tires. Steering is by wheel through rack and pinion. Annular ball bearings are used for the front and rear axles and the change speed gears. Two sets of brakes are used, a contracting and an internal expanding brake, both operating on the rear wheels. The wheel base is 98 inches, with standard tread, although a 60 inch tread will be furnished if desired. Weight is about 1,150 pounds. Control is by a foot lever for the clutch and another pedal which applies the service brake. One side lever controls the change speed gears and the other the emergency brakes. Spark and throttle levers are just below the steering wheel. Model 15 is identical with Model 14, with the exception that the wheel base is 94 inches, the body hung lower, wire wheels used, and the weight reduced to about 1,000 pounds. Model 11, which is illustrated, follows the same lines except that the motor is of six cylinders, same size and construction, and rated at 30-36 horse power. The wheels are of the artillery pattern, 32 inch, and fitted with 3½ inch tires. The wheel base is 110 inches.

THE REO.

The Reo Motor Car Company, of Lansing, Mich., manufacture two models of runabouts, viz., a single cylinder and a two cylinder, the single cylinder being equipped with a collapsible seat in the rear, and the two cylinder with or without rumble seat and also touring body with or without top. The engine of the small runabout is a single cylinder, horizontal, water cooled, with integral heads and water jacket, bore 4¾ inches, stroke 6 inches, and is rated at 8-10 horse power. The exhaust and inlet valves are side by side in a pocket in the cylinder head, and are mechanically operated from cams within the crank case. Ignition is high tension, with dry battery and a single unit coil on the dash. Lubrication is by splash and a gravity fuel lubricator for the cylinder. Water is circulated by a gear pump. A two speed forward and reverse planetary gear is located on an extension of the crank shaft, with the driving sprocket between it and the engine. Final drive is by single chain to the live rear axle, which runs on roller bearings. The frame is of angle steel and is supported on three-quarter elliptic springs in front and full elliptic springs in the rear. The front axle is a seamless steel tube with forged ends and trussed. The front wheels run on Timken roller bearings. The wheels are 28 inch, fitted with 3 inch tires on Goodyear detachable rims. Steering is by wheel through worm and segment. One set of brakes are fitted, operating on the rear wheels. The engine is located under the body, with the gasoline and water tanks under the hood. The control is by two pedals, one of which operates the reverse and the other the hub brakes; a throttle pedal beside the steering column, a hand lever at the side which controls the two speeds forward, and a spark lever just below the steering wheel. The wheel base is 74 inches. The two cylinder runabout is built on the same lines as the smaller model. The motor is a two cylinder opposed, 4¾ inch bore by 6 inch stroke, and rated at 18-20 horse power. Lubrication is by a two lead force feed oiler driven by a push rod and ratchet arrangement driven by one of the exhaust cams. The transmission is similar, being built stronger. The front springs are semi-elliptic, with full elliptic for the rear. Two sets of brakes are fitted, a transmission and wheel brake. The control is by two pedals, one of which operates the transmission brake and the other the reverse; an accellerator pedal, two hand levers at the side, one of which operates the two forward speeds and the other the hub brakes, and the spark and throttle levers just below the steering wheel. The wheels are 32 inch, fitted with 3½ inch tires on Goodyear detachable rims. The wheel base is 94 inches.

THE GYROSCOPE.

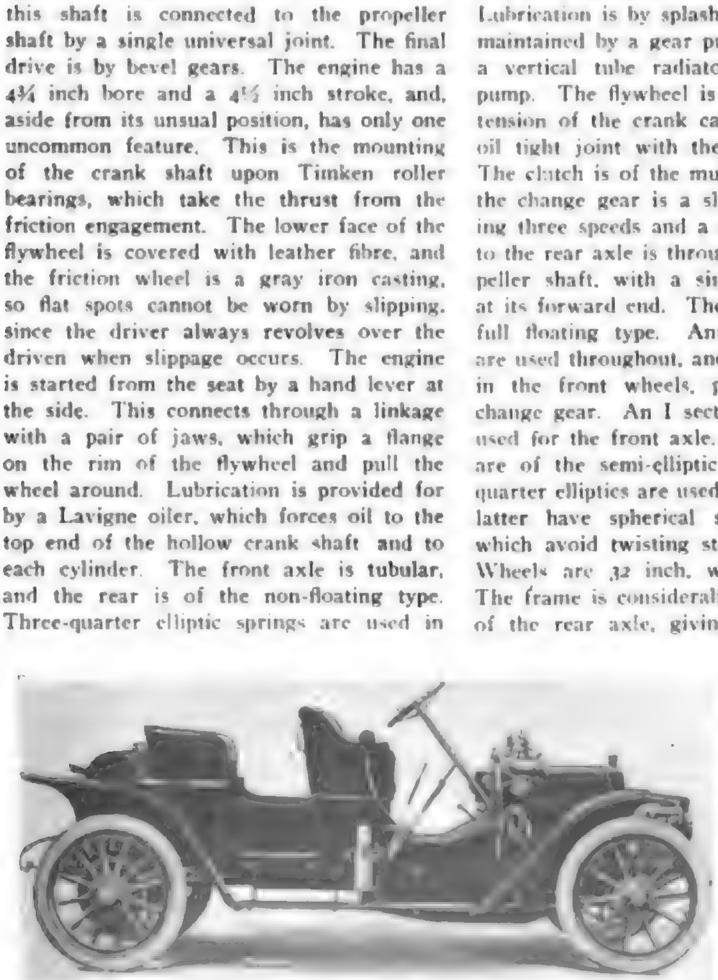
This new car, which is the product of the Blomstrom Manufacturing Company, of Detroit, Mich., is similar to the larger Gyroscope model. For the benefit of readers who are not familiar with the latter we may say that the Gyroscope auto takes its name from the fact that the engine flywheel is so located that its gyroscopic effect is used to make the car run more steadily. This is accomplished by placing the engine, which is a two cylinder opposed, under the hood, with its cylinders pointing fore and aft, and by turning the crank shaft axis vertically so that the flywheel revolves in a horizontal plane under the engine. Power is transmitted by friction from the lower face of this flywheel to a wheel splined to slide upon a fore and aft shaft; this shaft is connected to the propeller shaft by a single universal joint. The final drive is by bevel gears. The engine has a 4¾ inch bore and a 4½ inch stroke, and, aside from its unusual position, has only one uncommon feature. This is the mounting of the crank shaft upon Timken roller bearings, which take the thrust from the friction engagement. The lower face of the flywheel is covered with leather fibre, and the friction wheel is a gray iron casting, so flat spots cannot be worn by slipping, since the driver always revolves over the driven when slippage occurs. The engine is started from the seat by a hand lever at the side. This connects through a linkage with a pair of jaws, which grip a flange on the rim of the flywheel and pull the wheel around. Lubrication is provided for by a Lavigne oiler, which forces oil to the top end of the hollow crank shaft and to each cylinder. The front axle is tubular, and the rear is of the non-floating type. Three-quarter elliptic springs are used in the rear and semi-elliptics in front. The frame is of pressed steel. Raymond brakes act upon drums on the rear wheels. They are applied by a pedal. The other pedal lifts the friction wheel shaft and applies the engaging pressure by means of a cam movement. The fore and aft position of the friction wheel, which determines the reduction ratio from engine to rear wheels, is regulated by the inner hand lever. The wheel base is 95 inches, and the tread is standard. The wheels are 30 inch, fitted with 3 inch tires. Weight is given as 1,400 pounds.

THE CHALMERS-DETROIT.

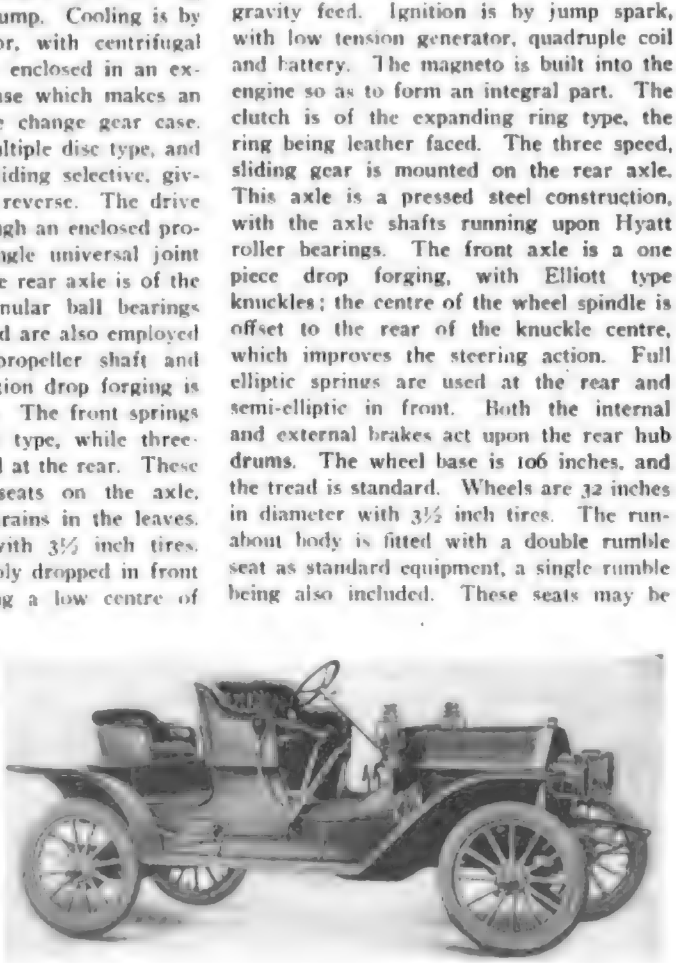
This new car is one of the first of the low priced runabouts of considerable size to appear upon the American market. It is made by the Chalmers-Detroit Motor Company, of Detroit, Mich. While the price is moderate, the car has many features which are usually found only upon more expensive machines. Its motor is a four cylinder vertical, 3⅞x4½ inch, rated at 30 horse power. The four cylinders are cast together, and the crank shaft, which is of unusual size, is mounted upon two large annular ball bearings. The exhaust valves are on the side and the inlet valves in the head, both being of unusually large diameter, and both operated from a single cam shaft. Lubrication is by splash, the oil level being maintained by a gear pump. Cooling is by a vertical tube radiator, with centrifugal pump. The flywheel is enclosed in an extension of the crank case which makes an oil tight joint with the change gear case. The clutch is of the multiple disc type, and the change gear is a sliding selective, giving three speeds and a reverse. The drive to the rear axle is through an enclosed propeller shaft, with a single universal joint at its forward end. The rear axle is of the full floating type. Annular ball bearings are used throughout, and are also employed in the front wheels, propeller shaft and change gear. An I section drop forging is used for the front axle. The front springs are of the semi-elliptic type, while three-quarter elliptics are used at the rear. These latter have spherical seats on the axle, which avoid twisting strains in the leaves. Wheels are 32 inch, with 3½ inch tires. The frame is considerably dropped in front of the rear axle, giving a low centre of gravity. The gasoline tank is at the rear, high up to secure gravity feed. In front of the tank is a raised deck to which the rumble seats may be secured. It is sufficiently roomy to permit of carrying a large sample trunk. The 110 inch wheel base and short motor permit of the body being entirely between the axles. An unusual feature is that the space under the front seat is open, leaving room to carry a suit case or similar luggage. Large expanding brakes are provided upon the rear wheels, while a band brake and ratchet sprag act on the propeller shaft.

THE E-M-F.

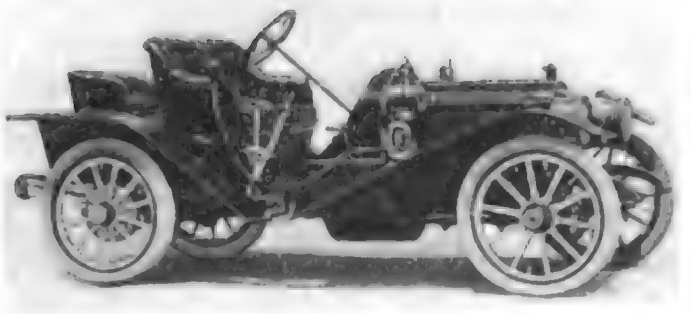
Except for the body and a few minor details this runabout is identical with the E-M-F. touring car which was fully described on page 140 of Vol. 22. It is made by the Everitt-Metzger-Flanders Company, of Detroit, Mich. The car is designed along accepted lines throughout, and its principal claims to novelty lie in a rather extensive use of pressed steel and in the unusually low price. The motor is a four cylinder, water cooled, of 4x4½ inch cylinder dimensions, rated at 30 horse power. The cylinders are cast in pairs and the valves are placed in pockets on the left side. Valves and manifolds are unusually large. Lubrication is by splash, the crank case level being automatically maintained by a gravity feed. Ignition is by jump spark, with low tension generator, quadruple coil and battery. The magneto is built into the engine so as to form an integral part. The clutch is of the expanding ring type, the ring being leather faced. The three speed, sliding gear is mounted on the rear axle. This axle is a pressed steel construction, with the axle shafts running upon Hyatt roller bearings. The front axle is a one piece drop forging, with Elliott type knuckles; the centre of the wheel spindle is offset to the rear of the knuckle centre, which improves the steering action. Full elliptic springs are used at the rear and semi-elliptic in front. Both the internal and external brakes act upon the rear hub drums. The wheel base is 106 inches, and the tread is standard. Wheels are 32 inches in diameter with 3½ inch tires. The runabout body is fitted with a double rumble seat as standard equipment, a single rumble being also included. These seats may be



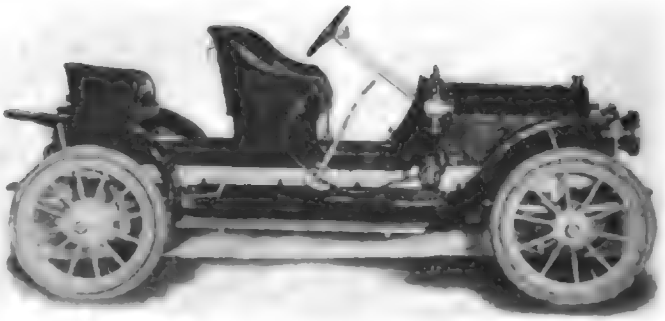
CHALMERS DETROIT 30 RUNABOUT.



E-M-F RUNABOUT



PACKARD 18 RUNABOUT.



OAKLAND RUNABOUT.

readily removed, leaving a large deck suitable for sample case, trunks or similar purposes.

THE GLIDE.

The Bartholomew Company, Peoria, Ill., are bringing out a runabout model, adapted from their touring car, which will have a wheel base of 106 inches. A four cylinder motor will be used, with a bore of 4¼ inches and stroke of 5 inches, with magneto for ignition. The frame is pressed steel supported on semi-elliptic springs front and rear. The wheels are 36 inches, fitted with 4 inch tires all around. Transmission is by Cardan shaft to the change gear case, which is part of the live rear axle, forming a unit with it. Sliding gears are used, with three speeds forward and reverse, operated selectively. No details of this model are obtainable at present.

THE PACKARD.

The Packard Motor Car Company, of Detroit, Mich., are manufacturing two models of runabouts, known as "30" and "18." These cars differ only from the touring cars in that the wheel base is shortened, the driver's seat placed further toward the rear, and the fuel tank is at the rear, the fuel being forced to the carburetor by a pressure system instead of by gravity. Model "30" has the regular four cylinder motor of 5 inch bore by 5½ inch stroke, and rated at 30 horse power (hence its name). The cylinders are cast in pairs, with integral heads and water jackets, and with valves in pockets opposite each other. This model was fully described in THE HORSELESS AGE of June 24, 1908. The carburetor is hot water jacketed and a hydraulic governor operating on the throttle controls the motor. Ignition is by Eisemann low tension magneto, with a single unit coil on the dash. Water circulation is by a gear driven centrifugal pump. The clutch is of the regular Packard design, being of the internal expanding type. Final drive is by Cardan shaft to the change gear case, which is incorporated with the rear axle. Three speeds forward and reverse are provided, operated progressively by a single lever. The frame is of pressed steel arched over the rear axle to give the springs a wider range of action. Semi-elliptic springs are used front and rear. The front axle is of seamless drawn steel tubing, and the outer ends of the rear axle are also steel tubes secured to the aluminum change gear and differential housing. The wheels, front and rear, are 36 inch, fitted with 3½ inch tires in front and 4 inch in the rear. Steering is by wheel through worm and sector gear, the steering column being raked to bring it in convenient position to the driver. Two sets of brakes are provided, an internal expanding and an external contracting, both sets operating on the rear wheels. The control is by two pedals, the left one operating the clutch and the other the expanding brakes. A small accelerator pedal operated by the foot is also provided. The forward speeds are controlled progressively by one lever, as heretofore, and the reverse by a lateral movement of this one lever. The emergency brakes are operated by the usual side lever. Spark and throttle levers on the steering wheel control the engine. The wheel base is 108 inches. The Model "18" is identical with Model "30" except in size. The motor is of 4 1/16 inch bore by 5⅛ inch stroke, and rated at 18 horse power. The wheels are 34 inches, fitted with 3½ inch tires front and 4 inch rear. The wheel base is 102 inches. Otherwise the car is the duplicate of Model "30," and was described in detail in THE HORSELESS AGE of August 19, 1908.

THE OVERLAND.

The Overland Automobile Company, of Indianapolis, Ind., are continuing their runabout model with increased dimensions, it being known as Model 30. The motor is of four cylinders, water cooled, with a 4 inch bore by 4½ inch stroke, and is rated at 30 horse power. The cylinders are cast singly, with integral heads and water jackets, with the inlet and exhaust valves side by side in a pocket in the side of the combustion chamber. The connecting rods and crank shaft are drop forgings, the crank shaft running on five plain bearings. The cooling is by thermo-siphon system, with a belt driven fan in front, aided by the fan spoked flywheel at the rear. Ignition is by Remy high tension magneto and batteries. A mechanical oiler is used, driven by an eccentric on the cam shaft. Power is transmitted by a Cardan shaft, fitted with two universal joints, to the two speed forward and reverse planetary change speed mechanism located on the live rear axle. The frame is of pressed steel and trussed, and is supported on half elliptic springs in front and full elliptic springs in the rear. The front axle is of I beam construction, with annular ball bearings. The rear axle is of tubular construction, of the semi-floating type, with the change gear case as a part of it. The wheels are 32 inch, fitted with 3½ inch tires on Goodyear detachable rims. The wheel base is 105 inches, with standard tread, and the car complete weighs about 1,600 pounds. Steering is by wheel through Warner worm and sector gear. The control of the car is by three foot levers, the right hand one controlling the low speed forward and reverse, the middle lever the high speed forward, and the left hand lever the hub brakes. The high and low speed levers are interlocked, so that when using the low or reverse the high speed is thrown out. This chassis is also fitted with different combination of rear seats.

THE OAKLAND.

Light weight, simplicity of construction and ease of control are the three features to which the Oakland Motor Car Company, of Pontiac, Mich., have paid particular attention when designing their runabout. The motive power is a two cylinder vertical motor placed under the hood. It is rated at 20 horse power, has a bore of 4½ inches and a stroke of 5 inches, and is balanced by a special device, which was described in detail on page 870 of Vol. 20. The cylinder heads are readily removable, and all parts of the motor are very accessible. The change gear is a two speed planetary, with multiple disc clutches in place of the usual bands. It is fully enclosed, being carried in an oil tight case upon the forward end of the propeller shaft. The rear axle is a special pressed steel construction, with cup and cone ball bearings for the driving bevels and Hyatt roller bearings at the wheels. The front axle is tubular, with ball bearings for the wheels. Both sets of brakes act on the drums of the rear wheels. The wheel base is 96 inches and the gauge 56 inches. Semi-elliptic springs are used in front and full elliptic at the rear. The frame is made of specially treated wood, supported by a deep truss. Either 30 or 32 inch wheels are furnished, fitted with

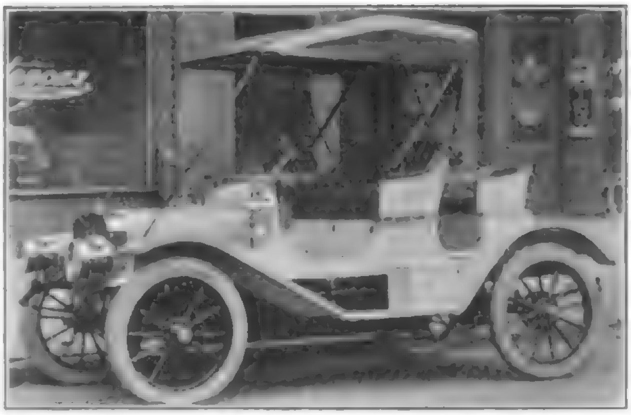
3½ inch tires. The weight is given as 1,500 pounds.

THE REGAL.

This car is practically the same as the 1908 model. It is driven by a 4x4 inch four cylinder motor, which is water cooled on the thermo-siphon system. The valves are all located upon the left side and are operated from a single cam shaft. Lubrication is provided for by a gear pump which forces oil into a longitudinal tube which supplies the cylinders and bearings by splash. The clutch is a leather faced cone, with unusually long and flexible spring, giving easy engagement. Drive to the rear axle is through a nearly horizontal shaft, with a single universal joint. This shaft is enclosed in a tubular casing, the front end of the tube being hinged to the central cross member of the frame so that it takes the drive and torque. The three speed selective sliding gear is mounted upon the rear axle. The front axle is of the tubular type and is dropped outside the spring seats. This allows of giving the frame a large drop and bringing the centre of gravity of the car unusually low. Full elliptic springs are used at the rear and semi-elliptics in front. These springs are unusually heavy for a car of this size, being 2 inches wide. The wheel base is 100 inches, the tread is standard. The wheels are 32 inches in diameter, shod with 3½ inch tires.

THE CARTERCAR.

This machine, which is characterized by its friction drive, is manufactured by the Motorcar Company, of Detroit, Mich. It is driven by a 5½x4½ inch opposed, water cooled motor placed crosswise under the hood. This motor follows conventional lines in its design, and is very ruggedly built, with unusually large bearing surfaces. Secured to its flywheel is a fore and aft shaft, on the rear end of which is mounted an aluminum alloy disc. A paper faced friction wheel splined upon a cross shaft makes frictional contact with the rear surface of this disc. Different speed ratios are secured in the usual manner by sliding this wheel. The drive to the rear axle is through a single large roller chain. The front axle is tubular. Semi-elliptic springs are used all around. The wheel base is 90 inches, and the tread is standard. The tires are 32x3½ inches. The Motorcar Company is one of the very few makers who have succeeded in producing a successful friction driven machine, and this car has been manufactured for the past three seasons without essential change.



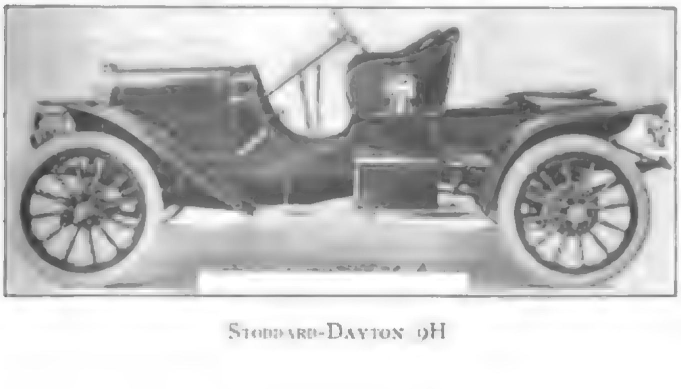
THE CARTERCAR.

THE STODDARD-DAYTON.

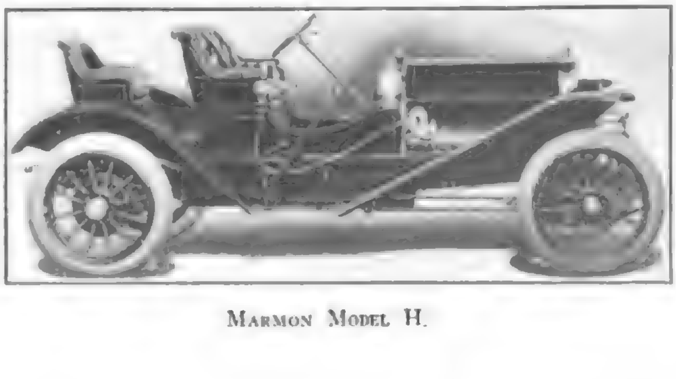
The Dayton Motor Car Company, of Dayton, Ohio, are manufacturing three models of runabouts, known as 9H, 9K and 9C, the smallest of which is of 25 horse power. The same principles of construction are embodied in all three models, the only difference being in size. Model 9H has a four cylinder, water cooled engine, with a bore of 3⅞ inches and stroke of 4½ inches, and is rated at 25 horse power. The cylinders are cast in pairs, with valves in the head, operated by push rods and rocker arms. The lubrication is by a mechanical oiler enclosed in the crank case. High tension ignition is used, with four unit coil and batteries. A double system will be installed extra if desired. Power is transmitted through a cone clutch to the sliding change gear case, which gives three speeds forward and reverse, operated selectively. Final drive is by Cardan shaft to the live rear axle. The frame is of pressed steel, supported on semi-elliptic springs front and rear. The front axle is an I beam drop forging and the rear axle a tubular steel, floating type. Wood wheels of the artillery type are used, fitted with 32x3½ inch tires for this model and 34x3½ and 34x4 inch for the other models. Two sets of brakes are fitted, one of the internal expanding type antd the other of the external contracting type, both operating on the rear wheel hubs. The wheel base is 103 inches, with the standard tread. The wheel bases of the other two models are 110½ and 120 inches, respectively. The car weighs complete about 1,700 pounds. The control is by two pedals, one of which operates the clutch and the other one sets the brakes; two side levers, one of which operates the change speed gears and the other the emergency brakes, and by spark and throttle levers on the steering column just below the wheel.

THE MARMON.

Nordyke & Marmon Company, Indianapolis, Ind., are bringing out a new model equipped with a four cylinder, water cooled engine of 4½ inch bore by 4¼ inch stroke, rated at 32 horse power. The cylinders are cast in pairs, with integral heads and water jackets. Inlet and exhaust valves are arranged in pockets oposite one another and operated by push rods from the cam shaft in the crank case. Cooling water circulation is by a gear driven centrifugal pump, and a belt driven fan in front creates the air draught through the radiator. The lubrication is by the Marmon positive system, a gear driven gear pump forcing the oil to the main bearings and thence through the hollow crank shaft to the crank pin, connecting rod and wrist pin bearings. A double system of ignition is used, viz., a high tension magneto to one set of spark plugs and a four unit coil, with batteries to another set. Power is transmitted through a multiple disc clutch within the flywheel by Cardan shaft to the change gear case secured to the differential housing on the rear axle. These sliding gears give three speeds forward and reverse, and are operated selectively. The differential and change speed gears can be removed without disturbing any other part of the car. The frame is of pressed steel, dropped, with a sub-frame for the motor supported on three points. Semi-elliptic springs are used in front and full elliptic in the rear. The front axle is of I beam cross-section, with ball bearing spindle yokes and conical roller bearings for the wheels. The rear axle is of the floating type, tubular construction, fitted with H. B. ball bearings. Two internal expanding brakes operate on each rear wheel hub, side by side. Wood wheels of artillery type are used, fitted with 34x4

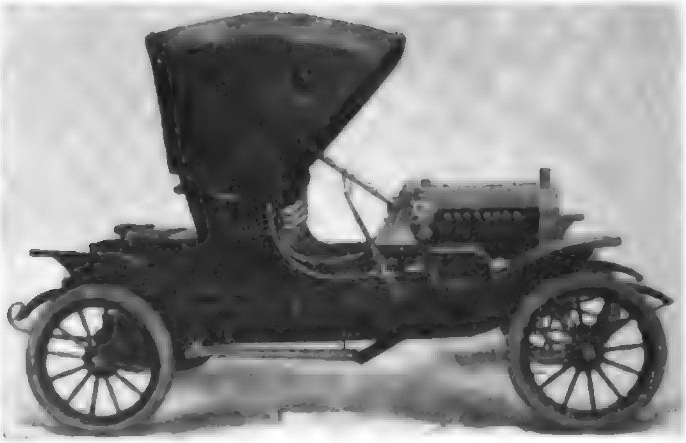


STODDARD-DAYTON 9H



MARMON MODEL H.

Franklin Model G Runabout.



Lambert.

inch tires in front and 34x4 inch in the rear. Steering is by wheel through a screw and nut mechanism. The wheel base is 112 inches, with standard tread, and the car weighs about 1,900 pounds. They also manufacture a Model H, which is shown in the cut. This car has the same general construction as Model 32, except that the change gear case is mounted on the engine sub-frame immediately to the rear of it. The motor is a 5x5 inch, rated at 40-45 horse power. The wheels are fitted with 36x4 inch tires front and rear, and the wheel base is 114 inches, with standard tread, and the car is equipped with full elliptic springs front and rear and with shock absorbers. The control is by two pedals, one of which operates the clutch and the other one set of brakes; two side levers, one of which controls the change speed gears and the other the emergency brakes, and the spark and throttle levers on the steering column.

THE FRANKLIN.

The Franklin air cooled cars are made by the H. H. Franklin Manufacturing Company, Syracuse, N. Y. Three models of runabouts will be built for 1907—the Model G, with four cylinders, 3⅜x4 inch motor, rated at 18 horse power; the Model D, with four cylinders, 4¼x4 inch motor, rated at 28 horse power, and the Model H, with six cylinders, 4¼x4 inch motor, rated at 42 horse power. These motors are of the well known Franklin construction, placed lengthwise in the frame and cooled by a draught of air created by the fan spoked flywheel and the fan in front. These motors have the valves in the head, actuated by push rods and rocker arms, and also the auxiliary exhaust. In The Horseless Age of August 29, 1906, these motors were described in detail. The Bosch high tension magneto is used on all three models. On Model G the spark is permanently set, and there is therefore no spark lever for the driver. Models D and H have the regulation spark control and Model H has a governor controlled magneto action as a further precaution against back kicks. No governor will be used on the motors hereafter. All models are equipped with a multiple disc clutch of steel and bronze discs, which transmits the power to the change speed, sliding gear case. Three speeds forward and reverse are provided, the control on the Model G being self finding progressive and the control for Models D and H being selective. The front axles are made of seamless drawn steel tubing, as are also the rear axles. Models G and D are fitted with a semi-floating type of live rear axle and Model H with a full floating type. The wheels of the Model G are 32 inch front and rear, fitted with 32x3 inch tires in front and 3½ inch in the rear. The wheels of Models D and H are 36 inch, and are fitted with 36x3½ inch tires in front and 36x4 inch in the rear. The front wheels run on Timken roller bearings. The frames of these cars are laminated wood, mounted on full elliptic springs front and rear. A transmission brake and a brake operating on each rear wheel hub are provided. Model G weighs 1,650 pounds, Model D 2,000 pounds and Model H 2,350 pounds. The cars are controlled as follows: One pedal operates the clutch and the other the transmission brake. One side lever shifts the gears in the case of Model G progressively and on Models D and H selectively, and the other operates the hub brakes. The engine is controlled by spark and throttle levers mounted over the steering wheel. Model G, however, has only a throttle control, the spark being set. Steering is by wheel, through bevel gears. All the models are equipped with an auxiliary fuel tank, which is fitted automatically, but from which the fuel cannot be drawn without the knowl of the driver. The mud guards are provided with flanges, which prevent much side splashing. All models are ironed for tops, which are fitted at the option of the purchaser. Model D is illustrated fitted with an open touring body.

THE LAMBERT.

The Buckeye Manufacturing Company, of Anderson, Ind., are manufacturing an 18 horse power friction drive runabout, which is also supplied with a surrey body. The motor is a two cylinder opposed, water cooled, with integral heads and water jackets. The bore is 5 inches, with a stroke of 4 inches. The crank shaft is a drop forging, running on good sized plain bearings. The connecting rods are of bronze, with interchangeable babbitt bushings. The ignition is high tension, with the two unit coil on the dash. Lubrication is by a mechanical four lead oiler, which forces oil to the piston and main bearings. Thermosiphon cooling is used, the radiator being of the honeycomb type. The frame is of pressed steel, supported on semi-elliptic springs front and rear. The front axle is a seamless drawn steel tubing with forged ends. The rear axle is of the live type, running on roller bearings. The transmission is through a short shaft to the friction driving disc. A corresponding friction pulley keyed to a jack so that it can be slid back and forth, for the different speeds forward and reverse, transmits the power through a single chain to the differential on the rear axle. Means are afforded of easily adjusting the friction discs for wear of thin prepared paper surfaces. The entire transmission, including chain, is protected by a dust tight casing. The wheels are 30 inch, fitted with 3 inch tires, the front wheels running on ball bearings. One set of brakes are fitted to the rear wheel hubs, of the external contracting band type, and the reverse gives a very effective brake. Both front and rear mud guards extend to the body, thus preventing splashing of the body. The control is by two foot levers, one of which controls the engaging pressure of the friction discs, and the other applies the brake. These levers are interlocked so that applying the brake throws off the power. The hand lever at the side controls the position of the driven pulley and hence the speed. The engine is controlled by spark and throttle levers just below the steering wheel. Steering is by wheel through a screw and nut arrangement. The friction pulleys are proportioned to give speeds up to 35 miles per hour. Wheel base is 95 inches, with standard tread.

HIGH WHEEL RUNABOUTS.

THE HOLSMAN.

This high wheeled type of automobile is made by the Holsman Automobile Company, Chicago. We will illustrate herewith a new addition to their already well known line, which is the cheapest car made by them. The same standard construction is used, however, as in their other models. The motor used in all models is a two cylinder opposed, four cycle, air cooled, 4 inch bore by 4 inch stroke, rated at 124·5 horse power. The inlet valves are automatic and exhaust valves mechanically operated by push rods. The cylinder heads are detachable, being screwed into the cylinder and can be easily and quickly taken out and replaced when necessary. The fan spoked flywheel creates a draught of sufficient volume to cool the engine. A force feed lubricator ensures lubrication of the working parts. Power is transmitted through a two speed mechanism to a countershaft. Either speed is thrown in by an internal dog clutch. On each outer end of the countershaft two V grooved pulleys are secured. The two inner pulleys correspond to similar but larger pulleys on each rear wheel and over these pulleys runs the steel driving cable. The outside pulleys are opposite the tires of the rear wheels. In operation the countershaft, which can be rocked back and forth by a special lever, is thrown forward to tighten the steel cables and give the forward motion to the vehicle. To reverse, the countershaft is thrown backwards until the smaller pulleys engage with the tires. Solid steel axles are used both front and rear, equipped with Timken roller bearings. Full elliptic springs are used both front and rear, giving easy riding qualities to the car. The wheel base varies with the different models, from 65 inches to 75 inches, and the tread from 56 inches to 62 inches, at the option of the purchaser. The wheels are 44 inches front and 48 inches rear, fitted with solid rubber tires. With the reverse there are two sets of brakes; one set operating positively on the driving sheaves and the other the reverse pulleys. Steering is by lever, the car being controlled by the hands only. The driving cable is tightened by the reverse thrown in by the lever at the side. The weight varies with the different models from 900 to 930 pounds.

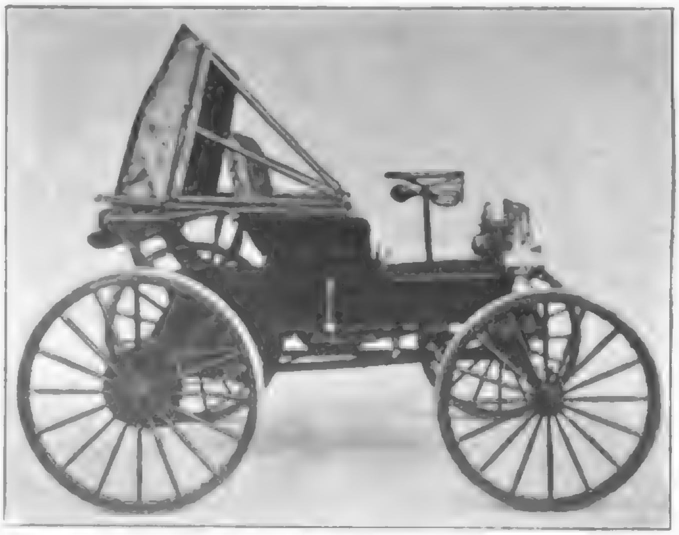
THE SUCCESS.

The Success Auto-Buggy Manufacturing Company, St. Louis, Mo., are manufacturing a high wheel type of automobile with runabout and surrey bodies. The motor is a two cylinder, opposed, air cooled type, 4⅛ inch bore by 4 inch stroke, rated at 10 horse power. Water cooled motors of the same type rated at 12 horse power will be supplied at a small extra cost for those who desire them. The fan spoked flywheel creates the air draught for cooling. The body sills are reinforced with angle steel cross members, upon which is supported the motor, which is under the seat. The body is suspended on crosswise full elliptic springs, one in front and one in the rear, the axles being kept in alignment by reaches. Solid axles are used front and rear, the wheels running on plain bearings unless roller or ball bearings are specified, when they will be supplied extra. A planetary change speed mechanism, giving two speeds forward and reverse, is attached to the crank shaft extension. Transmission is by roller chain to the differential casing on the countershaft, and thence by double side chains to the rear wheels. The wheels are of the Sarven type, 40 inches in front and 44 inches in the rear, fitted with either 1 inch steel or solid rubber tires, the rubber tires being extra. Two band brakes operating on the transmission and two hub brakes are fitted. Steering is by wheel through ratchet and chain, which moves the front axle with its wheels as a whole. They also manufacture in the same style and following the same principles of construction a four cylinder, vertical, 20 horse power model, and also a single cylinder, one wheel drive model.

THE KIBLINGER.

The W. H. Kiblinger Company, of Auburn, Ind., manufacture a high wheel type of automobile in two runabout models, besides their surrey and commercial types. The two runabouts are known as Models D and H, and differ only in the relative size of the parts. Model D is equipped with a four cycle, two cylinder opposed, air cooled motor, with a bore of 3¾ inches and a stroke of 3¾ inches, and is rated at 8-10 horse power. It is hung from the frame under the body. The inlet valves are automatic, and the exhaust valves mechanically operated by push rods and rocker arms. Lubrication is by pressure sight feed, the compression in the crank case being used. The fan spoked flywheel creates the air draught for cooling the motor. Ignition is by jump spark, with a two unit coil and dry cells. On the crank shaft extension is located a two speed forward and reverse planetary change speed mechanism. A single chain transmits the power from this mechanism to the differential casing on the jack shaft. This jack shaft is of the live centre type, the casing extending out from the frame and forming the support for the sprockets. Final drive is by side chains to the rear wheels. The frame is of angle iron, supported in front and rear by single full elliptic springs and crosswise to the frame. The axles are reinforced wood, of the "Long Distance" type, with Collinge collars, and are connected together by reinforced wooden reaches. The front wheels are pivoted for steering, a lever being used on this model. The wheels are 38 inch Sarven type, with 1¼ inch steel rims.

HOLSMAN MODEL 4.



SUCCESS AUTO BUGGY.

Solid rubber tires are fitted extra. Wheel steering is also fitted to this model extra. One set of external contracting brakes is used, acting on the rear wheel hubs. Control is by means of foot levers for the low speed forward, reverse and hub brakes, a side lever for the high speed forward, and spark and throttle levers, which with the steering tiller are at the driver's side. Ball or roller bearings will be fitted throughout at extra cost. The wheel base is 69½ inches, with standard tread. Model II, the larger car, is equipped with a 12 horse power motor, with a bore of 4⅛ inches and stroke of 3¾ inches, with mechanically operated inlet and exhaust valves. With this car the regular wheel steering is fitted, with spark and throttle levers on the steering wheel. Except for these differences the two models are alike.

THE H. BROTHERS "6."

This high wheeled type of automobile is manufactured by the H. Brothers, 76 South 43 Court, Chicago, Ill. The motor is a two cylinder opposed, rated at 10 horse power. The lubrication is by a four lead mechanical lubricator, which forces the oil to the cylinders and main bearings. Ignition is by jump spark, with two unit coil and batteries. A two speed forward and reverse planetary change speed mechanism is used, and the power is transmitted to a jack shaft and thence by side chains to the rear wheels. The frame is of reinforced oak, with a truss rod in a groove in the bottom. Full elliptic springs are used in front and rear. The axles are solid forgings, with ball bearing hubs. The front wheels are 38 inches and the rear 40 inches, fitted with 1⅛ inch solid rubber tires. One set of brakes are fitted, of the internal expanding type, operating on the hubs of the rear wheels. Steering is by wheel through spur gears, with the steering wheel set on a tilting column. The wheel base is 86 inches, with standard tread. They are also bringing out another model which is known as Model 7. It has a wheel base of 74 inches and is built on the same lines as Model 6, only smaller.

THE STUDEBAKER.

The Studebaker Brothers Manufacuring Company, of South Bend, Ind., will put on the market in a few months a high wheel type of automobile. Although no detailed specifications are ready, it will be equipped with an air cooled, two cylinder, opposed motor, placed crosswise in front under the hood. The drive will be by Cardan shaft to the live rear axle. High wheels will be used, fitted with solid rubber tires. They have had an experimental car on the road for some time, and expect to have it standardized in a little while.

THE DUER.

The Chicago Coach and Carriage Company, Chicago, Ill., manufacture a high wheel type of automobile. The motor is a two cylinder, opposed, air cooled type with a bore of 4 inches and a stroke of 4 inches rated at 12 horse power and set crosswise in front under the hood. The valves are located on top, the cylinders at the ends, the inlet valves being automatic and the exhaust mechanically operated. The fan spoked flywheel creates the air draught that cools the engine. Ignition is jump spark, with two unit coil and batteries. A mechanical oiler is used, forcing the oil to the main bearings. Power is transmitted from the engine by a shaft, fitted with a telescope universal joint, to the change gear case, which forms a unit with the jack shaft. The change gears give two speeds forward and reverse, the car being started and operated on the high gear, the low gear being used for unusually hard going. Grooved pulleys are secured to the outer ends of the jack shaft, the final drive being by cables to corresponding grooved pulleys on the rear wheels. The jack shaft is slid back and forth for engaging the cables, this action being permitted by the telescope universal joint on the engine shaft. The frame and body sills form one unit, reinforced with steel plates. The frame is supported on semi-elliptic springs in front and full elliptic springs in the rear. Solid standard axles are used, fitted with taper roller bearings. The front wheels are 44 inches and the rear wheels 48 inches, fitted with 1¼ inch solid rubber tires. The wheel base is 72 inches, with standard tread. One set of brakes are used, operating on the wheel sheaves. Steering is by hinged side lever, which can be raised out of the way. No pedals are used, but there is a hand lever at the side, a rearward movement of which slides the jack shaft forward and tightens the cable, and a forward movement releases the cables and applies the brake. The throttle is controlled by a drum on the steering handle, operated while steering, and the spark by a lever on the steering column

H. Brothers Model "6."

THE CHICAGO.

The Chicago Motor Buggy Company, 171 La Salle street, Chicago, Ill., manufacture a high wheel type of automobile. The motor is a two cylinder, opposed type, air cooled, 4 inch bore by 4 1-6 inch stroke, and rated at 12 to 14 horse power. Inlet and exhaust valves are mechanically operated. Ignition is by jump spark from storage battery and coil. The engine is underneath the body with a two speed forward and reverse planetary change speed mechanism on the exterior of the crank shaft. A short chain transmits the power to the differential casing on the jack shaft, and from thence by chains to the rear wheels. The frame is of angle steel, supported on single full elliptic springs front and rear, set crosswise to the car. Reaches connect the two axles together. One set of brakes is used, of the internal expanding type, acting on the rear wheel hubs. Steering is by wheel, with spark and throttle levers on the column. The car is geared for a maximum speed of 25 miles an hour.

THE BENDIX.

This is a four cylinder, air cooled car of the high wheeled type, and is manufactured by the Bendix Company, Cragin Station, Chicago, Ill. The motor, located in front under the hood, is of the four cylinder, vertical, air cooled type, of 4 inch bore by 4 inch stroke, and is rated at 20 horse power. Lubrication is by a force feed, belt driven oiler, which forces the oil to each cylinder, splash being used in the crank case. Ignition is high tension with battery and four unit spark coil. The cooling air draught is created by a belt driven fan in front. Power is transmitted through a short shaft, fitted with two universal joints, to a two disc friction change speed mechanism. These friction discs are side by side and engage with similar friction pulleys, which are keyed to the divided countershaft by long keys, but are free to slide longitudinally on their shafts for the different speed ratios forward and reverse. Slippage between the frictional surfaces takes care of the unequal speed of the driving wheels when rounding curves. Easily removable stamped sprockets are secured to the outer ends of the countershaft from which the power is transmitted to the rear wheels by chains. The frame is of angle steel with riveted cross members and narrowed at the front to give greater steering action. The frame is supported by full elliptic springs front and rear. Front and rear axles are of Timken solid, ball bearing construction. The wheels are 40 inch, with staggered spokes, and fitted with 1¾ or 1½ inch solid rubber tires. Steering is by wheel, with the connecting rod in front of the axle. One set of internal expanding brakes are fitted to the hubs of the rear wheels. The friction change speed mechanism can be used for braking purposes. The control of the car is by, first, the left hand foot lever, which regulates the pressure between the friction surfaces; second, the outside hand lever, which shifts the positions of the driven pulleys. The right hand foot lever controls the hub brakes, and the engine is controlled by the spark and throttle levers on the steering column. The wheel base is 96 inches, with standard tread. The weight is about 1,600 pounds, and the car is geared for speeds up to 35 miles per hour. They also manufacture two models of two cylinder runabouts, one model of 10 horse power, with automatic inlet valves, and a model of 15 horse power, with mechanical valves.

THE BABCOCK.

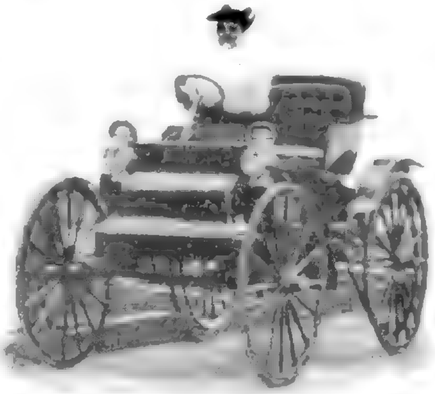
The H. H. Babcock Company, Watertown, N. Y., manufacture a high wheeled type of automobile. The engine is a two cylinder, opposed type, water cooled, with a bore of 5 inches and stroke of 4 inches, and is located in front under the hood. Ignition is by jump spark from dry cells and spark coil. Power is transmitted through a multiple disc clutch to the change gear case, which gives three speeds forward and reverse and is operated selectively. Final drive is by chains to the rear wheels. Both front and rear axles are solid steel, fitted with ball bearings. The wheels are 36 inch front and 38 inch rear, fitted with 1⅝ inch solid rubber tires. Two sets of brakes are used, a transmission brake and two internal expanding brakes, one on each rear wheel. Steering is by wheel through worm and gear. Wheel base is 84 inches, with standard tread, with the option of other treads extra. Weight of the car is about 1,300 pounds.

THE RELIABLE DAYTON.

This high wheeled type of automobile is manufactured by the Reliable Dayton Motor Car Company, Chicago, Ill. The motor is a two cylinder, water cooled, opposed type, located in front under the hood. It has a bore of 4⅜ inches by 4 inch stroke, and is rated at 15 horse power. The cylinders are cast with integral heads and water jackets. The valves are mechanically operated by push rods. A vertical tube, flanged radiator is used, the water being circulated by a gear pump. A belt driven mechanical force feed oiler forces the oil to the main bearings and crank case. Ignition is by jump spark from dry cells and coil. Power is transmitted through an external contracting band clutch to the unit construction change gear case and jack shaft. Sliding gears are used giving two speeds forward and reverse, operated progressively. Final drive is by double chains to the rear wheels. The frame is of reinforced ash, supported on semi-elliptic springs in front and full elliptic in the rear. Both front and rear axles are of the Timken solid roller bearing type. Wheels are 40 inches in front and 44 inches in rear, fitted with 1¼ inch Firestone solid rubber tires. Steering is by side lever, through rack and pinion. One set of brakes is used, of the internal expanding type, operating on the rear wheel hubs. Control is by two pedals, one of which operates the clutch and the other the rear hub brakes. A lever on the steering columns operates the change speed gears, and the engine is controlled by spark and throttle levers, also on the steering column.

DE SCHAUM.

The De Schaum Motor Syndicates Company, Buffalo, N. Y., are manufacturing several styles of high wheel, friction drive automobiles, including a popular priced runabout. The engine of this car is a two cylinder, opposed, air cooled, with a bore of 4⅛ inches and stroke of 4 inches, and rated at 10 horse power. Ignition is by jump spark, with two unit coil on the dash and a double set of batteries. Lubrication is by a mechanical oiler. Friction change speed mechanism is used, the final drive being through side chains to the rear wheels. The frame is supported on semi-elliptic springs front and rear. Solid axles are used fitted with Timken roller bearings. One set of internal expanding brakes is fitted to the rear wheels, and the reverse can also be used for braking. The front wheels are 38 inch and the rear wheels 40 inch. Both are fitted with 1¼ inch M. & W. solid tires. The control is by two foot levers, one of which controls the engaging pressure of the friction surfaces, and the other controls the rear brakes. The side levers control the position of the friction disc, giving the forward and reverse speeds. Spark and throttle levers on the steering wheel control the engine. The wheel base is 76 inches, with a tread of 54 inches.



The De Schaum

THE EUREKA.

The Eureka Company of Rock Falls, Ill., manufacture this high wheeled type of automobile in one model. The engine is of two cylinders, opposed, air cooled, with a bore and stroke of 4 inches each, and rated at 12 horse power. The valves are in the head and mechanically operated by push rods and rocker arms. The air draught for cooling the cylinders is created by the fan spoked flywheel. Lubrication is by a belt driven, four lead, force feed oiler, located just in front of the flywheel. A two speed planetary change speed mechanism is located on the crank shaft extension, from which the power is transmitted to the differential casing on the countershaft by a single chain. A double chain drive is used to transmit the power to the rear wheels. The engine and transmission are supported on a short angle steel frame, which is supported by two long Concord springs, one on each side, each end of which is secured to the axles. Front and rear axles are solid 1¼ inch Timken roller bearing construction. The front wheels are 40 inches and the rear 44 inches, fitted with 1¼ inch solid rubber tires all around. Steering is by wheel through rack and pinion, with the connecting rod behind the front axle. Two internal expanding brakes are fitted, one to each rear wheel hub. The control is by foot and side levers. The low speed forward, reverse (which can be used as a brake) and hub brake are controlled by the pedals, and the high speed forward by the side lever. The engine is controlled by spark and throttle levers on the steering column just below the steering wheel. The wheel base is 75 inches, with the standard tread, and the car weighs about 1,000 pounds. It is geared for 25 miles per hour on the high gear.

THE ZIMMERMAN.

The Zimmerman Manufacturing Company, of Auburn, Ind., are manufacturing a high wheel friction drive runabout. The motor is a two cylinder, air cooled type, located crosswise in front under the hood. The bore is 4¼ inches by 4 inch stroke, and the motor is rated at 14 horse power. The fan spoked flywheel in front creates the air draught for cooling the engine. Ignition is by jump spark, with dry cells and coil. A mechanical force feed lubricator forces the oil to cylinders and main bearings. The transmission is through a long shaft, which has keyed upon it, free to slide forward or backward, a friction pulley. This fully engages with two friction discs, which are secured to the inner ends of the divided jack shaft. The discs are connected to a port lever, which controls the pressure between the friction discs and pulley. Inasmuch as with this arrangement one of the wheels would have to revolve in an opposite direction to the other, the left hand disc is connected to the outer end of the jack shaft by spur gears, which gives the correct uniform motion with the other. No differential is used, slippage between the discs taking care of this action. Final drive is by double side chains from the jack shaft to the rear wheels. The frame is of angle steel, supported on two full elliptic springs, one spring to each axle, and the two axles are connected together by reaches. The axles are solid, with forged yokes and steering knuckles, and fitted with ball bearings. The wheels are 37 inch front and rear, fitted with 1¼ inch solid rubber tires. One set of brakes, of the internal expanding type, is fitted to the rear wheel hubs. Steering is by wheel through a Barnes standard gear. The control is by two pedals, one of which regulates the pressure of the friction engaging surfaces and the other the hub brakes; a side hand lever which controls the driving pulley and gives the required speed forward and reverse, and by spark and throttle levers on the steering wheel. The regular equipment includes two oil lamps, horn and set of tools. The wheel base is 80 inches, with standard tread, and the car weighs about 1,250 pounds and is geared for speeds up to 25 miles an hour.

THE CHAMPION.

The Famous Manufacturing Company, of East Chicago, Ill., are the manufacturers of the Champion auto roadster, a high wheeled type of automobile. The motor is a two cylinder opposed, rated at 10-12 horse power, air cooled, and located at the rear. A force feed oiler forces oil to the important parts of the engine. Make and break ignition is used. Two sets of transmissions are fitted, according to the requirements the car has to meet or the option of the purchaser. One set uses a planetary transmission with double chain drive to the rear wheels. The other is a friction mechanism with either double chain or cable drive to the rear wheels. The chain is a regular roller chain, and the cable of special treated material, which when in use takes on a smooth surface, which is practically water and dirt proof. The car has a speed of between 15 and 30 miles an hour. The changes of speed are accomplished in both systems by pedals, the controlling pedal for the friction drive being moved backward or forward, automatically applying the brake, and the foot is shifted from one pedal to another with the planetary. Solid standard ball bearing axles are used, with reaches between them.

ELECTRIC RUNABOUTS.

POPE-WAVERLEY ELECTRIC.

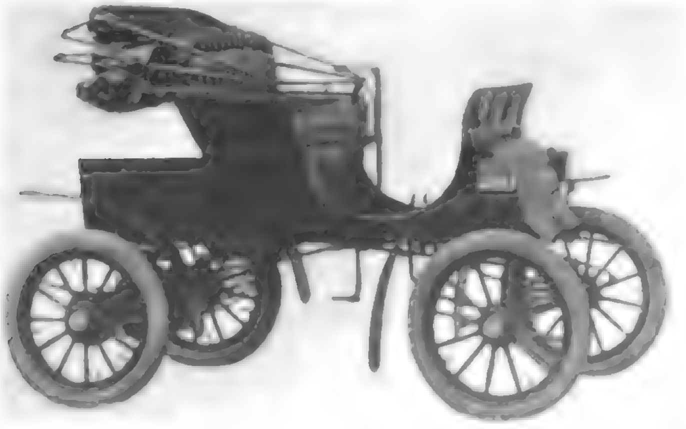
The Pope Motor Car Company, of Indianapolis, Ind., manufacture several models of runabouts, one of which, Model 69, we illustrate herewith. This car embodies the same constructional features that characterize all of this make. The motor is a special design Pope-Waverley, with a double overload capacity, giving a speed of from 5 to 17 miles per hour. Current is derived from a thirty cell battery, the option of the 9 P. V. Exide or 9 C. B. National being given. This battery is located in the compartment at the rear. The motor is geared direct to the differential casing of the live rear axle by noiseless herringbone type of gears, which run in oil and are thoroughly protected by an oil and dustproof casing. The wheel base is 6 feet, with a tread of 54 inches, and the body 6 feet 9 inches, supported on full elliptic springs front and rear. The wheels are 30 inches, fitted with detachable tires, 3 inch tires front and 3½ inch in the rear. Steering is by a lever located either at the side or in the centre as desired. Two sets of brakes are provided, one set operating on the hubs of the rear wheels and being of the internal expanding type, and the other being a contracting brake on the armature shaft. Both sets are so connected that the power is shut off before they are applied. The current to the motor is controlled by a short lever at the side of the seat, which operates the four contact controller under the seat. Three contacts are for the forward speeds and one for the reverse. A combination ammeter and voltmeter in front of the floor boards shows the condition of the battery at all times. Model 71 is a somewhat more compact car, the wheel base being 5 feet 9 inches. The body lines are different, a compartment being built in front of the dash in which are placed ten cells of the thirty cell battery, thus distributing the weight more evenly. Otherwise the construction is the same. A top is fitted if desired.

THE BAKER ELECTRIC.

The Baker Motor Vehicle Company, Cleveland, Ohio, are bringing out a new runabout which is known as Model R. The motor is series wound, rated at 2 horse power, with an overload capacity of 300 per cent. It is suspended from the frame crosswise to the car, and runs on annular ball bearings. A Renold silent chain transmits the power to a countershaft, with final drive by a single chain to the live rear axle. The Renold chain is enclosed in an oil and dust proof case, which thoroughly protects it. A thirty cell, 11 P. V. special storage battery is used, with sixteen cells in front under the hood and fourteen cells in the rear, thus giving an even distribution of weight. The motor speed is controlled by a nine point contact drum controller operated by a lever just below the steering wheel, which gives six speeds forward and three reverse, with a maximum speed forward of 22 miles an hour. The frame is of pressed steel, supported on semi-elliptic springs in front and full elliptic in the rear. The axles are of tubular construction, the rear axle being of the live type. The wheels are 32 inches, fitted with 3½ inch tires, and run on annular ball bearings. Steering is by wheel through gears of the Baker Company's construction. The wheel base is 70 inches, with the standard tread. Two brakes are provided, operated by foot levers. A combination ammeter and voltmeter indicates the condition of the batteries. A mileage of 117 miles has been obtained with one charge, it is claimed, but 70 miles is the regular duty under proper conditions. The operation of the car is by two foot levers for the brakes and the controller lever just under the steering wheel.

THE R. & L.

The Rauch & Lang Carriage Company, of Cleveland, Ohio, manufacture several styles of runabouts, all of them being of the same general construction and differing only in size of battery, wheel base and other minor



Pope-Waverley Runabout, Model 69.

Baker Electric.

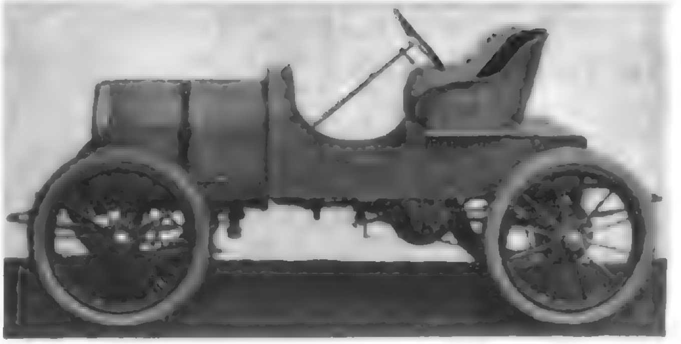
details. Their Model "10" Stanhope has a wheel base of 74 inches, and the car weighs complete about 1,800 pounds. The frame is of pressed steel, supported on semi-elliptic springs in front and full elliptic in the rear. The axles are of tubular construction, with forged ends. The wheels are wood, of the artillery type, fitted with 32x 3½ inch pneumatic tires, and run on roller bearings. The motor is of the compound wound type, and is designed to run at all times on a voltage of 48. The motor is mounted in a frame which is integral with the countershaft housing, the power being transmitted from the motor to the differential on the countershaft through a double silent chain. Both the motor and countershaft are equipped with annular ball bearings. Final drive is by side chains to the rear wheels. The storage battery is a twenty-four cell 9 M. V. Exide type, and is divided between the front and rear compartments. The motor control is by a lever at the side of the seat, which operates the radial type of controller, giving four forward speeds. The controller lever has a safety locking arrangement whereby the circuit can be broken and locked in this position to prevent anybody but the owner operating it. Steering is by hinged side lever. Three sets of brakes are fitted, one set, of the internal expanding type, acting on the rear wheel hubs; an external contracting brake acting on the armature shaft, and an electric brake operated by bringing the controller lever back to braking position, which brings the shunt coil in operation, thus giving a controllable type of electric brake. The control is by two pedals, one of which operates the hub brakes and the other the motor brake, and by the controller lever, which gives the forward and reverse speeds and the electric brake.

THE COLUMBUS ELECTRIC.

The Columbus Buggy Company, of Columbus, Ohio, are manufacturing several styles of runabouts, the differences being chiefly in the style of bodies fitted. The illustration shows their latest product. The frame is of pressed steel, supported on half platform springs in front and full elliptic in the rear. Both front and rear axles are of tubular steel construction and are fitted with roller bearings. The wheels are wood, of the artillery type, and fitted with 30x3½ inch pneumatic tires in front and 31x4 inch pneumatic tires in the rear. The motor is of the multipolar type, running on annular ball bearings, and supported in an aluminum frame hung from the main frame. The transmission gearing is enclosed in an oil and dust proof case, the final drive being by double side chains to the rear wheels, the chains also being enclosed in a protecting casing. The entire transmission equipment, comprising motor, controller, differential gear and hand brake, is located on the same sub-frame, and can be removed as a unit. The storage battery consists of tweny-four cells of 9 M. V. standard, distributed under the front hood and rear. The controller is of the radial type, and is operated by a lever on the steering column. With this controller speeds up to 20 miles an hour are obtained. Two sets of brakes are fitted, a transmission brake on the armature shaft and two internal expanding brakes on the hubs of the rear wheels. Steering is by wheel, the steering column being located on the left hand side of the car. The control is by one foot lever, which operates the hub brakes, and a hand lever just beneath the steering wheel which operates the motor controller, and a further movement of which cuts out the motor and applies the transmission brake. A combination ammeter and voltmeter on the footboard indicates the condition of the battery.

THE BAILEY.

S. R. Bailey & Co., of Amesbury, Mass., manufacture a victoria phaeton type of electric runabout. The frame is of pressed steel, supported on semi-elliptic springs front and rear. The axles are solid, of the "Bailey Pivot" type. Wooden wheels of the artillery type are used, fitted with 34x 3½ inch pneumatic tires front and rear. The motor is a Bailey special, designed for sixty volts, and is hung low in the frame toward the rear, thus giving all the space under the seat for carrying purposes. Drive is through a Morse silent chain to the countershaft and thence by side chains to the rear wheels. The storage battery is composed of thirty cells of the Gould type, with other makes at the option of the purchaser. The battery is enclosed in a strong box and is hung from the frame beneath the foot boards. Two sets of brakes are fitted, one set operating on the rear wheels and the other on the armature shaft. Both sets are operated by one foot lever, and so adjusted that both brake at the same time. This arrangement is used to prevent a strain to the motor and transmission. Steering is by lever, the lever column being fitted with a wheel, three-eighths of the circumference of which is cut away, making it D shaped. This affords a somewhat better grip for the hands in swinging the lever from one side to the other for steering. The control is by a single foot lever which operates the brakes, and the motor is controlled by a lever mounted on the D shaped wheel. This lever operates an interlocking controller, so interconnected that the master switch cannot be turned on unless the controller is in neutral position, and when the brakes are applied the power is automatically shut off. The wheel base is 76 inches, with a tread of 54 inches, and the car weighs complete about 2,000 pounds.



COLUMBUS ELECTRIC RUNABOUT.

New Automobile Plant at Goshen, N. Y.

The Coates-Goshen automobile plant is a new enterprise started at Goshen, N. Y., to manufacture high grade cars in small quantities. They are putting out a two or four passenger tourabout, designed to accommodate with a few changes a sporty runabout or a comfortable town car body. In designing this car arrangements have been made by which the 36 inch wheels with pneumatic tires may be replaced, if desired, with 40 inch wheels, fitted with solid tires, to suit the physician or business man who is satisfied to run more moderately and avoid tire troubles and expense. The motor is of the four cylinder, four cycle, water cooled type, 4x4 inches, fitted with Bosch dual magneto ignition, and will start from the seat. The moter is fitted with self-contained oil pump and self-contained cone clutch connected by a double universal joint with the transmission case, which is of the selective type, three speeds forward and reverse, fitted with Hess-Bright annular bearings, and the gears are of chrome nickel steel. There is a double universal joint between the transmission case and the straight line propeller shaft, which is thoroughly housed back to the rear axle. The front axle is an I-beam drop forging. The rear axle is of the floating type with internal and external hub brakes of liberal size. Wheels, 36x3½ inches, are on Timken roller bearings. The wheel base is 108 inches, with standard tread. The frame is of pressed steel, U shape, double drop type, which, notwithstanding the high wheels, gives a low centre of gravity. The suspension is of the semi-elliptic, three point or platform type.

The entire car is equipped with hardened ball joints instead of the common eye and clevice, and this feature admits of close adjustment, and consequently quiet running. The steering column is of the double screw type, non-reversible and adjustable with one adjustment. A cellular type radiator and housed fenders are among the other features.

Miss C. de H. Benest is the first woman driver of a motor omnibus in England. She was the only woman to take the examination for motor engineering recently held in London, and easily passed.

COMMUNICATIONS

One Doctor's Idea of a Serviceable Car.

Editor Horseless Age:

Your decision to give one issue of your valuable journal to the exclusive discussion of the runabout is certainly opportune. From my experience and observation the form of the business runabout that will eventually be evolved from the mazy confusion that now exists will be the high wheel runabout, not the big clumsy 48 inch wheel type, but one with wheels of not over 38 inches, with solid rubber or "cushion" tires. An 8 or 10 horse power, two cylinder, opposed, air cooled motor should be sufficient to give all the power needed. A speed of 15 to 20 miles per hour is all that could be desired. A double chain drive to rear wheels is, I think, best adapted to these machines.

A good friction transmission, I should think, would meet all the requirements of these light runabouts, and would simplify manipulation and eliminate complicated and troublesome parts.

O. I. Hess, M. D.

Advocates Low Centre of Gravity.

Editor Horseless Age:

Permit me to relate a few experiences and voice a few practical ideas upon the subject of runabouts, having had considerable practice in the design of automobiles, and also having operated a runabout (of well known make) under both severe and pleasant conditions for some years.

My occupation compels me to travel a great deal, and if the distance be a reasonable one, my greatest convenience has been my runabout; that is, if instead of waiting for the next regular train I could get to my destination ahead of the train. Of course, in case of long distances I would take the train.

But my runabout has stood up nobly in my hurried and severe calls, being compelled to "scout" around unfrequented and hilly roads, then after each ride to be left standing with little or no attention, except that of filling up oil and water tanks. The foregoing speaks for the good construction and design of this particular car, but under it all lies the fact that it is a runabout, which makes the above possible.

It is obvious that the runabout is the ideal business car, and yet I have taken many a long pleasure ride with comfort and reliability. It is easily seen that this type of car is coming more and more to the front. I cannot understand the use of making ponderous touring cars with colossal horse power. They are, of course, sought after by the fastidious, but never by the practical.

In the runabout type of car we should strive for a low centre of gravity. We are not making the mistake which was made when the first electrical locomotive was built, which was wrecked owing to low centre of gravity. When we attain lower centre of gravity then we can proceed to lighten our cars. We now have some good alloys of aluminum; why not make the cylinders from this and have the bore composed of seamless drawn tubing? This tubing comes with a pretty good finish inside, and with very little work can be brought to accuracy. The four cylinder arrangement is no doubt a good one for the runabout. The car should be a model of simplicity, rugged in construction, of few parts, and devoid of confusing methods of control.

George F. Sandstrom, M. E.

Used Runabout in Campaigning.

Editor Horseless Age:

I hope this letter will not be too late for your Runabout Number, as I feel it my duty to let you know of the wonderful results and pleasure I derived from a little roadster. I had a hard battle to uphold the liquor business in Muscatine, Ia. This fight was on for eight months. During that time this car, a 1907 model, was on the road day and night, rain or shine. Without same I could never have stood the strain of this campaign. In that time I covered 6,412 miles, with no expense except for gasoline, oil, storage battery charging, and the retreading of the two driving wheel tires.

I have beaten cars costing twice its amount on the road and up the worst kind of hills in sand to the hub, and it has never failed me.

Otto C. Seidlitz

Speed Trapping Profitable in New Jersey.

The A. C. A. is to protest to the Motor Vehicle Commission of New Jersey against the operations of Justice of the Peace Manfred Naar, of Mercer County, who, according to the investigations of the Executive and Public Safety Committees of the club, has been doing a thriving business prosecuting motorists for exceeding the speed limit. According to these investigations, Naar, during the month of August, cleared for himself the snug little sum of $438.75. His field of operation is the 20 mile stretch of road between Mercerville and Hightstown. Presumably he times the cars passing along this road, but at any rate he takes their numbers, and then, after having ascertained the owner's name from the registration list, sends him the following letter:

"Dear Sir—There has been lodged against you a complaint by one of the officers of Mercer County for violating the automobile law, to wit: Exceeding the speed of 20 miles per hour on the stone road leading from Mercerville to Hightstown. If you desire a trial in this matter an early answer will greatly oblige me.

"Under our automobile law, if you do not appear within five days, I shall be compelled to serve a summons upon the Department of State of Motor Vehicles."

It is stated that the party addressed usually complies with the request to visit the justice, and is fined according to a regular scale, up to $25. The rule is observed never to fine a resident of Mercer County. In August the cases disposed of by the justice numbered 117, and the State Treasury profited to the extent of $549 by the exploits of the magistrate.

Naar in response to the above accusations has issued a statement in which he denies that he has a measured mile stretch on the road near his office. He explains that his object in sending letters to offenders against the motor vehicle law directly, instead of through the State Commission, was "to save expense."

The Runabout in Church Work.

In several previous issues of The Horseless Age have been printed articles written by ministers of the gospel, on their experience with automobiles, although their class have not been very extensive users of motor cars, largely, no doubt, owing to the comparatively limited income of most parsons. Most of the ministers whose flocks are scattered over considerable territory find it very difficult to get personally acquainted with all of them, owing to the large amount of traveling that would be required, and a speedy little runabout, reliable and economical in upkeep, would be appreciated by the majority of clergymen. The need of such conveyance is felt in newly developed territory where churches are generally far apart and members are often located at great distances. Such are the conditions in Oregon, and one of the ministers of the Methodist Church there, the Rev. W. E. Euster, of Pendleton, has purchased a four cylinder, 22 horse power runabout, which he drove personally from Spokane, Wash., to his home. Mr. Euster says that he can do four times the amount of work for the church in a given time as he could without the machine.

Program of Roads Congress.

The International Roads Congress will open in Paris on October 11, with a reception, at which the delegates will be received by M. Fallieres, the President of France. On the next day the first meeting will be held at the Sorbonne, followed by the opening of the exhibition in the gardens of the Tuileries. On the 13th the delegates will visit places of interest near Paris, and during the remaining days will visit Versailles, Fontainebleau, Nice and Monte Carlo. The Congress will be divided into eight sections and altogether ninety-nine papers will be read. Thirty-seven of these will come from France, seventeen from Great Britain, fifteen from Belgium, twelve from Germany, the remainder coming from Switzerland, Italy, Holland, Austria, the United States and Russia. The final meeting will be held on October 17, but the trips will be continued until the 20th.

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The Runabout Number.

The present issue is devoted to the runabout, and more particularly to the runabout for practical or business uses. This phase of automobile development has been more or less neglected in current automobile literature during the past several years. From the large number of articles from physicians in this issue it is apparent that the medical profession still hold the lead as practical users of automobiles. The extent to which runabouts are used by doctors in sections of the country with tolerably good roads is surprising. Thus we learn from one article in this issue that in Middletown, Conn., twelve out of the fifteen physicians having a regular practice employ motor cars, and in Poughkeepsie, N. Y., about one-half use the same means of conveyance.

During the period from 1900 to 1904 the medical profession were the mainstay of the automobile industry, nearly all of the cars then manufactured being apparently suitable for their use. When the touring craze broke out some years ago, and ever since the majority of the makers have centered their attention on cars above 30 horse power, the business runabout appears to have been relegated to the background. Doctors and business men looking for a practical conveyance did not take part in the discussion of such questions as "Four vs. Six Cylinders," "The Retarding Effect of Windage," and others that have agitated the automobile trade during the past several years, and have to an extent been lost sight of. Nevertheless, the use of small cars for practical purposes has largely increased, and, what is still more a cause for satisfaction, business automobiles are now being used far more successfully than ever before.

On January 7, 1903, the first Doctors' Number of THE HORSELESS AGE was published, and on November 1, 1905, the second. The present issue forms in a sense another link in this chain of testimony from users regarding their practical experiences. The time interval between successive issues of this series has in each case been approximately three years, and the progress in construction made during the interval is plainly reflected by the general tone of the articles in the issue following it as to the degree of satisfaction derived by users.

The present number for the first time confirms the absolute practicability of the runabout as a physician's conveyance. What better proof is needed than that scores of physicians under entirely different conditions have used cars for seven or eight years continuously? Almost every one of the writers states or hints that he will not go back to the use of the horse while the roads are good. Of course, there are still occasional instances of failure, but these must be ascribed to either lack of mechanical ability, the purchase of entirely unsuitable cars, or very unfavorable road conditions. As in everything else undertaken by men, we may always expect a certain percentage of failures.

Perhaps the greatest value of the present number to the reader who is about to purchase a car is in enabling him to wisely choose the most suitable type of vehicle. If he has to travel hilly, muddy and sandy roads, the experience of those writing in this issue shows that he wants a powerful, flexible motor (which means a multi-cylinder one) and preferably a three speed gear. Such a car, if well made, costs necessarily rather high. On the other hand, those who can travel practically all the time on improved roads with no steep grades may get along well with a single cylinder motor and a two speed gear, a car which not only can be bought at a lower price but should be less expensive to maintain. Many physicians favor the high wheel car, and there can be little doubt that with the same grade of material and workmanship in both this type of car, with its lower speed, is less expensive to maintain than the standard type of runabout. But some who have gone in for this type have found to their sorrow that it is not merely the principle of construction which determines the practical value of an automobile, but mainly the manner in which this principle is applied. The general excellence of our modern automobiles results from the accumulation of more than ten years' experience, which, however, only benefits those makers who have taken part in the development.

There is probably no other calling in which the money value of the time lost on the road per day, on the basis of average earning capacity, reaches such a high figure as in the case of the physician, and it is, therefore, perfectly natural that medical men are very keen in respect to adopting improved methods of transit, some having adopted the automobile even before its state of development really warranted it. The motor car is now, however, being taken up by numerous other classes who have to do much road traveling, as the present issue plainly shows. There are said to be 100,000 physicians in this country; within a few years there will be as many rural mail carriers, and with the contractors, salesmen, inspectors, collectors, ranch owners, etc., who will be able to use runabouts in their daily work to advantage, there is obviously an immense field for this industry of the runabout, built up on a commercial basis and independent of fads and fashions.

While we intended to confine this issue mainly to runabouts for business purposes, the general title of Runabout Number was adopted, and in the catalogue of runabouts made in this country, found elsewhere in this issue, are included many vehicles which on account of their high power and high first cost may not be suited for business purposes, and which certainly were not designed specially for such use. But as they are runabouts and it is absolutely impossible to say what is the limit of power and price for business uses, they were included.

Dragging Brakes.

An inspection of the braking system on some of the 1909 models shows that designers are not paying the attention they should to insure that the brakes are free in the "off" position. This is particularly true of the band brakes, and to a lesser extent of the expanding type.

The band brake is an excellent type if properly designed, but quite a little precaution is necessary to keep it from dragging upon its drum. Often we see these brakes hung from above with only the natural spring of the band to clear them. When suspended in this manner it clears well enough when the vehicle is stationary, but must swing back and forth and drag to a certain extent when the vehicle is in motion.

Occasionally we see these brakes supported either at the front or back side only. With such a construction the band drags most of the time.

To absolutely prevent dragging from the band's weight, inertia and distortion, it is necessary that it should be supported in at least two places. This can be done by placing one of the supports opposite to the linkage and letting a forked piece attached to the band slide over the support. Another good way of getting positive clearance is to place a number of supports so that the outside of the band will rest against them when it is in the proper off position. In order that this method may be effective the band must be so made that the spring of the steel will hold it firmly against these supports. We have observed cases where these supports were merely ornamental, as the bands never sprung out far enough to touch them.

However, the faults in the suspension of band brakes are not so serious or so common as faults in the construction and adjustment of the operating linkage. Wherever the rods which connect the brake to the forward operating shaft do not move in absolute unison with the rear axle struts, the brakes are tightened and loosened by each deflection of the rear springs. We have seen cases where this action was great enough to apply the brakes so strongly as to nearly stop the car. Probably on a great many cars now in use the brakes drag enough to considerably reduce the mileage per gallon of gasoline. This condition is all the more serious because it is difficult to tell whether the bands are dragging, since it is almost impossible to watch the brakes when the car is running, and wheeling the car over a smooth floor does not give any idea of what occurs when it is going over a rough road.

Of course, dragging caused by spring deflection occurs both on expanding and contracting brakes, and is even liable to be more serious in the former because they have less clearance and it does not require so much movement to apply them. Brakes located upon the driving shaft are not usually affected by spring deflection.

Should Road Clearance Be Increased?

The proper road clearance for an automobile is, of course, determined by the nature of the highways it is used upon. This is a matter of common knowledge and has been very thoroughly impressed upon the automobile-using public in this country through the importation of European cars with much less clearance than is required for American roads.

Experience has shown our manufacturers what clearance is necessary for the conditions under which their cars are used, and they have usually kept as near this figure as they deemed safe. It is a good thing to keep the weight of the car as low as possible, and for this reason the dropped frame is rapidly increasing in favor. While this construction has in many cases not lowered the clearance of the car when it is standing upon a level surface, it has frequently decreased the clearance when passing over rough roads, for it is often the height of the flywheel which is the determining factor under such conditions.

The moderate price touring cars, which are at present appearing in such number, have many of them been designed with a clearance which is only sufficient for reasonably good road conditions. Doubtless it is the intention to sell them largely for use over such roads, but it would seem as though their makers had been rather neglectful of an important tendency in the market. One of the largest fields for the low and moderate priced car at the present time is in small cities, country towns and among well to do farmers. The importance of this portion of the market can scarcely be overestimated, for it is rapidly increasing.

A car to give satisfactory service in such localities must have a greater road clearance than is needed for city or main road use. It will be quite a number of years before the cross roads of this country will be good enough so that a low hung car with the usual "French" arrangement of parts will be a success over them. It is more than probable that some of the cars now being placed upon the market will not find a ready sale in outlying districts.

A. C. A. and A. A. A. Reach Agreement.

A compromise has been effected the past week by the Automobile Club of America and the American Automobile Association, and announcement of the fact was made on September 17. The Board of Governors of the A. C. A. ratified the agreement at their last formal meeting, but it was not until September 16 that the executive committee of the association did their part, after a protracted meeting. The representatives of both bodies then met, and an official statement was issued, from which the following is taken:

It is agreed that the Automobile Club of America is the only American member of the International Association of recognized automobile clubs, and that it is and shall be the only authority in America for the drafting of rules affecting and for the granting of sanctions for international races and for the regulation of such races in this country. On the other hand, the matter of the sanction of and the formulation of rules for local and national races is left, as heretofore, in the sole power and jurisdiction of the association. The two bodies agree to co-operate with each other in making the Vanderbilt Cup race and the Savannah Grand Prize race successes. After the races of this year the two cups are to be deeded to an independent racing association (The Long Island Parkway, Inc.), and are to be contested for annually, the Grand Prize Cup as the international trophy, and the Vanderbilt Cup as the National trophy. It is also agreed that the club shall not encourage other clubs to withdraw from the American Automobile Association.

Following is the definition of an international race as the term is used in this agreement:

"An international race or contest is one which is announced or advertised as 'international,' or one which is open to entrants of America and foreign countries. Cars of foreign manufacture may be entered in a race or contest without making the same an 'international' race or contest, provided, however, that such cars be owned and entered by American citizens, firms or corporations."

It will thus be seen that promoters of races, by simply announcing them as "international," can obtain sanctions from the A. C. A., and this course, it is reported, is to be followed by the Motor Racing Association of New York, which has obtained from the A. C. A. a sanction for its next twenty-four hour race, to be held on the Brighton Beach track October 2 and 3.

The agreement between the two bodies will remain in force until 1910, and thereafter until terminated upon twelve months' notice in writing.

Runabouts in Austria-Hungary.

By Robert Atter.

More than two-thirds of the five thousand-odd automobiles circulating in Austria-Hungary belong to the voiturette, or runabout class, a sufficient testimony in itself to the popularity of the small car. Moreover, the dealers say that while the demand for the big, expensive car is pretty well at a standstill, there is a growing demand for good, reliable small cars of simple construction, and which can be had from anywhere between $900 to $1,500. But after careful and exhaustive inquiries made in many directions I am bound to say that, broadly considered, the automobile market in Austria-Hungary is not just now in a very promising condition. It would seem that all the rich people have bought cars and don't want any more, while the middle classes have not money enough to indulge in such luxuries. At all events, they will not buy cars at the present price; they will have to become considerably cheaper first. Fear of the income tax authorities also has something to do with it. The possession of an automobile would certainly be regarded by these officials as evidence of increased wealth, and as Austria-Hungary enjoys a graduated income tax system the taxpayer is loath to give any pretext for having this invariably unpopular tax put up any higher upon him.

To return, however, to the question of the runabout car, the advantages of these over the larger, heavier car are freely admitted by dealers and buyers alike in Austria. The small car costs much less, both in the first instance and also in running expenses, while in many cases it will perform just the same service as the larger vehicle. This is especially true when it comes to the question of cars for business purposes, and it is in just this field that the best opening can be found for encouraging the use of motor cars. So far only two classes of men have shown any real intention of adopting automobiles for business purposes in Austria, namely, doctors and commercial travelers. The former, indeed, have taken the matter up in serious earnest, as is shown in the organization of the Austrian Medical Automobile Club, with headquarters in Vienna. The avowed purposes of the club are to facilitate the acquisition of automobiles by the members and to enable them to operate cars at a minimum cost, which ought not to exceed the expense of a carriage and horses. The club proved to be an immediate success, and has been the means of converting many medical practitioners into enthusiastic motorists. The club's first business was to make an exhaustive investigation as to the best and most suitable kind of automobile for doctors' use in large cities. All the principal car experts were consulted and numerous trials made, after which the first conclusion arrived at was that the heavy cars were quite unnecessary and, in fact, distinctly unsuitable for medical purposes, first, because of their comparative clumsiness for daily usage in crowded, narrow streets; and second, on account of their higher price and cost of running. And after deciding so decisively in favor of the small car, a further number of experiments were made with these with a view to recommending particular types and makes. The list of cars tried included the following:

CLASS 1, CARS UP TO 10 HORSEPOWER.

A. Ruppe & Son Company, Apolda, two cylinder (Piccolo), three speed; maximum speed, 27 miles; price $1,000; seating capacity for two. With seats for three and maximum speed 24 miles, $1,100.

Puch Company, 9 to 10 horsepower, two cylinder; maximum speed, 30 miles; three speed; seating two; $1,120. Three seated landaulette, same type, $1,150.

Kraftfahrzeuggesellschaft, Vienna, 8 and 9 horsepower, one cylinder; maximum speed, 30 miles; four speed; for two seated landaulette, $1,200. For three seated, $1,300.

CLASS 2, CARS UP TO 14 HORSEPOWER.

Bock & Hollender, Vienna, 10 to 12 horsepower, two cylinder; maximum speed, 33 miles; four speed; three seated landaulette, $1,500.

Oesterreichische Neue Automobilgesellschaft, Vienna, 10 to 12 horsepower, four cylinder, three speed; maximum speed, 33 miles; four seats, $1,520.

A. Ruppe & Son Company, Apolda, 12 to 14 horsepower, four cylinder, air cooled, four seated landaulette; maximum speed, 33 miles, $1,560.

CLASS 3, CARS UP TO 18 HORSEPOWER.

Laurin & Clement, Vienna, 14 to 16 horsepower, four cylinder; maximum speed, 36 miles; three speed; four seated, $2,400.

Fabrique Nationale, Belgium, 14 and 16 horsepower, four cylinder; maxium speed, 36 miles; $2,300.

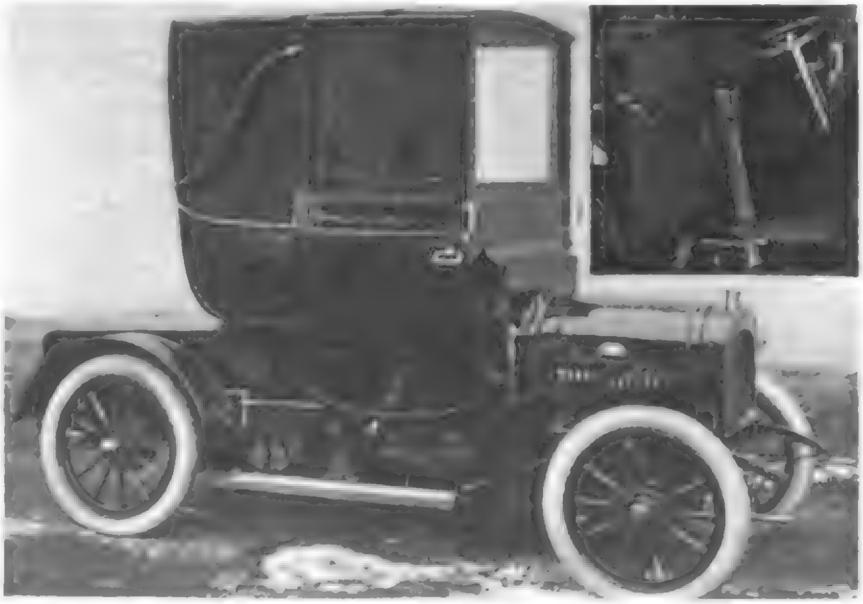
All of these were favorably reported upon and recommended to the members of the club for purchase.

Two firms, A. Ruppe & Son Company, Apolda, and the Oesterreichische Neue Automobilgesellschaft, Vienna, have agreed to furnish the doctors in Vienna with these light cars, or, rather, to operate them, supplying everything necessary, such as chauffeurs, cleaners, tires, benzine, oil, grease, illuminating and cleaning materials, ordinary repairs and garage accommodation, for inclusive monthly payments of $85, $91 and $102, respectively, according to the variety of car, and $90 for the four cylinder, 10 to 12 horsepower car. These charges will include the supplying of substitute cars without extra charge while the owner's car is being repaired.

The contracts are based upon the calculation that the monthly journey of a car will average 1,000 kilometers, or 600 miles, which has been found to be a fair average of the distance covered by a Vienna doctor in the course of his city practice.

The club also offers its members special facilities for purchasing cars at reduced rates, and further undertakes to place insurance against accidents upon specially favorable conditions.

Doctors who were interviewed were practically unanimous in favor of a 10 to 12 horsepower two cylinder car, weighing from 1,000 to 1,200 pounds, as being the ideal car for a city medical man. They were equally unanimous as to the advantages of motor cars in their profession, both as savers of time and also as regards expenses as compared with horses and carriages.



Puch Doctor's Automobile.

Inside controlling levers shown in upper right hand corner.

One favored me with the following account of his experiences as to the respective cost of the two modes of conveyance.

Horses.	Automobile.	
$480.	Twelve per cent. amortization on $1,000 car	$120
	Benzine, oil, grease, etc.	90
	Repairs	80
	Tires	80
	Garage	40
$480.	Total	$410

In making the above calculations he reckoned on the car being run about 10,000 kilometers, or 6,000 miles in the year. He said that it must also be remembered that a pair of horses doing 6,000 miles a year could not be expected to last more than five years, which would increase the cost by amortization at least 20 per cent., which must be added.

It might be interesting to add the experiences related by a country doctor who has given up his horses for a motor car. In the beginning, he said, it was absolutely necessary that the doctor should have a real interest in motoring, and also possess enough manual dexterity and mechanical knowledge, not only to drive his own car, but also to make small repairs in case of accident, and put on new tires, etc. For the country doctor could not possibly afford the luxury of a chauffeur. For practical purposes one should buy a small car simply constructed, two seated and not too long in the body, as it was often necessary to be able to turn around in very narrow spaces. Although a longer car runs more smoothly and comfortably when going fast, that is of no consequence, for the doctor need not race, a speed of 24 to 27 miles an hour being quite sufficient along a level road. In districts where there were no mountains a 6 to 8 horsepower car was heavy enough, a larger car using up more benzine and costing more generally. In buying a car the doctor should look less to speed than to strength and safety. A good car ought to be had for $1,000 or $1,200. For running expenses the doctor calculated that an ordinary two cylinder car, running three hundred days a year, making about 6,000 miles, would cost for benzine $75, for oil and grease another $20, tires $60, and $45 for repairs. Reckoning the cost of a small car at $1,000, and its life at six to eight years, another $150 would have to be set aside for amortization. Thus the country doctor's car would cost him about $100 a year, and would enable him to do his work in two-thirds of the usual time, besides saving all the trouble with horses and coachmen.

Besides doctors the only other class of persons in Austria which has hitherto shown any inclination to adopt the small car for business or professional purposes is the commercial traveler. And even with these men so few have yet bought cars that it is difficult to get any reliable data as to their value for trade purposes.

Until recently 90 per cent. of the automobiles in use in Austria-Hungary were imported. Latterly, however, aided by the great banking houses, no less than four new factories have been started within the monarchy, while four already existing ones have been greatly enlarged. It is interesting to note that the banks in Austria engage largely in commercial enterprises, such as iron, sugar, oil, coal, and manufacturing of all kinds, frequently beginning by financing concerns and ending by owning them. They have special commercial departments with trade experts at the head. As the result of these developments in the home industry the imports of cars from abroad have largely decreased, and, indeed, some of the Austrian manufacturers have already begun to get a foothold in foreign markets.

A very fair idea of the kinds and classes of light cars in use here may be obtained from the following list of cars which took part in the last International Trial Races, held here in June. The course was from Vienna over Bruck, Leoben, Klagenfurt, Marburg, Gratz and back to Vienna, a distance of 430 miles.

Two Cylinder Cars.

De Dion-Bouton, 12-16 h. p.; weight, 2,000 pounds; rate of speed chosen for trial, 24 miles.
Puch, 10 h. p., 1,550 pounds, 18 miles.
Bock & Hollender, 10-12 h. p., 1,600 pounds, 18 miles.
Piccolo, 10 h. p., 1,300 pounds, 18 miles.
Piccolo, 6-7 h. p., 950 pounds, 18 miles.
Piccolo, 12-14 h. p., 1,700 pounds, 18 miles.
De Dion-Bouton, 12-16 h. p., 2,200 pounds, 18 miles.

Four Cylinder Cars.

Laurin & Klement, 14-16 h. p., 2,150 pounds, 21 miles.
Peugeot, 12 h. p., 2,300 pounds, 18 miles.
Opel, 12 h. p., 1,800 pounds, 18 miles.
Laurin & Klement, 14-16 h. p., 2,050 pounds, 24 miles.
Laurin & Klement, 14-16 h. p., 1,850 pounds, 24 miles.
Fiat, 14 h. p., 2,700 pounds, 21 miles
F. N., 14-16 h. p., 2,050 pounds, 21 miles.
Puch, 20 h. p., 2,000 pounds, 24 miles.

These trials proved very successful, every car finished the whole course and managed to keep to the rate of speed chosen with a remarkable degree of accuracy.

As has already been pointed out, the demand for automobiles in Austria-Hungary is not at present very lively, nor is it likely to increase very greatly until some cheaper cars are introduced. The American manufacturer may then have a chance to see what he can do here; so far he has not done very much. The Buick car, No. 10, four cylinder, 18 horsepower, was brought over here by Mr. J. L. Poole, and I am informed that he only succeeded in disposing of 25 cars in Austria, against 125 in Germany and 225 in England. These cars have been offered for sale at 7,000 crowns, or $1,400, at which price a very fair Austrian built vehicle can be had. The home made car attracts buyers more because of the facilities for obtaining new parts, while it can generally be repaired more cheaply than the imported car. The absence of these advantages seriously handicaps the American manufacturer in the eyes of the dealers and buyers here.

After many talks with automobile agents and manufacturers I am bound to say that the American car is viewed with a good deal of mistrust and even suspicion here. Much of this is due to the injudicious advertising methods employed by many American manufacturers, which are, as a rule, entirely unadapted to catch prospective buyers here. It is useless to print glowing pictures of the enormous capacity of the "Eagle" factory, which can turn out 250 completed cars a week. That doesn't appeal to the slow Austrian buyer a bit. Instead of attracting it even repels him, as he at once concludes that such cars are what he calls "Schlosserarbeit"—that is, "blacksmith's work."

The clever American advertiser seeking to do business in this market ought rather to lay stress upon the handsome appearance of his cars, their excellent and finished workmanship, their strength and durability, and capacity to climb steep grades and stand the racket of not too smooth roads. A few advertisements of this class would prove much more successful in bringing business than hundreds of showy notices calling attention to great wholesale production. But the manufacturer who really desires to do business in this market would save much time and trouble by sending a live agent to look over the field. Letters, circulars, catalogues and advertising matter are comparatively useless. The manufacturer should, if possible, come over himself. One trip would be enough to convince him as to the possibilities or otherwise of doing any profitable business here. If he decided against it he could then drop the matter completely and turn his attention to other and more promising fields.

There is nothing in the special physical conditions of Austria-Hungary to call for any particular car construction. Strength and durability are the most essential qualities looked for, as it must be remembered that the country includes a large area of mountainous districts, where the scenery is peculiarly beautiful and hence attractive to motoring tourists. The roads are very fair on the whole, much better, in fact, than one finds anywhere in America, although poor in comparison with the highways in France. The climate offers no special difficulties, the extremes of heat and cold being far less than in the United States. It ought not to be difficult to provide cars suitable for this market, but at present the chief desideratum seems to be a good reliable car that can be bought as cheaply as possible.

A most peculiar non-skid tire is that being manufactured by the Firestone Tire and Rubber Company, of Akron, Ohio. It is called the "Firestone Non-Skid," which name is placed in raised letters around the body of the outer tire casing. Thus the name itself prevents the car from skidding, say the manufacturers.

LEGISLATIVE and LEGAL

Tire Chain Ordinance Declared Unconstitutional.

Justice Davis of the Supreme Court of New York has declared the tire chain ordinance of the Department of Parks of New York city to be invalid and in violation of the Constitution of the State of New York and of the United States. This decision was rendered in the case of Edward Anderson, the driver of a taxicb, who was arrested on March 25 last for operating an automobile with chains on the tires of the rear wheels in Central Park, near Seventy-second street. He was convicted and committed in the Magistrate's Court, but a writ of habeas corpus was secured, and upon the trial before Justic Davis the above decision was rendered. The ordinance was declared unconstitutional on the ground that it is in direct violation of the Motor Vehicle Law of the State of New York, known as Chapter 538, Laws of 1904. The justice said regarding this point:

> This statute contains a uniform and comprehensive plan for the regulation of the use of highways by automobiles except with respect to speed, and forbids the adoption by local authorities of ordinances regulating that subject. The ordinance in question contrary to this statute excludes from the free use of the park highways all automobiles having chains on their wheels even though they have complied with all the provisions of the motor vehicle law, and admits them to such free use only upon obtaining permission from the commissioner. For this reason the ordinance cannot be upheld. * * *
>
> We may assume that the purpose of the rule is to protect the road bed, although that does not appear from the record, but whatever its purpose may be, the effect is to regulate the use of automobiles whose owners make use of chains to insure their practical and safe operation over the highways of the parks when they are muddy, slimy or otherwise slippery. As stated above, such regulation by the local authorities is forbidden by the statute referred to.

The Court further held that the State Motor Vehicle Law is absolutely comprehensive upon questions of the regulation of motor vehicles, and that it forbids all regulation of such vehicles by local authorities with the one exception of speed, and this only when the conditions prescribed by statute are complied with.

Upon the question of the unconstitutionality of the ordinance, Judge Davis held that in conferring an arbitrary power upon the commissioners to discriminate between those to whom they shall grant permits and to whom they shall be denied the ordinance denies the equal protection of the laws, and is in violation of the Constitution of the United States and of the State of New York.

> It is a vital defect in the ordinance in that it contains no provision guaranteeing uniformity in its enforcement. No rule or principle is provided to secure its impartial execution. Inequality in its enforcement is thus not only possible, but probable, and so it fails to insure equal protection to all persons similarly situated, and for this reason it is unconstitutional.

The Court further held that the ordinance was in violation of the Constitution of the State of New York and of the Fourteenth Amendment of the United States Constitution in that it arbitrarily discriminates between chains and other devices, used to prevent skidding of automobiles. Upon this point the Court said:

> Why the owners of the chain device should be put in one class, and those using the other devices in another and exempt class, is not at all clear. * * * Indeed, one fails to discover any reasonable basis or principle whatever justifying the placing of the chain method in a prohibited class by itself. It follows, therefore, that the ordinances make an unlawful discrimination against those who use chains as a part of their vehicle equipment.

Speeder's License Revoked.

J. B. R. Smith, State Motor Vehicle Commissioner of New Jersey, has revoked the registration of the automobile of E. R. Bergdoll, of 929 North Twenty-ninth street, Philadelphia, for exceeding the speed limit at Elwood recently. Bergdoll appealed from a fine imposed by Justice Carver at Elwood, and ignored the citation of the Motor Vehicle Commission to appear at Atlantic City on September 12 and give testimony. Hence the license was revoked.

Chicago Officials to Enforce the Wheel Tax Ordinance.

The municipal authorities of Chicago have decided to take measures to enforce the recently enacted wheel tax ordinance against automobile owners, many of whom are alleged to have failed to pay so far. The first action taken consisted in sending a circular letter which was delivered at the houses of the delinquent owners by uniformed policemen. Out of 10,000 owners of automobiles on the registration list at the State capital, less than 2,000 have paid the fees required by the city for the use of its streets. At least one-half of the machines registered are owned in Chicago. The letter explains that the license fees are as follows:

Automobiles with seats for two persons......	$12
Automobiles with seats for more than two persons	20
Automobile trucks, coaches and buses........	30

The letter also quotes the ordinance and states that fees should be paid to the city collector. Automobilists who fail to comply within a reasonable time will have their names turned over to City Prosecutor White, who will collect the fees through the courts.

Legal Notes.

The City Council of Norwalk, Ohio, has passed an ordinance limiting the speed within the city to 8 miles per hour, in conformity with the new State law.

Assistant State's Attorney James J. Barbour of Illinois, and S. S. Gorham, attorney for and secretary of the Chicago A. C., are conducting an investigation of alleged "hold-ups" of automobilists by country authorities. There is a possibility of grand jury action if evidence can be found showing that justices of the peace and constables in any cases have been extorting money to "settle" cases of alleged speeding.

A. S. M. E. Season to Open Oct. 13.

The season of professional meetings of the American Society of Mechanical Engineers will be opened on Tuesday evening, October 13, by a meeting of the Gas Power Section in the Engineering Societies Building, at 29 West Thirty-ninth street, New York. Two papers are to be read,one by E. A. Harvey, on producer plants, with data upon costs, performance, etc., and one by N. T. Harrington, giving the result of tests to determine the loss of fuel weight in a freshly charged producer, due to increase of ash contents in the fuel bed. The first paper will be illustrated by lantern slides showing actual plants and plans for the arrangement of apparatus. Discussions of standards to be used in gas power work and the usual business will occupy the rest of the meeting.

Society of Automobile Engineers Meet.

The fall meeting of the Society of Automobile Engineers was held at Cleveland on Thursday and Friday of last week. The papers read included one on Universal Joints by H. Vanderbeek, of Hartford, Conn.; one on Carbon in Automobile Steels by Thomas J. Fay, and a translation on Valve Timing by Chas. B. Hayward. Most of the time of the members in attendance was taken up by visits to local factories. On Saturday morning the party left for Akron, Ohio, where they were shown through the works of the B. F. Goodrich Rubber Company, and Saturday afternoon they visited the plants of the Timken Roller Bearing Axle Company and the Cleveland-Canton Spring Company in Canton. On Saturday evening entertainment was provided at the Courtland Hotel, Canton.

Raise Auto Assessments.

Automobiles of Ramsey County (St. Paul, Minn.) are to be increased 40 per cent. over the values returned by the county board of equalization. This action was taken by the State Board of Equalization after finding that the average value of the machines as returned was only $454, as against $623 a year ago. There were 621 machines found this year, an increase of 150 over last year. The total value of the automobiles in Minnesota on the assessment rolls is $1,443,959. There are 3,516 machines.

The A. A. A. Racing Board held a meeting on September 23 and considered the case of the "outlaw" Motor Racing Association, two of whose officials were present. No action was taken, however, but another meeting will be held in a few days.

MINOR MENTION

The K. W. Ignition Company, of Cleveland, O., have purchased a tract of land and will erect a factory thereon in the near future.

The Zeidler Lamp and Brass Company, of Lomira, Wis., has sold its entire stock, patents, tools and dies to the Crescent Company of Chicago.

The Reo Motor Company, of Lansing, Mich., has declared a 5 per cent. dividend to all employees who have been in the service of the company for a year or more.

The Tiley-Pratt Company, Hartford, Conn., are making arrangements to build a new automobile factory on the site of the old factory that was destroyed by fire last week.

The annual convention of the rural mail carriers of Kansas is to be held at Ottawa next year. A large number of automobiles will be exhibited and tried out during the convention.

The Schaefer Company of Berlin, Wis., manufacturers of gasoline engines, motor car and boat equipment, have closed their plant at Ripon, Wis., and now occupy the new plant at Berlin.

The Crane & Whitman Automobile Works on Seventh street, near the Boulevard, Bayonne, N. J., have been shut down. The company built motors on contract, and also built several automobiles for experimental purposes.

J. M. Quinby & Co., of Newark, N. J., have taken the agency for Pennsylvania cars, and will shortly open a sales depot in New York City in connection with the show rooms for their carriage and motor car bodies.

It is announced that there will be no change in the Kissell Motor Car Company of Hartford, Wis., following the death of Louis Kissell, president, beyond a formal reorganization as required by the incorporation laws of the State.

The O. G. Storle Valve Company of Kewaunee, Wis., makers of brass valves and fittings for motor cars and boats, will remove their plant to Fond du Lac, Wis., where they will have better shipping facilities and a better territory.

The Bartholomew Company, of Peoria, Ill., are negotiating for the purchase of the building at Peoria Heights formerly occupied by the St. Louis Motor Car Company, which went into bankruptcy last year. The Bartholomew Company will use part of its old plant in addition to the new one, if the deal goes through.

The Security Trust Company, Indianapolis, Ind., has been appointed receiver for the Commercial Motor Vehicle Company of that city. The petition was filed by William H. Thomas, secretary of the company, who states that the company is indebted to him for $250 borrowed money, and for $1,650 put in when the company was incorporated.

The Waban Webbing Company, 16 South street, Boston, Mass., manufacture an inner tube protector consisting of a heavy webbing, three inches wide, which is placed between the tube and outer shoe. It is claimed to give complete protection against punctures and blowouts, and not to cause friction and chafing.

The Madison Square Garden Show committee met on Monday and allotted spaces to exhibitors of commercial vehicles, decided on the Hotel Breslin as the show headquarters, appointed Arthuh N. Jervis press agent, and let the contract for advertising the show to Lord & Thomas. Allotment of spaces in the electric vehicle section was postponed.

The Velie Motor Vehicle Company's factory under construction at Rock Island, Ill., is nearing completion. It will be a reinforced concrete structure, four stories high and 400 feet long. The company expects to begin operations about the first of next year. A touring car and a roadster, both equipped with four cylinder "American and British" motors, will be built.

A new company, the Matheson Automobile Company, was organized on September 12 to take over the entire selling end of the Matheson Motor Car Company, of Wilkesbarre, Pa. The new company will locate at Sixtieth street and Broadway, New York City, and will distribute throughout the country. The manufacturing company will devote its energies to the manufacture of the cars exclusively.

On the application of E. L. Pease and Edward Cargill, Justice Bigger recently named H. C. Moore as receiver of the R. A. Williams Automobile Company, of Columbus, Ohio. Messrs. Pease and Cargill allege that the company did not pay them the rent for the building to which they are entitled as receivers of the Broad-Oak Rink and Automobile Company. The justice fixed the receiver's bond at $10,000.

A meeting of Ford branch managers was held at Detroit last week. On Tuesday evening there was a bowling match between the branch managers and the office force; on Wednesday the old factory and the new factory now under construction were inspected and the new Model T was explained to the managers, and on Thursday the convention wound up with a luncheon and a trip on Lake St. Clair on the steam yacht Hornet.

The contract for decorations for the Grand Central Palace Show will probably be given to the S. R. Ball Company, who decorated the Madison Square Garden for former automobile shows. The decorative scheme is based on the early English period, with pillars and balconies in stucco and beam work. In the accessories division, the floors will be covered with a heavy fabric padded underneath. For the sign work, both accessory and automobile exhibitors will be supplied with glass signs with pennants, within which are electric lights, the whole mounted upon ornamental pillars.

E. H. Waterman, of Fresno, Cal., is endeavoring to secure the construction of a boulevard through Kern, Tulare and Fresno counties, and finds that the Tulare County supervisors are willing to do their share of the work. Waterman proposes that the boulevard begin at Famosa, on the Southern Pacific Company's line, going thence to Porterville, Exeter, Lindsay, Visalia, Orosi, Dinuba and Reedley, thence west to the railroad.

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., have assumed full control of the National Battery Company, of Buffalo, N. Y., which went into receiver's hands on February 1 last. The plant will remain at Buffalo, but the new management will conduct all business. It is announced that all claims against the National Battery Company have been settled and the entire property has been restored to the stockholders.

Club Notes.

The Rochester (N. Y.) A. C. has moved into its new quarters at the Hotel Seneca, on Clinton avenue, South. The club will have its rooms on the lobby floor.

The Albert Lea (Minn.) A. C. has been organized, with Edward Olson as president; S. Svendson, vice-president, and Dr. A. O. Watland, secretary and treasurer.

Twenty motorists of Red Bluff, Cal., recently organized a club and elected James Seeley as president and F. W. Becker secretary. H. C. Swayne, Dr. Fife and Dr. Bowman were named a committee on constitution and bylaws.

An automobile club was organized in Raleigh, N. C., in the mayor's office on September 12 last. The club will be known as the Raleigh Automobile Club, and will be affiliated with the A. A. A. Messrs. L. A. Mahler and R. D. Godwin were the chief factors in the organization of the club.

The Beloit A. C. disclaims any connection with the race meet held at Beloit, Wis., on Labor Day. The meet was the worst kind of a fizzle because the promoters, it is alleged, were fly-by-nights and cast much bad reflection on the club, because its name was used in advertisements. Only one contest was pulled off, and the contestants refused to go further. More than $1,000 was taken in, but someone "skipped out" with the sack and left the crowd in an intense state of excitement. None was more irate, perhaps, than Charles W. Van Sickle, of motorcycle fame, and several other well known drivers and riders.

The Savannah A. C. intend to hold a convention of representatives of all the automobile clubs in this country at Savannah, Ga., on November 25 and 26, to discuss the formation of a new national organization of motoring clubs. The club asks for one delegate at large and one additional representative for every 100 members from each club for the convention. A governing body for the proposed organization is to be formed from the delegates, and other officers will be elected. This announcement was made prior to the compromise between the A. A. A. and the A. C. A., which may possibly cause this convention to be called off.

The Milwaukee A. C. intends to hold a twenty-four hour race at the State Fair Grounds on Friday and Saturday next, September 25 and 26. The contest is to start at noon on Friday and end at mid-day on Saturday. The programme comprises 2, 5 and 10 mile races in addition to the twenty-four hour event.

Commercial Notes.

Bert Perin, a Green Springs, Ohio, rural mail carrier, is thinking seriously of buying a runabout for his work.

The Spring Valley Water Company, of San Francisco, uses two motor cars in its regular work in San Francisco.

Chas. T. Clayton, rural mail carrier, No. 2, Belmar, N. J., has had fourteen horses in five years for covering his route.

County Road Supervisor Hanson, of Faribault, Minn., has purchased a high wheel automobile with which to inspect the roads.

The Alpha Portland Cement Company, Easton, Pa., have received a Franklin touring car, which is to be used between their Centre Square office and their mills at Alpha and Martin's Creek.

The Hoff Auto Company, of Tucson, Ariz., will shortly install a daily service to the neighboring mission of large touring cars and sightseeing vehicles. The Hoff garage is being overhauled and will be enlarged during the next spring.

The Imperial Oil Company, of California, has bought a 30 horse power motor car for use in its oil fields in and round Fresno and Bakersfield. The Standard Oil Company uses a 30 horse power touring car in the oil region of King City, Monterey County, Cal.

A test of the availability of motor cars for military purposes will be made by officials of the War Department during the manoeuvres of the regular army at Atascadero, San Luis Obispo County, Cal. Colonel Brainard and other officers will conduct the test.

The Bakersfield (Cal.) agency of Fairbanks, Morse & Co., manufacturers of gas engines, has just been supplied with a second runabout, for the use of the "outside man" in his trips to the oil fields. The manager of the agency also drives a runabout on his business trips.

A. B. Brown, a commercial salesman from a Grand Rapids shoe store, covers twenty-three counties in lower Michigan in a runabout. He says that if he depended on the railroad for transportation he would not be able to make all of his customers more than once a year. In the summer time, when trade would be slack if it were not possible to visit every country store in his district, Brown visits every dinky store in the country. The country storekeeper is always flattered to have a traveling man visit him in an automobile and a large order is usually given.

The Queens Transit Company, of Flushing, N. Y., which operates a motor transit line between Flushing, Whitestone and Willets, has put on two additional cars to accommodate the increasing traffic. One of the cars is an open one and the other has a closed body.

San Francisco Motorists Are Urged to Respect the Law.

Max L. Rosenfeld, President of the California Automobile Dealers' Association, points out that automobile operators are permitted a higher speed (20 miles an hour, and 10 miles at crossings) on the streets of San Francisco than in any other town of the United States, and urges them to respect the police regulations, which, he says, are very reasonable and are enforced with good judgment. He complains that some operators drive their cars at night with unlighted lamps, and when called on to halt by the police dash on at high speed.

The Mechanical Efficiency Contest on Long Island.

The two day "mechanical efficiency" run on Long Island, held by the New York Automobile Trade Association, on September 16 and 17, was finished on the evening of the 17th, thirty of the forty-nine entrants arriving at the A. C. A. clubhouse within the specified time. Four other cars arrived after the time limit expired; these had dropped out of the run at various places, but had kept on as soon as the necessary repairs, etc., had been effected.

The contest was held over a route between New York and Montauk Point, L. I., the first day's run being to Montauk Point via the south shore roads. The second day's run was from Montauk to New York via the roads on the north shore of the island. There were eight classes of cars in the run, one being for taxicabs, in which an American Locomotive cab made a regular and perfect score. Two women drivers competed, Mmes. Cuneo and Ramsey, and both had perfect scores to their credit. A F. N. motorcycle, ridden by E. L. Ovington, made the run to Montauk in perfect time despite the deep sandy "roads" encountered, which necessitated considerable walking while pushing the machine. Following are the results:

CONTESTANTS.

Make of Car.	Driver.	Score.
CLASS A—CARS SELLING FOR $850 OR LESS.		
Cadillac	E. Brandt	Perfect.
Maxwell	F. Henshauser	Perfect.
Reo	J. W. Gogarn	Perfect.
Ford	F. Bunnell	Perfect.
Brush	W. W. Price	Late at control.
CLASS B—CARS SELLING FOR $851 TO $1,250.		
Reo	R. M. Owen	Perfect.
CLASS C—CARS SELLING FOR $1,251 TO $2,000.		
Maxwell	C. D. Kelsey	Disqualified.
Chalmers-Detroit	W. Knipper	Perfect.
Mitchell	W. D. Brown	Withdrew.
CLASS D—CARS SELLING FOR $2,001 TO $3,000.		
Mitchell	C. A. Kirchoff	Perfect.
Apperson	S. B. Bowman	Perfect.
Oldsmobile	F. G. Falberth	Perfect.
Mitchell	G. Delameter	875 points.
Stoddard-Dayton	A. H. Whiting	Perfect.
Pullman	P. Cimiotti	Perfect.
CLASS E—CARS SELLING FOR $3,001 TO $4,000.		
Mora	W. W. Burke	Perfect.
White	Chas. Lowe	Perfect.
Stevens-Duryea	C. Reichenbach	895 points.
Stevens-Duryea	F. Eveland	Perfect.
American Locomotive	F. Johnson	Perfect.
CLASS F—CARS SELLING FOR $4,001 AND UP.		
Rainier	Mrs. J. Cuneo	Perfect.
Rainier	L. Dishrow	Perfect.
Züst	V. Pisani	Perfect.
Acme	J. W. Mears	Perfect.
American Locomotive	H. C. Townsend	Perfect.
CLASS G—TAXICABS CARRYING TWO PASSENGERS AND DRIVER.		
American Locomotive	—— ————	Perfect.
CLASS H—TOURING DIVISION.		
Haynes	W. Shuttleworth	Perfect.
Oldsmobile	W. J. Wyatt	Perfect.
Stevens-Duryea	C. K. Louther	Late at control.
Stoddard-Dayton	R. Newton	Late at control.
Maxwell	Mrs. J. Ramsey	Perfect.
Autocar	F. A. Burelle	Late at control.
Lozier	H. M. Cashbunt	Disqualified.
Lancia	Harry Fosdick	Perfect.
F. N. Motorcycle	Earle Ovington	Perfect.

Garage Notes.

E. J. Phelps will erect a garage at 723-731 Third avenue South, Minneapolis, Minn.

L. W. Kirk and J. J. Willett will open an automobile garage in the Dr. W. H. Watson Building in Chebansee, Ill.

J. C. Watterson and J. C. Jordan will open an automobile and general machine shop at Elkhart, Ind., in a building at 130 East Jackson street.

Harry Leyman, formerly assistant general manager of the Pope Motor Car Co. in Toledo, has opened an agency for Buick cars in Cincinnati, Ohio.

The Marinette Auto Co. has moved its headquarters from the old location near the Marine Iron Manufacturing Co. to the Cook Building on Main street, Marinette, Wis.

Henry C. Taylor has removed from 323 John street, Harrison, N. J., to 435 Harrison avenue, where he will continue his business of repairing, storing and renting automobiles.

The Coit Automobile Co. has opened for business at 2025 Farnam street, Omaha, Neb., where the Rambler and Mitchell cars will be handled and a regular garage business conducted.

George Helmick and L. V. Petitt will shortly erect a modern garage in Decatur, Ill. This is the only garage in the county. A general repair business will be conducted.

The York Auto Co., of Omaha, Neb., will erect a brick garage on Lincoln avenue, that city, this fall. The building will be three stories in height, and measure 45x120 feet.

A brick building at 110 Sixth street, South Minneapolis, Minn., has been leased to the Twin City Automobile Exchange, who will conduct a repair and storage business therein.

E. Clendenning has purchased the Moon garage of Victor Moon at Van Wert, Ohio, and will conduct a general storage and repair business, in addition to handling Goodrich and Diamond tires.

S. M. Nathan has been appointed agent for the Ford Motor Co. at Fitchburg, Mass. Mr. Nathan announces that he will have demonstration cars on hand, but will not have a garage this season.

A. and J. Grier, of Ft. Smith, Ark., will shortly erect a brick garage at the intersection of Tenth street and Catholic avenue. The building will be one story in height, and will measure 110x50 feet.

The Standard Automobile Company has opened a garage at 338 North Main street, Wichita, Kan. The company will do a general storage and repair business in addition to handling the Jackson car.

The Pioneer Implement Co., of Council Bluffs, Ia., will shortly erect a concrete garage at Tenth avenue and Sixth street, that city, where a general storage and repair business will be conducted.

J. Timendorfer has leased two rooms in the Dodge Building, Euclid avenue and East Seventeenth street, Cleveland, Ohio, for the purpose of exhibiting the Buick cars, for which he is agent for northern Ohio.

The Wilmington Automobile Co. will shortly open its garage on Tenth street and Delaware avenue. The building will be two stories in height, of concrete and steel. Accommodations for 100 machines are provided.

Arthur Coombs and Ernest Gogin, New York city, have leased for a long term a building to be erected on the north side of Sixty-sixth street, west of West End avenue, in which they will conduct the Algonquin garage.

The Pence Automobile Co. will shortly erect a six story concrete garage and warehouse at the corner of Hennepin avenue and Eighth street, Minneapolis, Minn. This structure will be one of the largest garages in this country, it is claimed.

The Serfas Motor Car Co., of Lehighton, Pa., have recently opened a garage and supply house on Iron street, that city, where a general repair business will be conducted, in addition to the motorcycle and sporting goods trade already established.

H. C. Bruner is about to erect a two story brick building, 150x50 feet, on Hennepin avenue, Minneapolis, Minn., for the Maxwell-Briscoe Automobile Co., Tarrytown, N. Y. A general repair business will be conducted, in addition to handling the Maxwell product.

The Smith, Clemens & Hopping Co., Dayton, Ohio, have recently moved into a new garage equipped with all modern appliances. They will have a line for 1909 comprising seven different cars.

The recently incorporated Southern Automobile Co., of Charlotte, N. C., will open for business October 1 on the ground floor in the Auditorium Building. They will handle Maxwell and Jackson cars.

H. J. Donahue has been appointed agent for Lambert cars in Wichita, Kan., temporary quarters of the agency being at 351 North Topeka avenue. A new building will shortly be occupied, as the accommodations are not sufficient in the present headquarters.

The Bay Counties Electrical Co., now located at Thirty-fourth and Telegraph avenue, Bay City, Mich., will erect a garage on Telegraph avenue, near Thirty-third street. A complete repair shop for electric machines is fitted, the garage being exclusively for these automobiles.

The Howard & Long Co. have recently been formed at Pittston, Pa., for the purpose of conducting a general garage business and handling the Chalmers-Detroit in that vicinity. The organizers, Messrs. Howard and Long, are commercial engineers in Wilkes-Barre, Pa.

The Olds Motor Works will open a branch in Philadelphia at 231 and 233 North Broad street on October 1, in charge of Wm. T. Taylor. This branch will handle the Olds business in all of Pennsylvania, southern New Jersey, Delaware, Maryland, Virginia and the District of Columbia.

The Standard Motor Car Co., of California, will build a permanent two story building on the southeast corner of Van Ness and Golden Gate avenues, San Francisco. The first floor will be used as a salesroom, and the second as a repair shop. The building will be 80x100 feet in dimensions.

New Incorporations.

National Motor Casting Co., Detroit, Mich.—Capital stock, $14,000.

Standard Garage Co., Lockport, N. Y.—Capital increased from $10,000 to $75,000.

Pope-Hartford Auto Co., Newark, N. J.—Capital, $50,000. Incorporators, B. C. Fincke, H. E. Holt and C. A. Dickson.

North Shore Garage Co., Chicago, Ill.—Capital, $5,000. Incorporators, John F. Fisher, A. K. Jergensen and Wm. E. Nelson.

Grand Avenue Garage, Brooklyn, N. Y.—Capital, $10,000. Directors, Frank M. Knauss, Edward V. Slauson and Clifford L. Beare.

Auto Motor Manufacturing Co., Dayton, Ohio, Capital, $10,000. Incorporators, Frederick C. Nichol, Jos. Sherhard, Fr. Krause and Jacob Sammet.

Owners' Repair and Maintenance Co., Newark, N. J.—Capital, $10,000. Incorporators, S. Raymond Clark, William L. Du Hadway and Russell B. Matthews.

United Automobile Dealers' Association, Newark, N. J.—Capital, $20,000. Incorporators, S. Raymond Clark, William L. Du Hadway and Russell B. Matthews.

Southern Automobile Co. of Charlotte, N. C.—Capital stock, $25,000. Incorporators, J. W. Zimmerman, J. R. Ross, E. B. Littlefield, P. P. Zimmerman and J. H. Boone.

Aston Motor Car Co., Bridgeport, Conn.—Capital stock, $10,000, of which $2,500 is paid in. Incorporators, T. R. Aston and G. E. Morton, of Bridgeport, and M. A. Hall, of Long Hill.

Capital Auto Sightseeing Co., Alexandria, Va.—Capital maximum, $25,000; minimum, $5,000. Incorporators, W. W. Anderson, T. W. Buckey and C. W. Sprague. To buy, sell and hire automobiles.

Chester Auto and Tire Filling Co., Buffalo, N. Y.—Capital, $10,000. Incorporators, T. Chester, Sunbury, Pa.; A. J. Chester and H. C. Harrison, of Buffalo. To manufacture compounds for filling rubber tires.

Tax-A-Cab Transit Co., New York.—Capital, $500. Directors, S. Edwin Lester, Herbert G. McLear and Willis B. Davis.

Trade Personals.

H. J. Newman, who two years ago designed the Pennsylvania car, has joined the Miller Cart Co., of Goshen, N. Y., who are bringing out a line of high class cars.

J. H. Neustadt has disposed of his interest in the Neustadt Auto Supply Co., of St. Louis, Mo., and will hereafter be affiliated with the Hydrocurve Boat Co., of Edwardsville, Ill.

Geo. Burwell, of Lansing, Mich., has succeeded W. J. Miller as superintendent of the Oscar Lear Automobile Co., of that city. Mr. Burwell was formerly connected with the Olds Motor Works in the technical department.

C. D. Snow, who held the Stevens-Duryea agency in Providence, R. I., for the last six years, has given up that agency, and associated himself with the American Locomotive Co. in the sale of Berliet cars.

Richard Bacon, Jr., formerly manager of the Cleveland agency in Chicago, Ill., has gone with the Haynes Automobile Co. at Kokomo, Ind., where he succeeds C. B. Warren as sales manager. Mr. Warren is now representing the Stearns in the territory west of Utah.

Trade Literature Received.

Wende & Co., 350 Wabash Avenue, Chicago.—Catalogue of the Swiss-Komet magneto.

National Brake and Clutch Co., 16 State Street, Boston, Mass.—Pamphlet on cork inserts.

Turner Brass Works, Sycamore, Ill.—Catalogue of braziers, blow torches and general brass fittings.

Charles E. Miller, New York City.—Folder giving prices of various makes of American automobile tires.

H. H. Franklin Manufacturing Co., Syracuse, N. Y.—Catalogue of 1909 models of Franklin automobiles.

The Gramm-Logan Motor Car Co., Bowling Green, Ohio.—Catalogue of the Gramm-Logan motor truck.

Northern Electrical Manufacturing Co., Madison, Wis.—Bulletin and leaflets of electric generators and motors.

The Fisher Auto Co., 400-424 North Capitol Boulevard, Indianapolis, Ind.—The "Booster," relating to the new garage building of the company.

The Special Motor Vehicle Co., 323 East Fourth Street, Cincinnati, Ohio.—Circulars on Shumard's full elliptic spring outfit for Ford runabouts; also booklet of testimonials.

New Agencies.

Bay City, Tex.—B. D. Hurd, Meteor.

San Diego, Cal.—Hunt Automobile Co., Franklin.

Coming Events.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 27 to March 3—Hartford, Conn., Annual Show, Automobile Dealers' Association.

The Horseless Age

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Wheels for Motor Trucks.

By S. Gerster.

Most people acquainted with the subject consider the road wheels one of the most defective parts of our present commercial motor vehicles, and it may be of interest to make a somewhat close study of the importance of this part and of the causes of its often unsatisfactory service. The wheel is in direct contact with the road and follows all irregularities of the surface, its asperities and depressions. The greater the load and the speed the greater the strain on the wheel and the tire. It is, therefore, of the greatest importance to know what strains it is possible to impose upon the wheel and the tire.

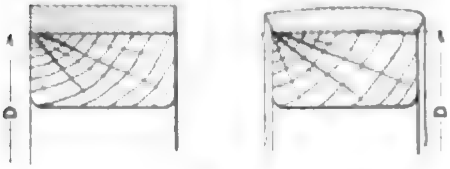


Fig. 1.

A light car fitted with pneumatic tires may travel at 40 miles per hour without danger of injury to the tires; if such a vehicle were run at 75 or 85 miles per hour it is evident that the pneumatics would stand up only for a few hours. The conditions are similar with respect to the wheels of heavily laden vehicles. If the speed is unreasonably high the tires will suffer first, then the wheels, the axles, the springs and the frame.

The principal condition of economical operation is that the speed of the vehicle must bear a suitable relation to its weight, its wheels and tires and the state of the roads on which it is to run. Pneumatic tires may be used for weights up to 1,500 pounds per wheel, at speeds of 40 miles per hour. This type of tire is, however, very rarely employed for commercial vehicles, owing to its high cost and its expensive maintenance, as well as to the fact that in general there is little advantage in speeds over 12 to 15 miles per hour for a truck. The pneumatic tire is, therefore, considered as practically limited to vehicles de luxe.

Pneumatic tires have been made for use on commercial vehicles, in an experimental way, and it has been attempted to solve the problem by placing two or three tires of small cross section side by side on the same wheel. In this way better results were obtained than with single pneumatics. This form of tire is more expensive than the solid rubber tire, but it permits of greater speeds being maintained.

For trucks up to 4 tons useful load, solid rubber tires are used to advantage; for greater loads the steel tire becomes more economical. Solid rubber tires are manufactured for loads up to 7,000 pounds per wheel, which corresponds to a vehicle for 5 tons useful load. This is the extreme limit to which one may go, but it is certain that the application of this type of tire is not advantageous. The set of tires for such a vehicle might cost nearly $1,600, which would materially increase the cost of the vehicle.

The rubber tire has the advantage over the steel tire of absorbing the greater part of the vibration and of permitting of a speed of 16 miles per hour and more. It wears rapidly, but it has the advantage that it insures greater reliability in winter, rubber slipping neither on snow nor on ice, while the steel tire, even if straked, always has a tendency to slip.

For the driving wheels it is advisable to use double rubber tires. The fastening means of these double tires to the rims are more secure, and the tires are, therefore, able to resist greater lateral forces. Smooth tires have come into almost universal use, block tires not giving satisfaction, as the blocks are ruined rapidly.

For vehicles of more than 6 tons useful load steel tires are used, whether the wheels themselves are of steel or of wood. This, the very oldest type of tire, may support very heavy loads, but its great weight is prejudicial to high speed, and it is necessary to run at 7½ to 9 miles per hour. This tire is comparatively cheap, and is the only one which has given satisfaction for heavy trucks so far.

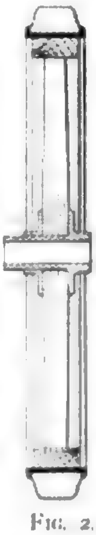


Fig. 2.

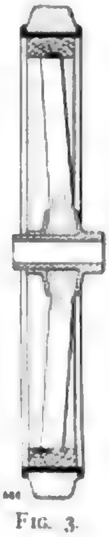


Fig. 3.

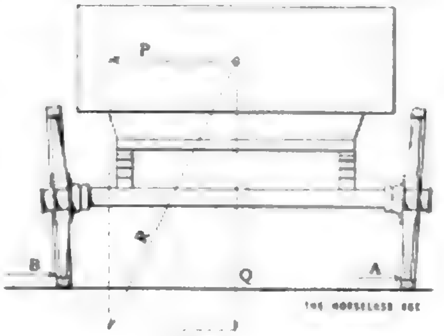


Fig. 4.

Fig. 1, herewith, shows the shape of such a tire when new and after being worn. The edges have bulged out as a result of the hammering received, and the interior diameter of the tire at the middle section has slightly increased. The wheels are made either of wood or of steel. Wood wheels are successfully used on trucks carrying less than 6 tons useful load, above which limit steel wheels are better adapted to the purpose; in fact, for the driving wheels it is even necessary to use steel.

The wood wheels should be adopted wherever possible, for the reason that they do not transmit the vibrations to the axles, as do steel wheels. If the wheel is fitted with rubber tires its fatigue is less than if it has a steel tire. A small diameter wheel is much stronger than a large diameter wheel, but its tires wear much more rapidly, on account of the difference in the length of the circumference. The following table gives the diameters of wheels commonly used with trucks of various carrying capacities:

Useful Load.	Diameter of Front Wheels.	Diameter of Rear Wheels.
1-2 tons	32 inches	36 inches
2-3 tons	34 inches	38 inches
3-5 tons	36 inches	40 inches
5-8 tons	38 inches	42 inches

Many designers prefer to use the same diameter wheels in front and rear.

A wood wheel of the usual construction requires frequent resetting, owing to the fact that the work it has to do is much more severe than that required of a horse vehicle wheel, which runs at an average speed of 5 miles per hour when loaded.

Wheels without dish, as shown in Fig. 2, are not to be recommended, as the least lateral shock will wreck the wheel and the spokes rapidly become loose and the tire

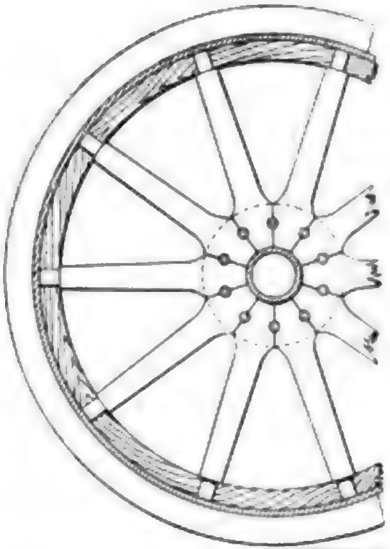


FIG. 5.

must be reset. This type of wheel is used for driving wheels of light cars, where it is difficult to arch the axle spindles. Good wheels have been made in the dished form, as shown by Fig. 3, since times immemorial. This type of wheel has the advantage of being very rigid, and especially little affected by stresses in the direction B. The wheel is less resistant to stresses in the direction A, from the inside. However, since the lateral stresses on the wheel result from the force B acting on the centre of gravity of the vehicle and the weight Q, the wheel on that side to which the resultant force R inclines is subjected to the greatest stress, which is in a direction opposite to P, against the wheel from the outside.

It will be seen from Fig. 4 that under these conditions the wheel on which comes the reaction B is under the greatest stress in this case, the other wheel, which withstands the reaction A, being partly deprived of its load, so that the reaction is very much smaller. All dangerous reactions, therefore, come on the wheel from the outside, and to these reactions it has the greatest strength or resistance.

The spokes are generally fitted into the hub and the felloe, as shown in Fig. 5. This construction will give satisfaction in the case of trucks up to 2 tons useful load. The spokes and felloes of these wheels are simply held in place by the steel rim or tire, which has been set on the wheel while hot and which in cooling has decreased in diameter and strongly drawn the wood portion of the wheel together. Wheels made in this manner are not always perfectly round.

Fig. 1 represents a wheel assembled in a different manner, which is not, however, the least bit better than the preceding one. The strength of a wheel depends to a large extent upon the dimensions of the hub, and many designers do not make the flanges of a sufficiently large diameter. It is well to have a formula for this diameter which has given useful results in practice. According to the following formula the diameter of the hub flanges is calculated from the diameter of the wheel spindle. In Fig. 7 the diameter D should be five times the diameter *d* of the spindle, for the rear wheel, and four times the diameter *d* of the spindle for the front wheel. However, the diameter of the hub flanges must not exceed one-third of the diameter of the wheel, and where the above rules give a result greater than one-third the wheel diameter they must not be used, and the flanges be made of a diameter equal to one-third that of the wheel. The above rules are applicable to wheels with parallel or plain bearings. Where a ball bearing is used, the distance H, Fig. 7, must be kept the same as for a hub with a plain bearing, and the shell of the hub must be made of greater diameter.

In order to rigidly secure the spokes in the hub it is necessary to give the faces F of the flanges an inclination of about 6 degrees.

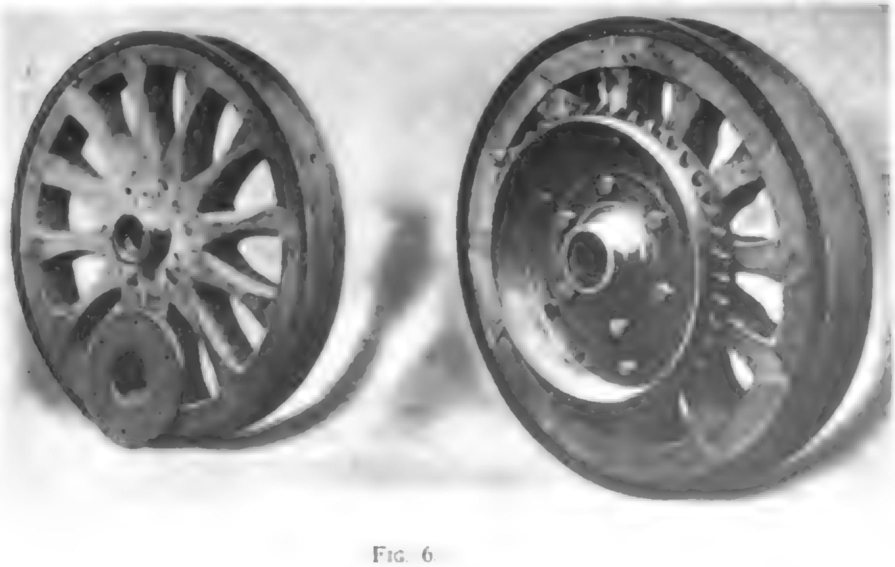


FIG. 6.

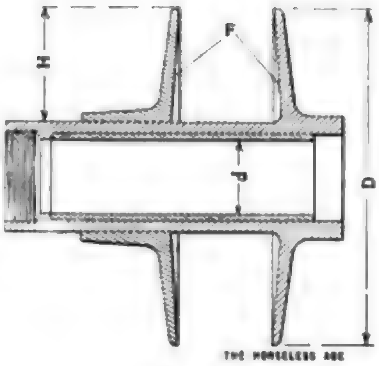


FIG. 7.

It has been found that wheels assembled in the manner thus described do not give satisfactory results in the case of very heavy vehicles. Partly on account of the drying out effect on the wood, but chiefly on account of the frequency and intensity of the inevitable shocks to which these wheels are subjected, the constituent parts soon become loose, and that is where the trouble begins. As soon as there is any play between the parts of a wheel the shocks resulting from the want of continuity in the wheel greatly increase their destructive effects, and soon bring about a dislocation of the assemblage. The only remedy consists in resetting. The wheel is entirely taken apart, the root of each spoke being cut down a little to allow the roots sinking deeper into the hub. This movement of the spoke necessitates making the bolt holes in the hub flanges oval, and this arrangement reduces the strength of the wheel. The shortening of the spokes entails a reduction in the diameter of the wheel.

In the case of steel tired wheels the tire is cut and then rewelded, with the object of reducing its diameter. In the case of a rubber tired wheel it is impossible to reduce the diameter of the steel rim, and one is obliged to renew the wood felloes. This defect of the ordinary wheel frequently entails stoppages of motor trucks and results in expensive repairs. For these reasons efforts have been made to devise new types of wheels, free from these defects, and it has been found that the so called "expanding" wheels conform well to these requirements. The expanding wheel is also subject to some of the defects of the ordinary wheel, the wood being still influenced by humidity and dryness, which latter reduces the length of the spokes, thus causing them to come loose; but with this type of wheel it is an easy matter to correct such a fault on the road as soon as it develops, and it is in this respect that the advantages of this construction are most apparent. Several designs of such wheels, some of them patented, have come into use.

It is not sufficient simply to take up the longitudinal play of each spoke, but play between the roots of adjacent spokes must also be prevented. One type of expanding

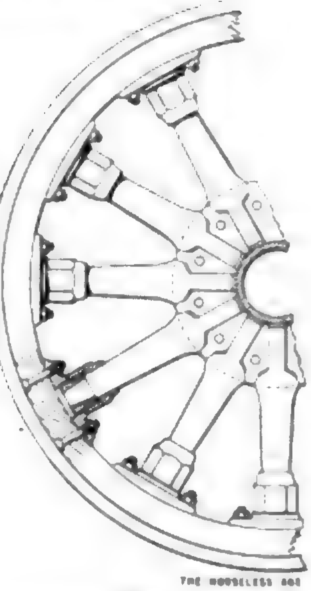


FIG. 8.

wheel, which has proven its worth in practical work, is shown in Fig. 8. Each spoke is fitted at its outer end with a threaded sleeve, the end of which is lodged in a flange fixed to the wooden felloe of the wheel. On this sleeve is placed a nut, which bears against the flange on the felloe. By screwing up the nut the spoke is forced against the felloe, and thus all play is taken up. In the hub the roots of the spokes, instead of resting one against the other, are separated by wedges. These wedges have slightly inclined shoulders on which the roots of the spokes rest when the spokes are expanded. The wedges are supported on the sleeve or shell of the hub. The clearance at the end of each spoke gives sufficient leeway for taking up the play which may develop during the use of the spoke.

When the spokes show a tendency to come loose on account of continued hard work and the effects of dryness, the nut is given a turn by means of a wrench, whereby the spokes are forced in toward the centre, in consequence of which the wheel resumes its original rigidity. The wood rim being made in sections, the radial pressure of the spokes suffices to apply it energetically against the steel tire. In a wheel of this type spokes that are damaged may be readily replaced.

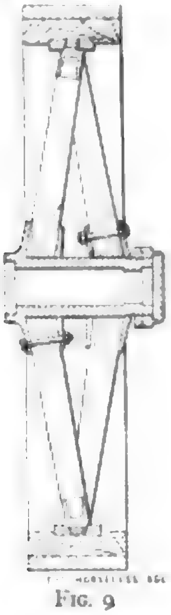


FIG. 9

Another type of wheel in use is shown by Fig. 9. It is composed of two "cones" of spokes; in other words, the wheel is double dished. If the spokes should become shortened on account of dryness, the ply may be taken up by turning the nut at the end of the hub, thus forcing the apices of the two cones together. Each spoke at its outer end is lodged in a tenon socket which is riveted into a place secured to the inside of the wood felloe. At their inner end the spokes are supported directly on the hub. The renewal of a spoke is as easily effected in this case as in the preceding one.

For very heavy trucks, designed for useful loads from 8 to 10 tons, it is preferable to use steel wheels, at least for the driving wheels—either cast of steel or made of sheet steel discs clamped between or riveted to the hub flanges. These wheels are open to the objection that they transmit the vibration to the axle and thus cause crystallization of the axle material, which frequently results in the breaking of the axle. These wheels are also used to quite an extent for smaller trucks, but in that case they are fitted with solid rubber tires, which absorb the greater part of the vibration. Cast steel wheels are similar in form to those used on traction engines, with oval section spokes.

British Runabouts.

By Roy Lindsay.

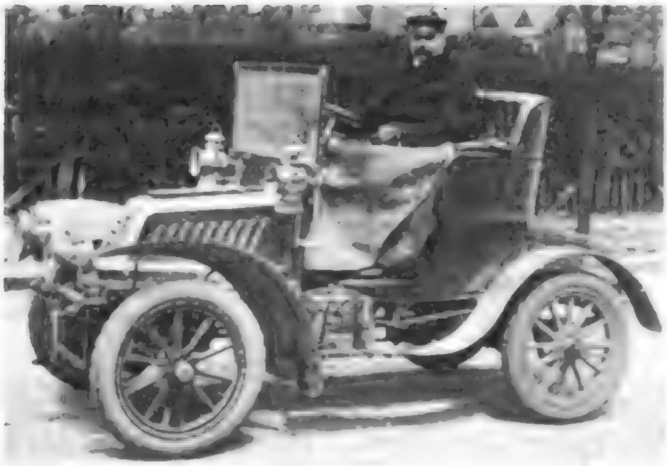
Until within the last few months the term "runabout" was never applied to small cars in the British Islands, "light cars" having invariably been the designation of machines up to about 12 horse power. Runabout is gradually creeping into articles in the technical press owing to descriptions of American events that have been published, but is never applied to vehicles beyond 12 horse power. The manufacture of such machines has always been a big item of their annual turnover among English factories, and although a very few firms were foolish enough to embark headlong into the big car business, the older established firms have recognized from the first that the market for cars beyond 16 to 20 horse power must ever be limited. At the moment of writing there is actually a terrible slump in the sale of large cars, British and foreign alike. Brand new large power cars of makes with world wide reputation—Mercedes, Panhard, De Dietrich, Delaunay-Belleville, Hotchkiss, Darracq, F. I. A. T., Berliet—are all a drug on the market, for the reason that users are now quite awake to the high cost of upkeep, particularly in tires, that the use of such machines involves. As an instance, the 35 horse power Mercedes is being offered by the sole concessionaries for $1,440, chassis with tires, and can really be purchased for $300 less where spot cash is forthcoming. Nobody will look at a second-hand machine over 20 horse power. These remarks are not meant to imply that the sale of cars beyond the power mentioned has altogether ceased, but as compared with twelve months ago there is a falling off of perhaps 75 per cent. in quantity, and prices are materially lower.

LIGHT CAR DEMAND CONTINUES.

The light car must always retain its hold upon the favor of the public, and will increase more and more in popularity as time goes on, not only for pleasure purposes but for the use of professional men—doctors, surveyors, land agents, builders, etc.—and in fact all classes of the community who wish to travel a little faster than a horse can carry them or to traverse a larger extent of country than lies within the capabilities of one or a pair of horses. It is to doctors that the car has proven of inestimable advantage, and despite the early troubles of those who ventured on the then thorny path of automobilism, the advantages so greatly counterbalanced the troubles that once the trial had been made no doctor could afford to return to more ancient methods. How many cars are actually employed by physicians in Great Britain no man can safely estimate, yet the existence of a big association, formed solely for the object of protecting the interests of medical motorists, attests the far reaching influence of the motor. Here and there a big vehicle is owned by some fashionable medico whose practice lies among wealthy people, but the average of professional incomes precludes ownership of anything larger than a 12 horse power machine for the majority, and this majority certainly includes 95 per cent.

THE DE DION.

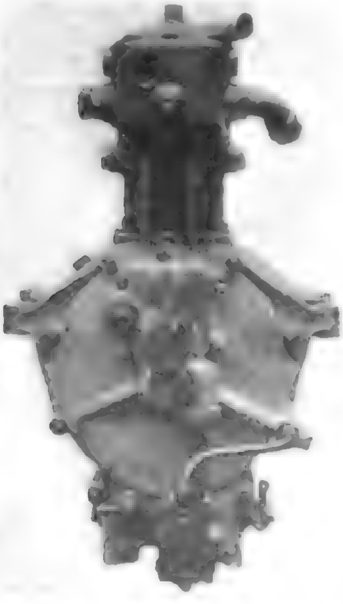
The one machine beyond all others that has proved itself eminently suitable to the wants of the profession is the single cylinder De Dion, of 6 or 8 horse power. The sole selling agents for these machines in England have endeavored to keep track of the names and professions of purchasers, and have compiled a list of over 700 physicians who are regular users; but this list is a long way from being exhaustive, as it only refers to sales of new machines negotiated directly, and at least another 700 are certainly employed for visiting patients. The smaller 6 horse power model with two-speed De Dion expanding fibre clutch gear is no longer made, yet the splendid workmanship and material, typical of everything coming out of the Puteaux factory, seems to endow these little machines with perennial life, for they never seem to wear out. Quite a quantity have been in regular daily use for five and six years, some of the owners attesting to distances exceeding 40,-



Eight Horse Power De Dion.

Six Horse Power Rover.

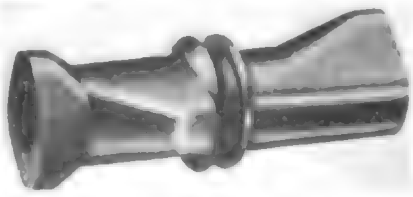
000 miles, at a total cost for repairs and renewals, exclusive of tires, of $100. Nor are these exceptional cases, there being plenty of doctors who have obtained the same successful results, and these are not confined to London or the neighborhood of the big towns, every quarter of the country revealing the same satisfaction. Apart from the regular daily round of visits a doctor's automobile is subjected to far harder usage than a pleasure vehicle or than would be required by men in other professions and businesses, because it is turned out at all hours of the day and night, and must be driven over apologies for roads. The mere fact of so many miles per annum being traversed is of small account unless the conditions are also taken into consideration, consequently the consensus of opinion among British medicos as to the merits of the De Dion is about the finest possible testimonial that could be accorded. The machines are not cheap, in the usual acceptation of that word, the 8 horse power single cylinder with two seated body, and without top or lamps, selling for $1,150, and second-hand vehicles in good condition are always eagerly snapped up round about the price of $950. It is a rather interesting fact that ever since the first 3½ horse power De Dion car was constructed ten years ago the same general design has been maintained without alterations, a horizontal propeller shaft transmitting to a gear box above the rear solid axle, the final drive being by two Cardan shafts, with a peculiar form of universal joint at each end, these shafts being set at an angle to the ground line and attached directly to the centres of the rear road wheels. The solid axle supports the whole of the weight of the wheels and frame, the gear box and Cardan shafts being spring suspended. Herein may be traced the freedom from trouble of De Dion cars, because no portion of the transmission is directly subjected to road shocks.



Six Horse Power De Dion Engine.

THE ROVER.

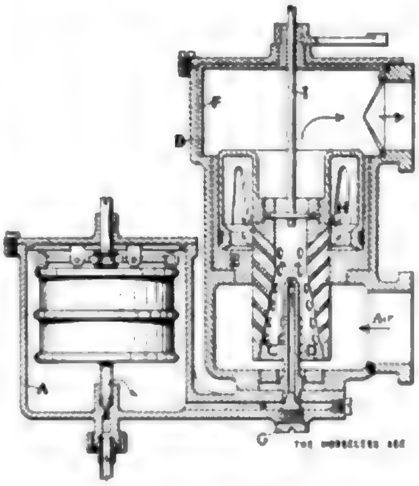
Next in general popularity comes the Rover, also a single cylinder machine, made in two models, 6 horse power and 8 horse power, selling respectively for $750 and $1,150, with two seated bodies. Entirely constructed at Coventry, the Rover has probably the largest sale of any purely runabout type in Britain, and has undoubtedly more friends in the various British colonies—Australia, New Zealand, India, etc.—than any other machine, not excepting the De Dion. Its highly original construction with true three point suspension and splendid springing makes it very light on tires, and the special pattern of carburetor patented by the Rover Company enables the majority of its owners to cover an average of 30 miles to the gallon of gasoline. Two half elliptic springs support the frame at the rear, the front resting upon a transverse half elliptic spring shackled to the sides of the vertical steering heads. The single vertical engine is placed under a bonnet, the crank case containing a pair of large flywheels. An integral rearward extension of the crank case carries a three plate disc clutch connected directly to the primary gear shaft, the gear box being bolted to the crank chamber in such a way that the oil for lubricating the engine also serves the same purpose for the clutch and gear wheels. The construction of the transmission gear is distinctive to the Rover, and is quite unlike anything else on the market; the propeller shaft is entirely enclosed within a large aluminum casing bolted to the rear of the gear box, the casing in turn being bolted to the aluminum casting carrying the differential and live axle. The framing that carries the body is only subsidiary, the power and transmission plant, including the rear axle, engine and all else, even the two rear wheels forming a trunk-like body that can pivot centrally on the front transverse spring. Gear changes are made by a lever beneath the steering wheel, a rod parallel to the steering column and extending to its base actuating over a quadrant just above the foot boards. A unique feature, in a small car, is the employment of the engine as a brake, a pedal to the left of the clutch pedal sliding the cam shaft bodily beneath the valve tappets. The cams for the inlet and exhaust valves have two profiles, and when the cam shaft is moved to the extreme limit of its travel the inlet valve ceases to open and the cycle of operations of the exhaust valve is quite altered. Instead of opening and closing at each two revolutions of the flywheel it opens and closes for the braking position at each revolution; but the valve opens at each downward stroke of the piston, and remains closed at each upward stroke. This engine brake is not meant to take the place of the ordinary pedal brake, as the compression effect is not accumulative and its usefulness is more apparent in the open country when



Rover Cams for Engine Braking.

descending long hills rather than in city traffic.

Lubrication is peculiar yet quite effective. A scraper that is just clear of frictional contact with the flywheel collects the oil off the latter as it is thrown up by centrifugal force, and guides the oil into a box where it runs by gravity to the engine bearings and big end of the connecting rod, and, draining into the confined space beneath the flywheel, is picked up again and returned to the box. Still another special feature of this car is the patented carburetor, the annexed sectional drawing showing its construction. A is the flat chamber body, B the mixing chamber body, C a sliding air regulating cone attached to floating piston E, the latter having triangular air ports H; D is the gasoline jet, F a piston throttle, G a drainage plug, and I a rod passing up through the throttle chamber and forming a central guide for the floating piston E. The drawing shows the carburetor in the starting position, with the air cone and floating piston C E at their lowest positions, causing the air entering from the lower right hand port to pass beneath the cone and circulate round the jet D, insuring a rich mixture. As the speed of the engine increases, or as the throttle is opened, the greater suction automatically raises C E, uncovering the auxiliary air ports H, permitting more air to reach the mixing chamber E without passing over the jet. The results that have been attained with this carburetor by ordinary unskilled drivers go to prove that the device really works exceedingly well at all engine speeds, while the absence of springs removes any tendency for the engine to race when the throttle is suddenly opened, or to cease revolving when the throttle is as suddenly nearly closed, the whole action being as delicately responsive as one could wish.



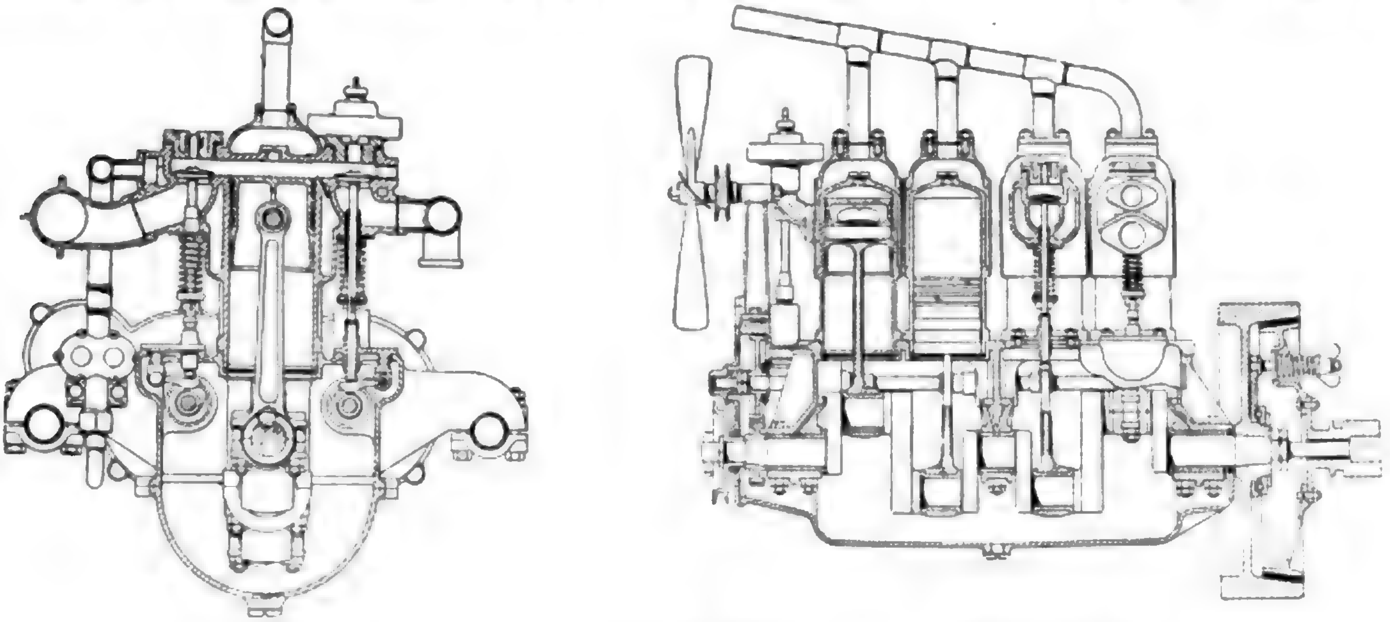
ROVER CARBURETOR.

THE COVENTRY HUMBER.

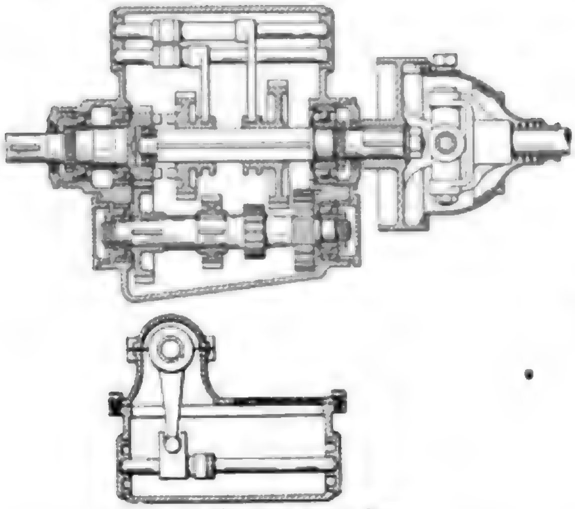
The 10 to 12 horse power Coventry Humber, with a four cylinder engine, 3¼ inch bore by 3¼ inch stroke, can be said to be about equal in popularity to the 8 horse power Rover, the details of design being based on those of larger vehicles. As concerns the home market only, it has probably a larger sale than the two cars previously mentioned, but it is not so well known in the British colonies. The wheel base is 8 feet, the track 4 feet, and the length over all 11 feet. With 760 mm. by 90 mm. tires, the car sells complete as a two seater for $1,175, or with a side entrance, four seated body, for $1,250, the latter being the type for which there is the greatest demand. The pressed steel frame is carried on two half elliptic springs in front and two half elliptic and a transverse spring at the rear, the front axle being built up from seamless steel tubing. The transmission is through a leather faced cone clutch, a selective type change gear with three forward speeds and reverse actuated from a side gate lever, propeller shaft with metal encased universal joints fore and aft, and floating live axle. Pedal and side lever brakes are external types, those on the rear wheel hubs working around drums with very large diameters. Engine cooling is maintained by a rotary pump carried on the crank chamber, and circulating water through a nest of gilled tube radiators, and the details are completed by accumulator coil ignition and splash lubrication. The oiling arrangement is about the only feature that can be criticised on this otherwise well thought-out machine, a pump on the dashboard having to be worked by hand every time a charge of oil has to be given to the engine. The use of ball bearings has been carried almost to the limit, the engine itself being the only portion not fitted with these friction savers. Clutch ring, gear box (with six sets of balls), bevel drive, road wheels and steering column all have ball races. The finish and workmanship compare favorably with the very best machines turned out from British or Continental factories.

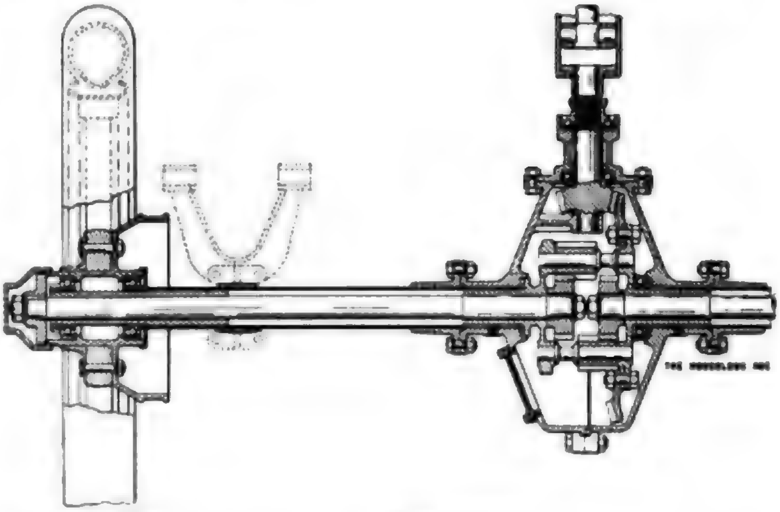
THE SWIFT.

Another very popular car is the 12 horse power, two cylinder Swift, selling complete with two seated body for $1,125, or with four seated side entrance body on a slightly longer chassis for $1,325. The principal specifications are as follows: Pressed steel frame, half elliptic springs front and rear, tubular axle in front, rear live axle, engine with separate cast cylinders 102 mm. bore by 111 mm. stroke, crank shaft pins set at 180 degrees, with balancers on ends of the web, aluminum crank case split horizontally with large inspection door in the upper half, enclosed timing wheels in front, water circulation by gear driven centrifugal pump circulating through vertical gilled tube radiators with belt driven fan behind; transmission by leather faced clutch, three forward speeds and reverse of selective type, gate change side lever, universal joints at each end of propeller shaft, as also between engine and gear box; pedal brake metal to metal behind gear box, rear brakes external metal to metal; wheel sizes, 30 inch, with 3¼ inch tires. This vehicle has



FRONT ELEVATION. HUMBER ENGINE. SECTIONAL ELEVATION.



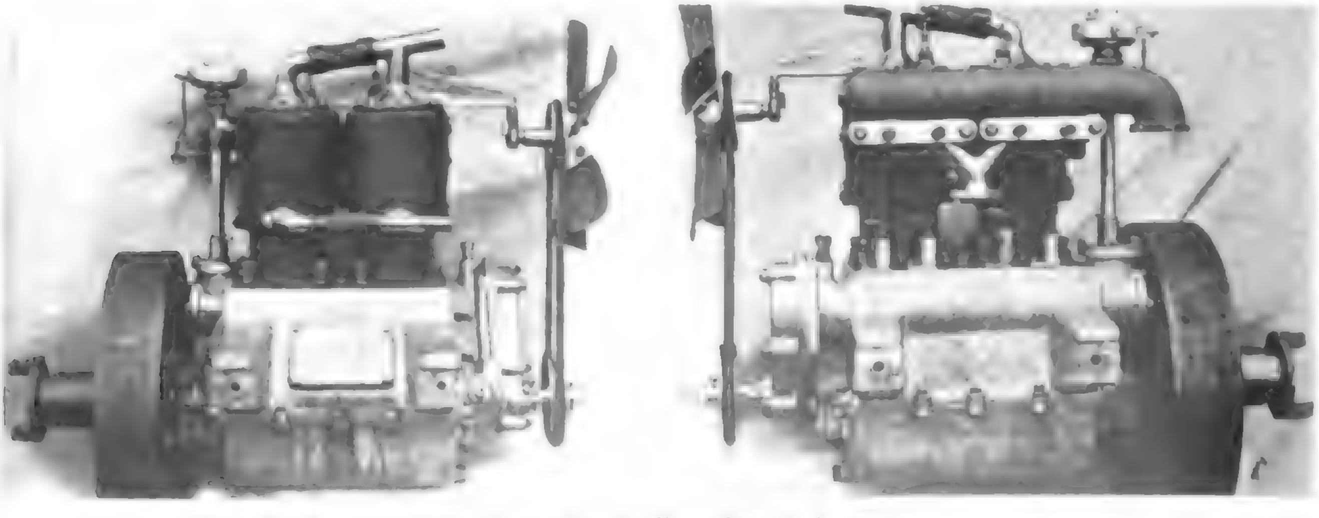


Change Gear Box. Humber Car. Rear Axle.

the defect of many of the leading British cars of good reputation and moderate price—that oil has to be supplied to the engine by a hand pump on the dashboard, a crude method that opens up too many possibilities of trouble if the driver forgets to give a charge at the proper time. In the national reliability trials this machine has always gained high honors, securing a silver medal in 1903, gold medal in 1904, gold medal in 1906, with top marks beyond the seventy other machines competing, gaining 995½ out of a possible 1,000 marks. In 1907 gold medals were won in both the Irish and Scottish reliability trials, and in the Irish and Scottish trials of 1908. Particular attention has been given to carburation in order to obtain economical fuel consumption, and for this purpose an extra air lever is brought up to the steering wheel, in addition to the usual throttle lever; the carburetor is a float feed spray, but has a distinctive feature in the throttle, this taking the form of a shutter opening and closing from the centre, exactly the same as the Iris diaphragm or adjustable stops of a camera. The combined throttle and auxiliary air supply is so arranged that at quarter opening all the air has to come from the main air inlet and pass over the sprayer, while gradual opening of the throttle decreases the main air supply until at full opening the air from the auxiliary port goes straight into the mixing chamber, and is kept clear of the sprayer. The water pump, fan and carburetor are mounted upon the engine, and can be lifted bodily together from the frame. Next to the De Dion, the Swift is favored by physicians, the general excellence of construction and consistent reliability having earned for it a big reputation.

THE PHOENIX.

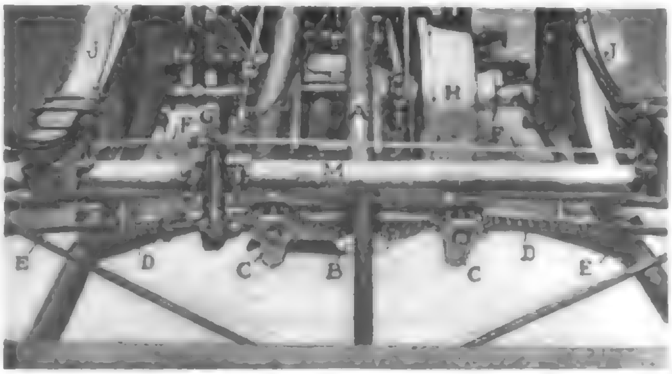
Somewhat a departure from the usual type of machine is the 8 horse power, two cylinder vertical engined Phœnix, a type that would be unsuitable for American country roads because of the small amount of clearance below the dirt screen, which, however, does not affect its sale in large numbers for use on the well surfaced roads in England. The manufacturers were originally concerned in the production of bicycles, and what may be termed bicycle ideas are quite apparent in the design, although in no way objectionable, as the experience gained in building very light bicycles and tricycles has served in turning out a very light automobile that will withstand any amount of hard work. The whole of the framing, including the axles and the cross members, are constructed of cold drawn seamless steel tubes, the various joints being made with malleable iron lugs brazed to the tubes. Half elliptic springs are used fore and aft, in a reverse position to the normal, viz.: the axles are clamped to the centres of the springs, but the tubular framing is taken *below* the axles and bent up at the extreme ends to carry the spring shackles. The bonnet is false, the separately cast cylinders of the engine, 80 mm. bore by 80 mm. stroke, being situated immediately below the dashboard so as to place the weight nearly in the centre of the wheel base, and also to save long chains in the transmission. Thermo-syphon water circulation is used, each cylinder having its own set of pipes and radiators, the latter taking the form of a number of vertical large diameter flanged tubes set in a circle between top and bottom tanks, each set of radiators being placed outside the car body and in line with the dashboard. This system of engine cooling has been proved highly successful, and on the hottest day it seems impossible to make the engine over-



Swift Ten to Twelve Horse Power Engine.

heat. Transmission from the engine, which is placed with cylinders athwart the frame so as to secure a perfectly straight line drive to the rear live axle, is by a single roller chain from crank shaft to a countershaft running in ball bearings. On this countershaft is a three plate disc clutch running in oil, and carrying a two speed and reverse epicyclic gear, the final drive being by a single roller chain to the spur wheel differential. The necessary tightening of the two chains for wear is obtained in a very simple way by carrying the countershaft on swinging brackets, which adjusts the front chain without disturbing the adjustment of the chains from the countershaft to the rear axle. The oil and gasoline tanks are on top of the dashboard, each having glass sight gauges inserted for instantly verifying the quantities. The pedal brake is applied to the countershaft, a side lever controlling internal expansion brakes within the front wheel hubs, the essential balancing of these last through a system of small pulleys being patented. The steering of the front wheels is also patented, and, so far as the writer is aware, is unlike any other machine, the accompanying photographic illustration showing it clearly. A is the steering column, which is continued below the front axle M, to the plain pulley B, the pulley revolving freely around a bearing on a short shaft rigidly attached to one of the cross frame members; C C are two plain pulleys of similar construction to B, also attached to the cross member; D D are two short lengths of ¾ inch pitch roller chain that run freely over the pulleys B and C C, and are attached to short rods E E, that in their turn are coupled up to the steering knuckles of the front wheels, the wheels running on the usual stub axles. The outer ends of the rods E E have two light spiral springs that are anchored to the framing, and are both in tension and tending to pull the stub axles constantly outward, so that the forward portions of the steering wheels, if not otherwise controlled, would turn in toward the frame. If the steering column A is turned to the right it pulls on the right hand chain D, steering the front wheel on that side in the desired direction, and the corresponding chain on the left being thereby slackened allows the left springs to pull the left front wheel round in the same path. The same illustration also shows the clutch H, main and supplementary half elliptic springs J K, the wire cable F controlling the front brakes and the balancer G, connected to the brake side lever. The false bonnet on this machine is made to serve for a tool locker, and a large platform to the rear of the seats has ample luggage capacity. The body is hinged to the frame above the rear axle, and can be swung up in 30 seconds for access to the transmission. Economical gasolene consumption is a big feature of the Phœnix, the majority of owners regularly doing 42 miles to the gallon, and on some official trials as high as 51 miles to the gallon has been done on several occasions. With standard equipment of wire wheels and 700 mm. by 80 mm. tires the total weight with body complete is 10½ cwts., and the car sells for $700.

Eight Horse Power Phoenix



Phoenix Steering Gear.

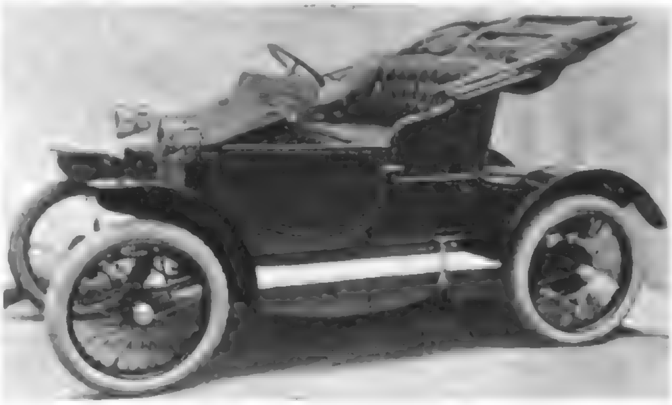
THE CLYDE.

An unconventional vehicle is the Clyde, made with single cylinder, two cylinder and three cylinder engines, all vertical and set athwart the frame, under the usual bonnet, with the crank shaft parallel to the front axle. The peculiarity of the machine lies in the transmission, the clutch and gear box being embodied as a portion of the live axle, an excessively lengthy chain running straight from a sprocket attached to an extension of the primary gear shaft, outside the gear box, that also carries the clutch. This system is quite different from that used on the 1908 model 18 horse power Darracq, the latter having a solid, unsprung axle to support the gear box and differential. Theoretically the Clyde ought to be a failure, because of the long single driving chain and position of the gear box, but in actual practice it is a highly successful machine. With but minute alterations of detail these machines have been so built since 1897, and although quite unknown outside England, and only constructed in comparatively small quantities, they sell mainly among doctors. In one respect the Clyde machines are exceptional, for nearly every owner uses them with plain rubber tires, and yet such a thing as a skid or slide slip in wet weather is never experienced, which the manufacturers attribute to front and rear axles having to carry about the same weight. The single cylinder, 8 horse power costs $900; the two cylinder, 10 horse power costs $995, and the three cylinder, 12 horse power costs $1,225, all complete with bodies, the largest having a four seated body.

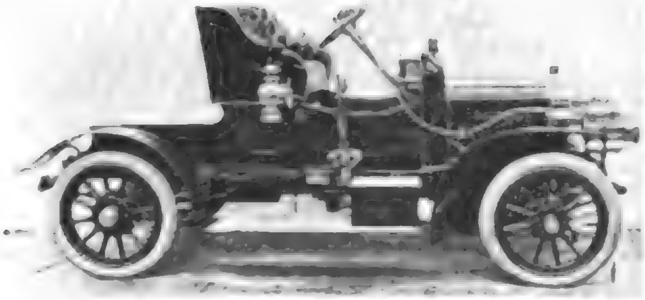
There are several other runabouts made in England on conventional lines—the Star, Starling, Jackson, Singer, Pick, Alldays, Vulcan, etc., which differ only in small details, and being strictly standard design, call for no particular comment. They are all made with single and two cylinder vertical engines, no difference of chassis design or size being necessary for the slight increase of power for the extra cylinder, the Panhard type of straight through sliding gear, three forward speeds and reverse, and propeller shaft transmission being the regular specification.

THE RILEY.

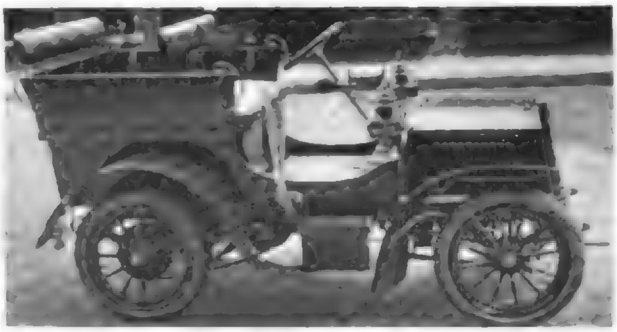
The Riley is possibly the only machine built in Europe that has a two cylinder "V" water cooled engine, of 12 horse



Riley Nine Horse Power.



Seven to Nine Horse Power Singer.

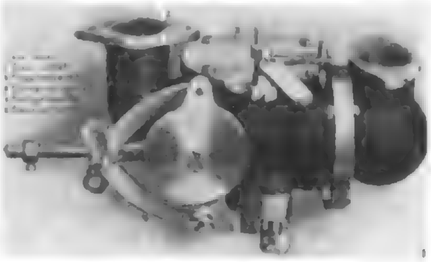


Jackson Eight Horse Power.

power. The cylinders are set at the correct angle of 90 degrees to each other, the connecting rods working on a single crankpin, with a pair of internal flywheels additional to the usual flywheel that forms part of the leather cone clutch. Two distinct lubricating systems are fitted to the engine, one being instantly available in case of mishap to the other; a mechanically driven piston pump constantly circulates oil to the bearings and cylinder walls, the standby consisting of a set of exhaust pressure feed sight glasses on the dashboard, together with a hand pump for any extraordinary supply required when climbing very long hills. The gear box is on distinctly original lines, the change wheels being always in mesh and the particular speed desired being clutched to the secondary gear shaft by a simple plate and key motion, the actuating key, shaped like a Woodruff, falling into a similar shaped slot in a plate, thereby pushing the clutch arm forward against the pull of a spring. Final drive is by propeller shaft and live axle. Wire wheels are generally fitted, the Riley firm also supplying a patented detachable wheel of their own at the option of the purchaser.

THE ADAMS.

A type of machine on strict American lines, called the Adams, has an increasing sale, due largely to smart advertising methods, coupled with excellent workmanship. A pressed steel frame is supported on the axles by quarter elliptic springs, the power plant consisting of a single cylinder horizontal engine, transmitting through two speed epicyclic gear to a single roller chain drive on to the live axle. The special feature of the Adams is the entire control, excluding the side lever for rear brakes, by means of interlocking pedals. There are separate pedals for each of the forward speeds and reverse, as also an accelerator pedal, the speed pedals locking automatically when fully depressed, any engaged pedal being instantly released when any other pedal is pushed right down. The system is foolproof and quite successful, and the Adams has done more toward popularizing planetary gear in England than all previous efforts in this direction. A smart catch phrase, "Pedals to push, that's all," so aptly conveys the means of control that most motorists know it by that title rather than the name of the maker. It sells with a two seated body for $950, and can be had with a three speed planetary gear for about another $60.



The Swift Carburetor.

This list of cars does not pretend to be exhaustive, only representative patterns of those embodying original design having been selected for notice. There are several others, turned out by small makers and selling only locally. All the cars mentioned in the course of this artice are manufactured entirely in England, Scotland and Ireland, with the single exception of the De Dion, which is noticed because the single cylinder models are built expressly for the British market, the whole output of the 6 horse power in particular being reserved for England. The lists of cars accompanying include everything beyond the comparatively unimportant "assembled" machines selling in Britain, divided into home and foreign productions, the latter taking in American cars. The prices given are the actual retail catalogue figures.

It is becoming more and more difficult for any foreign maker to obtain a footing in this market, for the home makers are more than able to keep pace with the demand, even such machines of repute like the French Gregoire, Junior, 11 horse power Panhard, etc., being increasingly difficult to handle by the concessionaires. In respect to American machines, the 10 horse power Cadillac is far and away the most popular; then come the 15 horse power Ford and the Reo. The Buick opened up here in 1907, but very few can have been sold. The Maxwell was pushed in 1905 and 1906, and then the London depot was suddenly shut down, just when people were beginning to appreciate its good points. Except the three leaders mentioned above, this system of opening a fine depot and

Ten Horse Power Adams.

Ten to Twelve Horse Power Swift.

closing it down after a year or two has done more than anything else to depreciate the selling power of American built machines in England, the Oldsmobile being perhaps the most glaring example. There have been persistent rumors of the intention of several American makers to attempt to start business in England, and if there is any foundation for these rumors it ought to be fully realized that there is no room for any unknown car in the British market that will cost more than $1,000 for machine (with two seated body, 3 inch tires and about 10 horse power), retail price, delivered to customer at the depot in London. The demand for this type of light runabout is continually increasing, but it must not be supposed that home makers are asleep, most all of them being prepared to cater for the class of business that will in the near future form the principal source of business. Money would be wasted in attempting to push anything at a higher price, those purchasers who can afford to buy and maintain 16 horse power or 20 horse power vehicles preferring to drive something that has already established a reputation for reliability.

PRICES OF BRITISH BUILT RUNABOUTS.

All machines in following lists are priced complete, with finished bodies, a good tool kit being usually included. Lamps are always charged for as extras. Those marked with an asterisk (*) sell freely and are well known in the home country and British colonies:

Horley, 9 h. p., single cylinder, two seats, tires 28x3½	$525
* Rover, 6 h. p., single cylinder, two seats, tires 28x3½	650
Phœnix, 8 h. p., two cylinders, two seats, tires 28x3½	700
* Starling, 8 h. p., single cylinder, two seats, tires 28x3½	750
Pick, 16 h. p., four cylinders, two seats, tires 30x3½	825
* Riley, 9 h. p., two cylinders, two seats, tires 28x3½	840
Sabella, 10 h. p., two cylinders, two seats, tires 28x3½	920
Hornet, 8 h. p., two cylinders, two seats, tires 28x3½	950
Chambers, 8 h. p., two cylinders, two seats, tires 28x3½	950
* Rover, 8 h. p., single cylinder, two seats, tires 30x3½	1,050
Cylde, 10 h. p., two cylinders, two seats, tires 30x3½	1,050
Singer, 9 h. p., two cylinders, two seats, tires 28x3½	1,075
* Star, 9 h. p., two cylinders, four seats, tires 28x3½	1,100
Starling, 10 h. p., two cylinders, four seats, tires 28x3½	1,000
* Swift, 12 h. p., two cylinders, two seats, tires 28x3½	1,125
Chambers, 10 h. p., two cylinders, two seats, tires 28x3½	1,160
Shamrock, 12 h. p., four cylinders, two seats, tires 28x3½	1,175
* Riley, 18 h. p., two cylinders, five seats, tires 28x3½	1,235
* Humber, 12 h. p., four cylinders, four seats, tires 28x3½	1,250
* Swift, 14 h. p., two cylinders, four seats, tires 28x3½	1,325
* Vulcan, 10 h. p., two cylinders, four seats, tires 28x3½	1,325
Bental, 11 h. p., two cylinders, four seats, tires 28x3½	1,350
Lotts, 12 h. p., two cylinders, four seats, tires 32x3½	1,375
* Star, 12 h. p., four cylinders, four seats, tires 30x3½	1,375
Scout, 12 h. p., four cylinders, two seats, tires 28x3½	1,425
* Belsize, 15 h. p., four cylinders, four seats, tires 30x3½	1,425
* Siddeley, 10 h. p., two cylinders, four seats, tires 30x3½	1,500
Calthorpe, 12 h. p., four cylinders, four seats, tires 30x3½	1,500
Thames, 15 h. p., two cylinders, four seats, tires 28x3½	1,600
* Talbot, 12 h. p., four cylinders, four seats tires 30x3½	1,700

FOREIGN BUILT RUNABOUTS ON BRITISH MARKET.

* Darracq, 9 h. p., one cylinder, France, two seats, tires 28x3½	$795
Reo, 10 h. p., one cylinder, U. S. A., two seats, tires 28x3½	875
* Ford, 18 h. p., four cylinders, U. S. A., two seats, tires 28x3	875
Mass, 8 h. p., two cylinders, France, four seats, tires 28x3	975
Sizaire, 9 h. p., one cylinder, France, two seats, tires 28x3	1,000
* Darracq, 10 h. p., two cylinders, France, two seats, tires 28x3	1,000
Gregiore, 8 h. p., two cylinders, France, two seats, tires 28x3	1,000
Adler, 9 h. p., two cylinders, Germany, two seats, tires 28x3½	1,050
* Cadillac, 10 h. p., one cylinder, U. S. A., four seats, tires	1,155
* De Dion, 8 h. p., one cylinder, France, two seats, tires 28x3½	1,155
* Darracq, 14 h. p., two cylinders, France, four seats, tires 28x3½	1,335
Zedel, 10 h. p., four cylinders, France, two seats, tires 28x3½	1,375
Buick, 18 h. p., two cylinders, U. S. A., four seats, tires 28x3½	1,470
Renault, 8 h. p., two cylinders, France, two seats, tires 30x3	1,530
Reo, 18 h. p., two cylinders, U. S. A., four seats, tires 30x3½	1,610
* De Dion, 10 h. p., two cylinders, France, four seats, tires 30x3½	1,670
Clement, 10 h. p., two cylinders, France, four seats, tires 30x3½	1,725
Metallurgique, 12 h. p., two cylinders, Belgium, four seats, tires 28x3½	1,725
Zedel, 12 h. p., four cylinders, France, three seats, tires 32x3½	1,725
Unic, 12 h. p., two cylinders, France, four seats, tires 30x3½	1,825
Vinot, 12 h. p., two cylinders, France, four seats, tires 30x3½	1,825
Panhard, 11 h. p., three cylinders, France, four seats, tires 32x3½	1,825
Adler, 12 h. p., two cylinders, Germany, two seats, tires 32x4	2,350

Testing Wood with the Microscope.

A new line of work, consisting of the microscopic examination of wood after it breaks in a testing apparatus, has just been started by the office of wood utilization in the United States Forest Service.

The structure of wood is complex. Every species has several different kinds of cells, each of which has its own size and form. There is also a wide variation in the number and arrangement of the cells in different species. These differences in structure have their bearing on the strength of the wood.

For some time past the Forest Service has been carrying on a large number of tests on many kinds of wood in order to determine their strength, stiffness, elasticity and other physical properties, so that they may be used to the best advantage

Maintenance and Repairs

Gasoline and Ignition Stops.

By "Owner."

The majority of stops of a gasoline engine are caused by the interruption of the flow of gasoline or the flow of ignition current. Rules are laid down in books of instruction to the effect that a sudden complete stop, with a quick regaining of power, is caused by an interruption of the electric current, while a slow stop, as where the engine dies down gradually, is the result of an interruption of the gasoline flow.

A bad connection on the battery or commutator, or, in fact, a bad connection in any part of the electric system, will cause a characteristic ignition stop, and will sometimes cure itself and give the engine its customary power; but the defect will show itself again sooner or later, and will eventually result in a dead engine until the connection is made tight and sound.

But sometimes a stop caused by the gasoline not flowing will show all the symptoms of an ignition stop, and in these cases much valuable time is lost and annoyance arises in the hunt for the real trouble.

For the space of a week or so the writer's car had all the symptoms of an ignition stop, which would result in a complete cessation of the working of the motor for a few seconds at a time, then the engine would take hold and drive the car ahead in its usual form for many miles, until the annoyance would again appear with the same result. There was no complete stop at any time, with one exception, when the engine died down completely, but started immediately when the crank was briskly turned. Connections on coil and batteries were tightened up, with no result, until on one later occasion the engine went out of business and refused to move again. No amount of persuasion could coax the engine back to life until the driver got off his seat and with one turn started the engine going immediately.

This occurred on several occasions, and was indeed very puzzling, as the engine refused to run after stopping on the road until started by the master hand of the driver. While this was complimentary to the driver it was annoying at the same time, to say the least, for any one person to have such complete command over an automobile, so it was determined to get at the cause of the trouble.

It was therefore determined to rewire the primary wiring of the car completely, and in doing this the trouble was immediately found. It was caused by the grounding of the battery wire on the brake rod.

The coil was mounted on the left hand side of the dashboard; the brake rod was also mounted on the dashboard and ran across the dash and underneath the coil box and very close to it. The battery wire ran from the battery box on the running board to the switch on the dash, and from the switch alongside the brake rod to the coil.

When the foot brake was put on the wire caught and turned around it and eventually the rubber insulation was worn off in spots, with a short circuit as a result. The reason the driver had such a magic touch was because he necessarily released the foot brake when he left his seat, and the wire detached itself from the rod. This action, of course, broke the short circuit, and the current was free to flow through switch and coil in the proper way.

New wire was installed, and no further trouble was given until a few days later, when, on switching from the battery to the magneto, it was found that it was impossible to get the engine to work on the magneto. The cause of this was quickly found after a short inspection.

The magneto wire, it seems, after it left the switch, passed near the shaft of the oiler pulley. The vibration of the car had caused this wire to sag down on top of this shaft, where it was quickly worn down to the bare wire. Securing the wire away from the shaft remedied this annoyance.

The car ran perfectly for many miles after these defects had been remedied, and full confidence was felt in the ignition system until one day recently, when without any warring we had the characteristic ignition stop, a sudden complete cessation of power, followed by the quick taking hold of the engine for a few moments, then a repetition, until the engine stopped completely. Examination of the wiring showed it sound and without any defect, and proof positive that it was in order was given when the vibrators snapped sharply when the engine was turned over. The stop was so exactly like an ignition stop that we were reluctant to suspect the carburetor, which rarely gave any trouble; but confidence in the wiring forced us to turn our attention to the gasoline supply, and there we found the trouble.

The supply pipe was found clogged at the tank end, but enough would flow to fill the float chamber at times to the proper level.

This, of course, resulted in the engine working when a proper level was reached and stopping when the fluid fell below that level. But the stop in this case was instantaneous, and the recovery was as quick, giving all the symptoms of an ignition stop.

The first step to be taken, therefore, when the engine stops, permanently or temporarily, is to examine the coil, and if all the vibrators work one can be positive that the cause of the stop is an interruption of the flow of gasoline. Defective batteries may cause a stop which is puzzling to many because of the fact that the vibrators may work and yet not produce a spark of sufficient power to ignite the charge; but the buzzing sound produced by a defective battery is quite different from the sharp, clear snapping given out when the battery is perfect.

A Demountable Rim Wrinkle.

Most users of demountable rims go about the replacement in the following manner: After the wheel has been jacked up and the rim removed, they proceed to put on the new rim, affix the wedges or turnbuckles, and set up the nuts in some order, depending on the individual. The wheel being jacked up is readily revolved, and the operator prevents it from turning with his knee. This looks all right, but it is not. The pressure of the knee on the wheel tends to make the wheel spring out of shape, considering the force required to set the rim on snugly, resulting in a poor fit and uneven wear of the tire. A better way would be to set up two or more wedges on opposite sides of the rim and then lower the wheel to the ground, setting all the wedges home. The result would be a proper fit, and even pressure from all the wedges. With contracting rims, the wheel should be lowered as soon as the rim is in place and the turnbuckle operated. This type is actually harder to fit properly than the wedge fastening type, particularly if there is grit on the bonding rim. The little extra time required by this method of replacement is amply compensated for by the far better fit of the rim obtained.

An Emergency Repair.

There has always been a tendency to lighten the universal joints on a car and to trust to thinner material of higher strength than that prescribed in engineering formulæ for universal joints. The pin connecting the yokes is usually the first thing to break, or come away, and a case of the joint pin coming away happened quite recently. The driver had had the car overhauled, and probably the lock nut or locking piece had not been set home, as the pin in some way worked clear and wore its way through the fabric boot which surrounded the joint. For some distance after the pin dropped out the yoke did not leave the spider, but on setting the brakes the yoke and shaft tore through the boot and struck the road. A joint pin is not usually carried in the tool box, and as the party had to reach their destination in time to catch a train a cold chisel was put in in place of the pin and was held in place by means of wire and tire tape. The emergency repair was successful, but owing to the imperfect fit care had to be taken in driving.

Trimming Gear Wheels.

The corners of the teeth of the dog clutches and second speed pinion of a car sent to a New York garage were in need of trimming, burrs having been formed on them owing to attempts of the owner to change gears without using the clutch. The teeth were otherwise quite sound, and a replacement would have been costly and consumed considerable time. The combined slider and dog clutch was removed to be trimmed, but it was found that owing to the special steel used in the gears no one would take the responsibility of softening and rehardening the teeth after the trimming. A file could not be used, as it would not "bite," so the part was taken to a tool maker, who trimmed the corners up with a small carborundum wheel running at high speed. The temper was preserved and time and expense were saved.

The Oil Well and Crank Case Standpipe Lubricating System.

We recently had a letter from a reader who had collided with certain parties claiming to be prior inventors of a system of lubrication used by our correspondent. The system in question consists of a well or sump below the crank case, into which the oil from the crank case drains through two or more standpipes or overflow pipes in the crank case designed to maintain a constant oil level in the case. From the well the oil is drawn by an oil pump and circulated to the various rubbing surfaces. Our correspondent, in looking through files of The Horseless Age, had found a sectional view of a Columbia engine in the issue of December 20, 1905, but it was necessary to prove that the arrangement was already known as early as January, 1905. Further search through the files of The Horseless Age revealed that the same arrangement was incorporated in the first small four cylinder Autocar, which was described in The Horseless Age of November 23, 1904. The cut of the engine there shown does not reveal this feature, but the description is very clear on the point. It states: "The (oil) supply tank is made of aluminum, and is secured to the bottom of the crank case. Two overflow pipes extend up into the crank case to the height at which it is desired to carry the oil level." As the date of this publication was earlier than that of the alleged invention, our correspondent's purpose was served. The incident shows the possible value of a file of The Horseless Age to manufacturers of automobiles and parts.

Dust Laying Experiments Near Toulouse.

A number of interesting experiments in dust laying have recently been made in the suburbs of Toulouse by M. Francon, an architect of that city. M. Francon's new process consists in applying several layers of liquid tar upon the road and immediately afterward applying fire to them. Under the action of the heat the tar penetrates the surface of the road, forming a paste with the road material which composes it, this paste, being impermeable to water, is quite hard, and, according to the inventor, resists disintegration for a long period. The Administration of Bridges and Highways intends to apply this method of tarring to some of the most frequented portions of the roads in the neighborhood.

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The A. C. A.-A. A. A. Agreement.

It seems to be the almost unanimous opinion that the terms of the agreement between the national body and the New York "local club," as the press agents of the national body have been wont to term it, are entirely in favor of the "local" club. The latter now has not only absolute control of all truly international races in this country, in which cars are entered by foreign manufacturers, but it will also have control over all races whose promoters may prefer to apply for a sanction to the Club instead of to the Association, the only proviso being that these promoters announce their races as "international." There can be little doubt that the leading motive of the two bodies in coming to terms was the desire to save their respective races this fall from utter failure. With only five entries for the Vanderbilt Cup race at the time of the preliminary closing of entries, a fizzle was certainly the only prospect, and it is therefore not difficult to find an explanation for what one of the press agents for the A. A. A. calls the magnanimous action of the latter body. It was a question of either raising the ban on the race or calling it off. The situation with respect to the Savannah race was not much, if any, better, though as this race was a month further off the exact situation could not be quite so clearly surveyed.

It seems that the most important effect of the agreement will be to foster rivalry between the two organizations for the patronage of race promoters. Unless this matter has been regulated secretly in advance, a drop in the fees for race sanctions may be expected. Another somewhat surprising action taken by the committees of the two organizations who drew up the agreement is the assignment of the custody of the two racing trophies to the Motor Parkway enterprise. It would indicate that individuals connected with this enterprise have much influence in the councils of both the Club and the Association.

Repair Charges.

Frequently disputes arise between repair men and their customers with respect to charges for work done, and in many cases where the customer does not openly object to paying the amount asked he still feels that he has been imposed upon—"robbed" is the usual term. In the majority of cases where seemingly outrageously high charges are made for small jobs the machinist wasted much time in locating the trouble, for which time the customer is obliged to pay. In other cases the parts requiring renewal or repair work are very inaccessibly located, and a great deal of dismounting and reassembling has to be done, which may consume much more time than the actual repair work itself, or it may come many times higher than the value of the part replaced. In such cases it is often difficult to make the customer understand the necessity for and the tediousness of the dismounting and reassembling process, if he has not seen the repair done himself.

In any case, the repairer should always keep an accurate record of the time spent and the materials used on the job. If that is done he can make out his bill and feel that his charge is absolutely just—that only material and labor actually furnished are charged for, and at rates which are the same to every customer, and which have been carefully determined in advance. But we are inclined to believe that this rule of keeping an accurate record of all time spent and materials employed on a particular job is not followed in a good many of the smaller shops, but instead an estimate of both items is made at the completion of the job and the charge fixed accordingly. There could be no more potent cause of trouble between repair men and customer than this laxness. It will be agreed that there is much chance for serious error in the estimate made at the completion of a job, and when the customer objects to the charges the repair man is not sure of his ground, as he would be if he had an exact record of all the work done and material used in the job. This system of records, which is universal among well organized shops, should be extended even to the smallest.

Some Necessary Precautions in the Use of Pressed Steel.

The 1909 models which have so far appeared show one feature which distinguishes them from the cars of previous years, namely, the extensive use of pressed steel parts.

This departure is entirely commendable, since it promises to lead to the production of cheaper, lighter and more durable vehicles. However, like everything else which is new, it affords opportunity for grave mistakes in design; and it is our purpose to point out two errors which are easy to make. The first relates to the rigidity of the parts; the second, to the method of joining them to other pieces.

It is comparatively easy to make a pressed steel part strong enough, and still have it very light. But if it supports bearing surfaces, gears, or similar parts which must be kept in accurate alignment, strength is not the only requisite. It is also necessary that the part be rigid. It is their rigidity which has made cast casings and frames the favorites for machinery. While the tensile strength of the material is usually quite low, its modulus of elasticity is comparatively high, so with the comparatively large sections ordinarily employed such parts are very stiff. In designing similar parts from pressed steel we are often in danger of losing these desirable characteristics, unless we take care to make the parts heavier than they need be for strength and pay attention to the joints.

Where pressed steel parts are bolted together or to cast or forged pieces, special care is often necessary to see that the bolt gets a secure hold upon the steel. Often the metal is very thin and will stretch around the bolt or tear out. If there is danger of this a reinforcing piece in the form of a boss or flange should be welded on where the bolts go through.

Insufficient metal at the bolted joints was the cause of the failure of pressed steel axles and other parts made several years ago, and it is to be hoped that the lessons learned then will be remembered and that nothing will occur to discredit a most valuable material.

What a Conviction for Speeding Means.

Although many automobilists look upon being convicted of violating the speed laws as more or less a joke, nevertheless, if they fully realized the real seriousness of a criminal record against their names, possibly there would be fewer violations of the law in this respect.

To be convicted of operating an automobile faster than the law allows means that the person convicted possesses a criminal record. Of course, his record of criminal conduct does not, ordinarily speaking, stamp him as a person not fit to associate with others; nevertheless, circumstances may easily arise in the future where it would be of value to him to be able to say that he had never been convicted of any crime. For example, if he should ever be put on the witness stand to testify in a civil suit, either as a party or a witness, he may be asked if he was ever convicted of any crime. If he had ever been convicted of overspeeding, he would be compelled to answer the question under oath in the affirmative, and his reply could be used to impeach his testimony as a witness. The jury may discredit his evidence, and upon argument of counsel the conviction against him may be used. It is the ambition of every true minded American citizen to have a clean and clear record, especially free from criminal conduct. To violate the automobile law constitutes a misdemeanor, a crime, and having been convicted of violating the law the offender has a criminal record.

The International Road Congress.

One of the most important topics of general public interest at the present time is that of the preservation of macadam roads. The rapid increase in the number of automobiles in use, and the great popularity of automobile touring in recent years have given a strong impetus to the good roads movement in this country, and very substantial appropriations for road construction have been made in many States. While the improved roads will benefit all classes of the community, they will be of greater advantage to automobile users than to any others, and it is probably not too much to say that the strong political influence of the large body of wealthy automobilists has been an important factor in the passage of these good roads laws.

At a time when such enormous sums are being spent or about to be spent in road construction, the discovery that the form of road surface generally laid down is rapidly deteriorated by automobile traffic was bound to cause considerable alarm. How the binding material is being drawn from between the stones of macadam roads by the wide tires of fast moving cars, and scattered over the road sides has probably been observed by everyone who has occasion to walk along highways on which there is much automobile traffic, and road officials both here and abroad have collected much incontrovertible evidence that roads are being greatly injured by such traffic. In France the matter was regarded of such universal import that an international road congress was called which will convene in Paris in another fortnight, and it is significant that eleven different countries will be represented at this congress by delegates, appointed either by the governments of the respective countries, or by national good roads organizations. It is to be pointed out, however, that the destructive effect of automobile traffic on roads and the remedies therefor, although the most important topics of discussion, are not the only ones that will be considered. Of the ninety-nine separate papers promised, some deal with the effect of different road surfaces on tires and vehicles, the improvement of cars so as to reduce roadwear, signals, sign posts, etc. It is to be hoped that the records of the congress will contain complete data of the numerous experiments with adhesive binding materials or dust layers made in various parts of the world in recent years. The use of these materials is becoming quite common on suburban roads, and if the deliberations of the congress should result in the elimination of some of the more unsuitable or ineffective of the many raw materials and preparations now used for the purpose it would not have been held in vain. The United States, perhaps more vitally interested in the subject of road preservation than any of the other countries, is well represented by a number of road experts attached to the Department of Agriculture, and we observe that no less than eight of the papers to be read were prepared by Americans.

In one sense, however, the question of road preservation presents a different aspect in this country from what it does in Europe. Most European countries are supplied with a complete network of improved roads, and there is little road building going on. Any treatment for the preservation of the road surface against the destructive effects of automobile traffic must therefore be applied to roads already made. In this country, on the other hand, the mileage of improved roads will probably be doubled within a few years, and a suitable process of constructing roads, in the first place, so they will not be affected by the suction effect of the tires is of vastly more importance than any process of treating roads already made. Among the tests carried out by the United States Government are some with road materials covered or coated with tarry material, which when compressd forms a continuous mass said to be quite as elastic as an asphalt pavement. Both tar and asphaltic oil have also been used in the construction of roads to render them dustless, but none of the various methods seems to have reached finality, and if the data regarding their cost and efficiency could be sifted and compared at the congress much good should result.

American Motor Adopted by European Firms.

After nearly thirteen years' use of the standard type of four cycle motor, the Daimler Motor Company, Ltd., of Coventry, England, have abandoned it for a valveless four cycle motor known as the "Silent Knight," the invention of Charles Y. Knight, of Chicago, Ill. This motor, which will be used on all the Daimler cars for 1909, was patented by Mr. Knight in 1906. It uses, instead of the ordinary inlet and exhause valves, concentric cylindrical sleeves which are operated by eccentrics so that ports in the sleeves open or close communication with ports in the cylinder. The original motor built was placed in a car and tested out, and the firm of Knight & Kilbourne was formed early in the same year to handle the car. The company finally abandoned the manufacture of the cars and motors, and in 1907 Mr. Knight took his motor to Great Britain where it was tried out by various motor builders, among whom were the Daimler Company.

Following the adoption of the motor by the Daimlers, the well known firm of Minerva Motors, Ltd., of Berchem-Anvers, Belgium, has also taken it up, and will manufacture it, having already acquired the Belgian patent rights.

The Cause and Prevention of Wear in Motor Cars.

(Paper by H. F. Royce, read before the British Association for the Advancement of Science in Dublin on September 8. Condensed.)

The excessive noise of some cars is largely caused by wear which should be as unnecessary as it is disastrous to the owner and to the motor movement. Although the noise due to such wear may not be so apparent in the lighter and more refined pleasure vehicles, to which the author's personal experience has been confined, the prevention of wear is of importance in the interests of the large class who have adopted the motor carriage in place of horses and carriages, and any reduction in the cost of maintaining motor cars must be of benefit to the movement generally as encouraging their use.

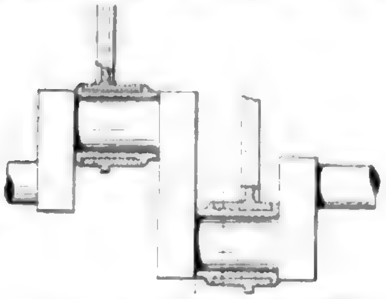
The subject may be dealt with under three headings:

1. **Design.**
2. Material and Workmanship.
3. Lubrication and Attention.

To obtain the best results, the conditions must be favorable under all three headings.

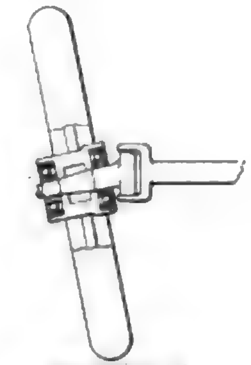
I. DESIGN.

It is extremely difficult to deal with the questions of design without showing a large number of illustrations, but the following are a few examples of practices in motor design which are worthy of special attention.



In this case the cylinders are sufficiently wide apart to admit of water-way between them. (*a*) But there is no centre bearing on the crank shaft between the two cranks. (*b*) The big end bearing is not central with the connecting rod. Disadvantages: (*a*) The pins tend to deflect excessively for want of intermediate support. (*b*) The bearing is loaded and will wear unevenly, and the portion of bearing marked A is probably worse than useless.

It is at first difficult to believe, but an examination of cars at an exhibition such as the annual show held at Olympia and the Grand Palais, Paris, makes it quite clear that, while a certain small proportion of chasses are obviously designed by men who are good engineers and who have taken great pains and care to make their designs as nearly mechanically perfect as the conditions will allow, there are many chasses which show that the designer is either extremely careless concerning, or has little knowledge or perception of, the science of mathematics. These latter chasses may, after a certain number of poor pieces have been eliminated, be more or less workable, and may, if well manufactured, satisfy the average purchaser's examination; but, owing to poor mechanical features, are bound to be costly in maintenance.



Front wheel considerably splayed to bring load under steering pivot, resulting in load falling beyond inner ball race. Often accompanied by very short hub, which makes ball bearings close together.

Bearings.—For instance, one observes (may it be said, with a shudder) that in such important features as connecting rods, shafts in change gear boxes, road wheels, and wheels running on studs, the bearings are so disposed that the load or pressure

(1) Does not fall in the centre of the length or bearing.

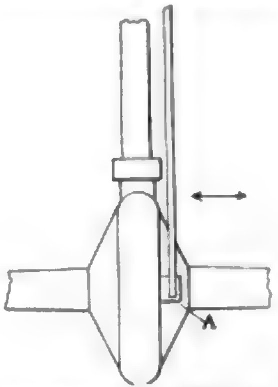
(2) Or, in the case of two rows of ball bearings, does not fall between the two bearings.

(3) Or, worse still, falls beyond and quite outside the bearing.

Absence of regard for the mechanical canon that pressure should either be centralized on or equally distributed along the whole length of a bearing is undoubtedly the cause of wear in many motor cars.

Deflections.—Road and other stresses cause twistings and deflections which may throw out of alignment various parts. Take, for instance, a comparatively rigid crank chamber fixed to the frame. The frame, owing to road irregularities, twists, and its side members thus act as powerful levers tending either to break the attachments or twist of the whole crank chamber. In the latter case, the bearings of the crank shaft become deflected from true axial alignment, causing excessive load to fall on small areas. Rapid wear, if nothing worse, must result.

At various points throughout the chassis similar departures from true alignment, used to control the back axle, is so fixed that no provision is made to allow of the caused by various stresses, must be anticipated, and should be provided for as far as possible.

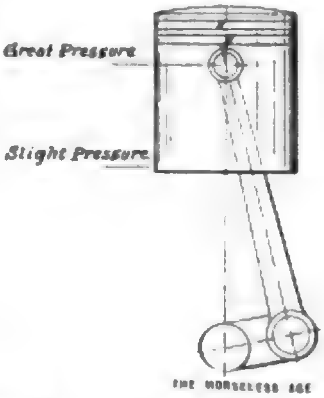


Plan of centre part of back axle showing torque rod fixed at A, with no provision for horizontal movement. The back axle does not remain at right angles to length of chassis, and also moves somewhat sideways owing to slack and elasticity of springs.

Again, there are crank shafts which have evidently insufficient support, such as double cranks with no bearing between them. In these cases, again, we have the distressing knowledge of crank pins bent out of true alignment. Excess of pressure on local spots, and the crushing out of lubricants at such spots, must, we know, be attendant under these conditions, and more or less rapid wear must result.

When one has to file a large surface one tilts the file so as to attack a small area at a time. That is what is happening in the case of the unhappy bearings referred to, and it was to avoid such a state of affairs that the swivel bearing was introduced in ordinary shafting work with such marked improvement.

Another instance of improper deflection is found in cars in which the torque rod, movement which must take place when one back wheel rises higher than the other owing to its surmounting an obstruction on the road, or owing to an uneven road surface. In such a case some slack must exist in the joints or the part must bend.



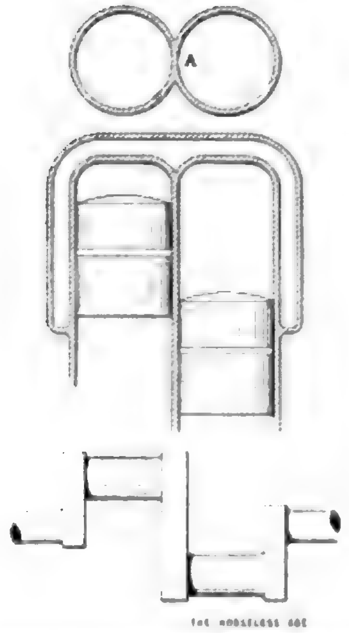
Piston pin much too near hot end of piston. Disadvantages: The thrust from reaction of the connecting rod falling chiefly on the hot and poorly lubricated end of the piston.

This is not an infrequent example of the disregard for correct mechanical principles.

Many similar instances could be pointed out. Unfortunately, the buying public are not experts, and it is only the expert who, in such matters, can see the difference between right and wrong.

Two chasses may, to the outward eye of the prospective purchaser, appear to be equally desirable and glorious, but one may contain faults which even the expert eye might fail to detect. Six months' usage is sometimes insufficient to discover faults in design and their resultant weaknesses, but certified tests over prolonged distances, together with official examination and statement of condition at the end of the run, are, in the opinion of the writer, the surest guides in such matters.

Another point that may be mentioned in connection with design is the importance of arranging that parts which are subject to much friction (such as gears, road wheel



A casting forming two or more cylinders in which there is no waterway between the cylinders. Disadvantages: There may be a strip of metal at point marked A, heated on both sides, which is hotter than the remainder of the cylinder walls, resulting in bad lubrication and wear.

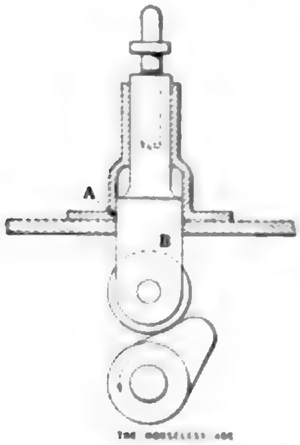
bearings, and universal joints) should not only be fitted with oil retaining devices, but also thoroughly protected against mud and water.

One sees universal joints on quite a number of expensive chasses which are not provided with any case at all, or perhaps with cases which cannot retain oil against the high centrifugal force engendered. It is hard to imagine the lubrication staying on a joint revolving at from 300 to 1,500 revolutions per minute, if it has the slightest chance to escape.

In the absence of an effective oil retaining case, these revolving joints may be trusted to get rid of any oil or grease which may be adhering to them, just as effectively as the hydro-extractor may be trusted to throw out the liquid. The same force will act equally well in either case.

The owner of a small car which had done well in some of the recent trials was heard to remark, after a journey of less than 60 miles, that he had to spend some time getting ready for the return journey. He secured a handful of nice, sticky grease, dived under the car, and dabbed it on the outside of the universal joint. It may probably be taken as certain that 99 per cent. of the grease was thrown off immediately the car attained any speed.

It must, however, be remembered that a case which is oil retaining need not necessarily be water excluding. Especially does this remark apply to road wheel hubs, which often allow water to be admitted. This is disastrous where ball bearings are employed.



Plunger form of tappet. Disadvantages: (a) Great pressure at point indicated by letter A. (b) This friction is especially severe during beginning of the lift of exhaust valve, because of remaining pressure in the cylinder on the head of the valve. (c) Friction owing to length of travel of the plunger. Note.—When the lifter is operated by a lever, these disadvantages are practically non existent.

2. MATERIAL AND WORKMANSHIP.

The choice of materials used in the construction of a motor vehicle are chiefly important for two reasons:

1. To avoid breakage.
2. To resist wear.

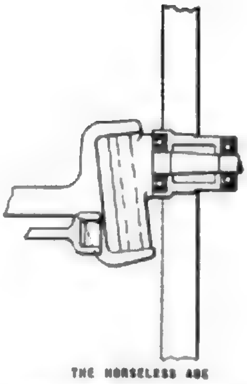
Time will only allow the writer to give a few notes on the latter.

If the film of lubrication could be perfectly maintained, the material used for the wearing surface would be quite unimportant. Aluminum, one of the worst wearing metals, might even be employed; but one cannot rely on the lubricating film always keeping the surfaces out of contact. In the case of the crank shaft, the position of affairs is aggravated by the fact that the steel in order to be really tough and reliable, is said to be in a state of pearlite, which, it is stated, under conditions of imperfect lubrication and in contact with hard bronze bearings is very likely to seize. Hence the success of such alloys as will run with such a steel shaft for a time fairly well without lubrication. Probably the most remarkable of these in that respect is lead, and alloys containing large proportions of lead; but the writer has always thought these too plastic to stand the severe mechanical stresses they are subject to in motor car work. Genuine babbitt metal of tin, antimony and copper seems excellent for crank shaft work if properly applied.

In almost every other part of a car the wear is taken on ball bearings, or the parts are capable of being case hardened.

Excellent results can be obtained with a properly case hardened shaft or other surface running with bronze bush or bearing. This combination is not nearly so exacting with regard to perfect lubrication as when one of the surfaces is of unhardened steel. Care should be taken to secure that the case hardening is of sufficient depth and is free from soft places, the shaft being ground down a few thousandths of an inch to exact size on a precision grinding machine and well polished.

Referring to gear wheels, which should in nearly all cases be thoroughly case hardened, the selection of material is more important under the heading of breakage, because any mild steel will case harden almost glass hard; but unless carefully selected and heat treated may be as brittle and weak as a zinc casting.



Steering head pivot inclined with cross steering connection, with single jaw joint which must necessarily be vertical. Obviously bad mechanics.

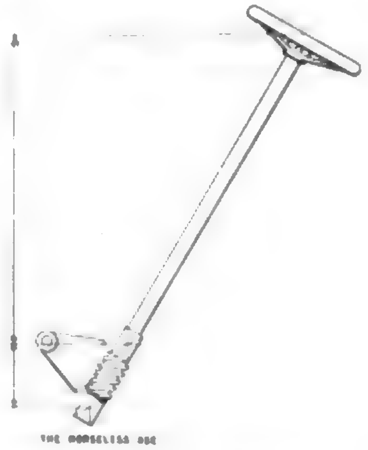
Ball bearings carefully arranged and well made are wonderful things, carrying enormous weights and bearing considerable ill treatment, but the materials for these deserve careful selecting. It seems better that both balls and races should be made of a good high carbon steel (although even this is improved with a small percentage of chromium), but good results have been obtained with exceedingly deeply case hardened mild steel. Really, this amounts to much the same thing as using high carbon steel, as the hard casing, to be satisfactory, should go nearly through.

It is worth while to repeat here that these ball bearings should, in all cases, be in oil retaining boxes and be thoroughly protected from water, their most deadly enemy.

3. LUBRICATION AND CARE.

The system of automatic lubrication is a matter of design, but automatic and hand lubrication are herein dealt with under the one common heading of "lubrication."

Engine Lubrication.—"Splash" lubrication of the engine, which formerly was the com-



A rough sketch of a steering column of ordinary construction. The two bearings are very close together on the box, and the steering wheel overhangs a great distance from these two bearings. The usual pulling at the steering wheel with one hand to turn it round, together with its overhanging weight, causes excessive wear on the bushes. This, together with the worm and quadrant type, which has such a small area of contact, gives conditions favorable to rapid wear.

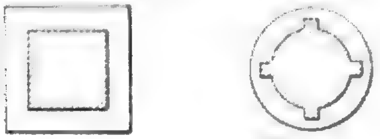
mon practice, had two main objections:

Firstly, it was difficult to maintain exactly the correct level of oil in the crank chamber; and

Secondly, the extent to which the oil arrived between the surfaces of the bearings and remained there was uncertain and imperfect.

Chauffeurs ascertained that their cars ran better, that their engines pulled better, were more silent, rattled less, when they gave them plenty of oil, and, as a consequence, cars, the engines of which are fitted with this type of lubrication, are seen belching forth clouds of blue smoke. While the public have suffered from the over lubrication pest, owners have frequently suffered from under lubrication, in the form of worn and sometimes seized engine bearings. It has been found better, therefore, to adopt the forced system of engine lubrication which is used in high speed steam engine practice, for the following reasons:

1. More Perfect Lubrication.—So perfect and consistent is the film of oil maintained by this system that there have been cases in which the connecting rod bearings have, apparently, never touched the crank pins, since the latter have shown throughout their surface a bronze color undisturbed by sign of wear or polish. In motor car work the engine sucks into the cylinders much road dust and grit, so that as good results cannot be expected as in the case of a stationary or marine engine; but for all that wonderful results have been obtained. For instance, the amount of wear in a connecting rod after 15,000,000 revolutions has been ascertained to be not more than one-thousandth of an inch of slackness.



Square or key-wayed shaft, which is expected to slide. The parts are required to slide (although, owing to oblique action or the parts being near the centre of the shafts, the load is intermittent), for example, in cars in which back springs are used as radius rods. This arrangement is sometimes applied to propeller shafts.

2. It is better that the oiling shall be constant and out of the control of the driver.—Under this system the engine is always sufficiently lubricated and never over-lubricated. The lubrication is not dependent, as in the case of splash oiling, on whether the last 5 per cent. of oil is or is not put into the crank chamber.

Car Lubrication.—The lubrication of parts of the car other than the engine is, as a rule, dreadfully neglected. To oil the joints, etc., situated under a car is a dirty job, which does not appear to recommend itself to most chauffeurs. Those who have been coachmen dread lubrication lest the car should look greasy or oily; but if these men could only realize the havoc which is played with their master's property by want of lubrication, they would—for they are, as a class, excellent, honest and painstaking—make it a rule to get into a suit of overalls, lubricate every part, and end up by cleaning off surplus oil, thus satisfying their cleanly instincts.

Proper Lubricants.—Next, let a warning note be sounded as to what kind of oil to use. This can be roughly outlined as follows:

1. Do not use thin oil.
2. Do not use stiff grease.
3. Use oil of ample viscosity (body), and of good lubricating properties.
4. Use the very thickest oil, that will always be liquid, for all parts except the engine.

Lubrication, to be thoroughly effective, must be susceptible to capillary attraction and gravitation. Much could be said on this subject, but I abstain for fear it should not be interesting to many, although too much emphasis cannot be placed upon the importance of this matter. Reverting for one moment to a question of design, it should be added that there are points where the film of lubricant cannot be continuously maintained. In these positions, the ball bearing and the case hardened surface come as a valuable aid to the designer.

In summing up it seems to be of the utmost importance that the designer should provide:

1. Satisfactory (and, as far as possible, automatic) means of lubrication.
2. Ample or thoroughly case hardened surfaces.
3. Protection against mud and water.

The Runabout in South Dakota.

By A. E. Beaumont.

South Dakota, with its broad stretches of level prairie and its splendid highways, both natural and improved, offers an unusually appropriate field for the runabout or light automobile and, considering the newness of the country, an astonishingly large number of this class of machines is in use throughout the State.

A symposium of interviews with doctors, real estate agents, contractors, traveling salesmen, rural mail carriers and others, reveals that the one advantage that stands out to mark the superiority of the runabout over the horse and carriage is almost entirely a matter of saving time. This saving of time is not alone apparent in the superior speed of the machine over the animal, but also in hitching up, unhitching, watering, feeding and giving rest to a horse, all of which are constant annoyances to one who uses the old method of getting over the country. There is also the uncertainty incident to the vagaries of the animal, and business and professional men make no small matter of the reliability of the automobile, which gives them greater freedom from the petty annoyances that detract from their capacity for business.

THE BANKER.

A country banker, who has had long experience with the various duties that accompany the pursuit of his business in a new country, speaks very enthusiastically of his experience in substituting the runabout for the horse. He said:

"As a country banker I do a large and diversified collecting business, and a large part of this work carries me into the rural districts. The clerical force in my bank is necessarily limited, and I find it inconvenient to spare a man from the bank to make long drives into the country to make collections for machinery firms and other supply houses. When I used a horse and buggy for this country driving it was necessary to have a man out during almost every afternoon of the fall season, when most of the collections are made, and frequently the collector would be unable to drive back to town the same day, and I would have to reckon with the additional expense and loss of time incident to remaining out in the country over night, and driving back the next day.

"After I purchased a runabout there was a decided saving in time, expense and inconvenience. I would have the auto ready at the bank door at the close of business in the afternoon, and jumping in, I would speed away 10, 20 or more miles into the country, see my man, and return in the twilight or dark. The machine would not require the attention on arriving at home that I would have to give to a horse, and I could have my supper and still have the evening left for work or rest.

"The advantages of the runabout in my business are so apparent that I would not go back to the horse and buggy under any consideration. During one busy season I hired an extra automobile for use after banking hours, as I found it more profitable to send out two men at that time than to spare one from the bank all day.

"An important part of our work is clerking sales. There are always farmers selling out and moving to some other part of the country. They hold big sales and the bank takes charge of them and passes on the paper that is given in exchange for stock, machinery, grain, etc., as the sales are seldom for cash. It will not do to leave this important credit work to an inexperienced man, and I usually clerk the sales myself. I send a man in my runabout to distribute handbills advertising the sales all over the country, and I use the machine in going to and from the sales, at a great saving of time and energy."

THE REAL ESTATE DEALER.

By far the larger amount of the time of a real estate dealer in a farming State like South Dakota is taken up in showing prospective purchasers over the country. Frequently a party of a dozen or more come from Eastern States on specially arranged home seekers' excursions, and they must be taken care of by the dealer. Real estate men in this State are using the runabout consistently for this purpose. Members of the party are taken in different directions. It is not good policy to take a large load of purchasers at one time, and the real estate dealer is much more likely to make a sale if he takes one or two men to see just the kind of a farm they are looking for, and gives them his personal attention. Here is where the runabout gets in some of its best work.

Garages are maintained in some of the smaller towns that are dependent largely upon the real estate men for their existence. A real estate firm may have one or two machines, but there are times when they have use for more. When they have a prospect of making a deal they are not niggardly about paying for the use of an automobile and a driver for a day's run. One real estate dealer said:

"I would rather have one prospective purchaser and take him out alone in a smart little runabout than to have two and take them out in a cumbersome and slow-moving livery rig. A customer is flattered and complimented by being taken out in an automobile. Besides that, there is a comfortable and prosperous note in the steady roll of the exhaust and the easy, gliding motion of the runabout that makes the occupant of the machine feel at peace with the world. After a spin over the country at a pretty fast clip I find that my customers are in a better mood to close a deal than at any other time."

THE DOCTOR.

Of all the South Dakota business and professional men who have expressed themselves in favor of the runabout instead of the horse, none are more enthusiastic or positive in their statements than the physicians. Most of those whose practice is not extremely large have dispensed altogether with the inevitable hired man or driver who is a necessary part of the establishment of every physician who depends upon horseflesh to take him to and from the homes of his patients. The cities have more physicians than the towns alone can support. All of them depend largely upon the country practice for their livelihood. When they drive horses they must have the best, with considerable speed and endurance. It is not uncommon for a physician to purchase a new horse every year, disposing of one of his old ones to a livery stable. Not many horses can keep up the pace that is required of them by a doctor with a large country practice for more than two years. It will be seen that in this there is a large item of expense.

The runabout, on the contrary, not only keeps it up but positively thrives on the speedy trips. Some of the older doctors, who have driven horses for twenty or thirty years, professed great scorn for the "chug-chug" machines which some of the younger members of the profession commenced to use several years ago. These old doctors may now be seen spinning along in runabouts of their own. Their prejudices were overcome in a very short time after a few jolts like the following:

Mrs. Dash, wife of a wealthy farmer was taken suddenly ill with an acute complaint. Her daughter hurried to the telephone which now connects all the prosperous farms with the city systems.

"I suppose you want Dr. Blank, Ma?"

"Oh, no," says Mrs. Dash between groans. "I can't wait for him. Call Dr. Bright, he has an automobile."

After an illness of two weeks, Mrs Dash recovers and comes to town, meeting Dr. Blank on the street.

"I hear you have been ill, Mrs. Dash," says the doctor, stiffly.

"Yes, doctor, and I knew you wouldn't like it, my employing Dr. Bright, but I was taken so sudden, and was in such terrible pain, I had to have help right quick, and you know Dr. Bright has an automobile. Why, he pulled into our yard in less'n a half hour after my daughter called him up, and you know it's twelve miles from our place to town."

Dr. Blank looked thoughtful, and a short time afterward was noticed talking to an automobile dealer and inquiring the prices on light runabouts.

A UNANIMOUS VERDICT.

There are other business and professional men who use the light runabout in their work, but the banker, the real estate dealer and the physician use by far the larger number in this section of the country. A great many are used for pleasure alone, but outside of the three above named classes, the prosperous South Dakota farmer is perhaps the best patron of the dealer in runabouts. His machine is of inestimable value to him in the busy season when it is necessary to come to town for repairs or supplies. Taking them all together, the verdict of those who have substituted the runabout for the horse in South Dakota is unanimous. Not one of them has been heard to mention a single particular in which the old method of travel on country roads is superior to the new, the modern, the quicker and the altogether more satisfactory use of the automobile.

Some Things Learned in 23,000 Miles of Driving.

By W. O. Hunt, M. D.

After twenty-three years' practice in a residential city with good roads, but many quite steep hills, using only horses, in October, 1904, having seen the advantages of an auto, I purchased a single cylinder, air cooled runabout, disposing of two horses and keeping one for emergencies. During the nearly four years I have had a varied experience and feel that I can give some good advice to my colleagues in the profession who are uncertain about the availability of an auto. The first winter I laid up the auto for about three months; since then I have continued to run it most of the winter. The chief trouble came from punctures and consequent delay in responding to perhaps an urgent call.

I had a very good man, who understood the machine thoroughly, and kept it in good condition, and while the repairs were quite heavy, the machine was out of commission for only short periods. Two years ago I put on solid rubber tires, hoping to escape the frequent delay from punctures. For six months I had no anxiety in that respect, but the machine and myself suffered from the constant jar and pound of the unyielding tires. The roads being macadam, with numerous cross gullies and depressions and frequent paved car tracks, made life miserable, and I cut them off and threw them away, replacing them with pneumatic tires. The third day I had a puncture, and I at once put on leather tire covers, and have had no trouble since from punctures. The expense of the car has been rather high, repairs averaging $150 to $200 per year, the car costing altogether $550 to $600 per year for upkeep.

I have now purchased a light four cylinder touring car, which enables me to take all hills at high speed, take the family riding, and gives me a reserve car. I have sold my horse and carriages, and cut loose altogether from such means of locomotion.

I figure that I can keep a second car cheaper than I can a horse, as both cars will seldom be in use at the same time and they cost nothing when idle. I would advise a physician with family to have two cars, a runabout and light touring car, dispensing with a horse altogether, as it is very seldom in winter when a car cannot be used. I think a water cooled car advisable, as with the anti-freezing mixture the danger from cold can be avoided; my air cooled car heats up if going any distance and cranks harder in very cold weather. A runabout should not weigh over 1,200 pounds; it should have two to four cylinders, and not cost over $800, with top, storm apron and lights. It should have puncture proof covers on the rear tires only, as the front tires seldom get punctures, and the covers reduce the speed of the car somewhat. Have the machine thoroughly overhauled once a year; it will cost $50, but will pay in the better running of the car and the increased security from the wear and tear of small parts. Another point is not to wash your cars too often; mine are washed with hose, sponge and chamois, not over ten times a year, when covered thick with mud. As a rule, an oiled cloth is best for everyday use to remove not only dust, but also a moderate coating of mud. It will not scratch or mar the varnish, and will keep the gloss of the car much longer, as my car testifies.

Gasoline should be bought in 100 gallon quantities, and kept in a tank in the yard. I have an ideal arrangement for a garage; my land slopes in the rear so that under the house, on a level with my drive, I have a room 25x20 feet, which gives room for two cars, a work bench and storage shelves; it is well lighted by windows and electric light, has a cement floor and walls, a plastered ceiling and double outside doors. Hot water pipes for the rooms above go through it, furnishing plenty of heat.

NEW VEHICLES AND PARTS

Hewitt Five Ton Truck.

The Hewitt Motor Truck.

The Hewitt Motor Truck Company, 10 East Thirty-first street, New York city, has brought out a gasoline motor truck chassis to which a wide variety of bodies are applicable.

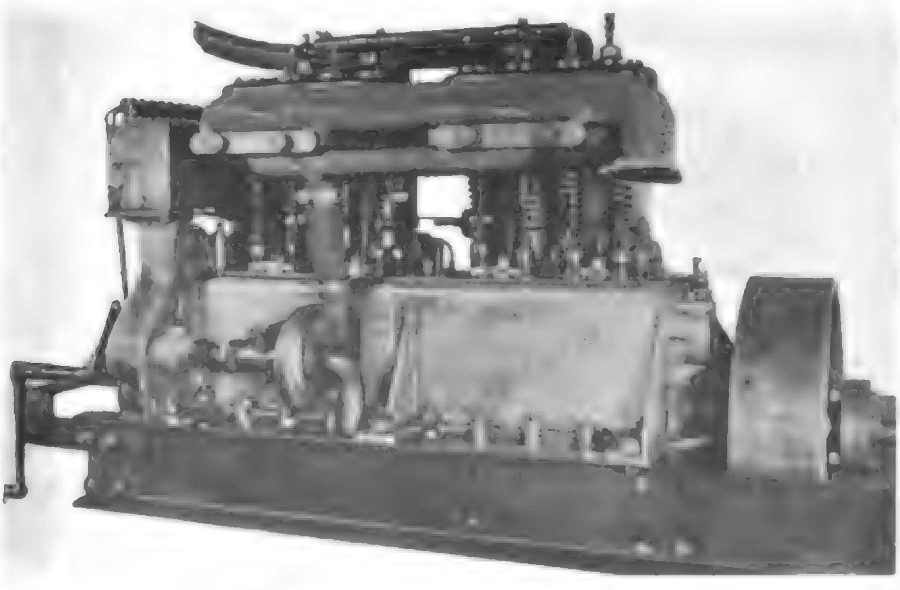
The pressed steel frame consists of two tapered side members of horizontal V section, having a spread of 9½ inches at the centre of load, 6½ inches at front and 7 inches at the rear, with 3½ inch flanges, the stock varying in thickness from three-sixteenths to one-quarter inch. The length of the frame is 214 inches and its width 40 inches, the side members being united by six cross members of horizontal V section, disposed as follows and of the following dimensions: One forming the front of the frame and extending laterally beyond the frame line, and to the full width of the driver's seat of 7 inch spread with 3 inch flanges at the middle and 1¾ inch flanges at the ends. Another just at the rear of the forwardly mounted engine, of 5 inch spread and 2½ inch flange. A third at the rear of the planetary change gear, of 5 inch spread and 2 inch flanges, a fourth at the front of the countershaft and bevel gear housing with 7 inch spread and 2 inch flanges, another at the rear of this gear box, of 8 inch spread and, lastly, the rear closing member of the frame, of 7 inch spread and 3 inch flanges. All cross members are hot riveted to the side members, substantial gusset plates and reinforcements being employed where needed. These cross members are so attached to the side members as to be progressively lower toward the rear in order to provide a straight line drive.

The sub-frame which carries the power plant is 107 inches long and is supported by the cross members. It is slightly inclined downwardly toward the rear. Its members are of horizontal V section, of 4 inch spread and 2 inch flanges. All frame fittings, such as spring hangers and brackets, are of crucible steel, cast in graphite pots.

Semi-elliptic springs are used throughout, the front ones being 44 inches in length and consisting of leaves 3½ inches wide, the three upper ones being of three-eighth inch stock and the remainder of five-sixteenth inch thickness. The leaves are fishbacked to guard against disarrangement, and their number is dependent upon the conditions of use of the individual truck. The front springs are fixed at their forward ends in crucible steel hangers and their rear ends are slidably held.

The rear springs are 54 inches long, made up of 3½ inch leaves tapered at the ends and are slidably secured at both ends. They are fishbacked on the edges, and the three upper leaves are so proportioned as to carry the static load, leaving the remainder effective to take up dynamic effects. Both axles are of solid, rectangular section, hammer forged from the bar. The front axle is 3¾ inches in depth and 2½ inches wide, with Elliott steering forks of a vertical spread of 6¼ inches integral therewith. The rear axle is 3⅞ inches deep and 2⅝ inches wide and slightly cambered. The steering pivot and axle stub are forged integral, with the steering arm inserted on a taper in the pivot and secured by double nuts. A bronze and fibre thrust bearing is used between the pivot and the yoke. The steering linkage is of Shelby tubing with drop forged clevices, and all joints are fitted with bronze bushings having crossed oilways and supplied with oil filler caps. Left hand control is used, and the slightly inclined column, which carries a 20 inch oval section wheel, operates a rack and pinion device, the gear faces of which are hardened. This steering device is secured to the left hand end of the front cross member and its bracket is integral with the front spring hanger. Oil retainers are fitted to the two bearings of the column. The vehicle wheels are of Schwartz manufacture, of 36 inches diameter, with fourteen spokes and felloes 3¼ inches deep, and are each fitted with two Consolidated rubber block tires, the blocks of adjacent tires being staggered and individually replaceable. Two Timken roller bearings fitted with dust washers are used on each wheel.

The power plant consists of three units entirely separate and connected by universal joints; namely, the forwardly mounted engine, the two speed and reverse planetary gear and the bevel gear and differential combination, with cross shafts carrying the sprockets of the double chain drive. The four cylinder water cooled motor has cylinders of 4¼ inch bore and 5½ inch stroke, cast in pairs, with pocketed valves all on the



Hewitt Engine—Left Side.

left hand side. Its A. L. A. M. rating is about 29 horse power. An aluminum crank case, split on the bearing line, with two very large inspection doors on the left side, through which the connecting rods and pistons can be removed, is employed. The crank shaft is of carbon steel: of 2 inch diameter throughout with 1 inch cheeks, with 4½ inch pin bearings and having main bearings of the following lengths: 7⅞ inches at the flywheel end, 4¼ inches at the front end and 4¾ inches at the middle, bushings of special babbitt being employed, which are hand scraped when assembled and again after the engine has had 100 miles of road service. The 18⅝ inch, 115 pound flywheel is shouldered on to a flange forged upon the crank shaft end.

Gray iron pistons, 6½ inches in length, with four diagonally split rings above the pin, are used, the piston pins being of 1⅛ inch Shelby tubing, hardened and ground and fast in the piston lugs. An oil relief ring, with escape through the piston, is turned below the expansion rings. The drop forged connecting rods are 13⅞ inches long, of H section, and are bronze bushed for the piston pin. Nickel steel bolts are used to secure the rod tips, and babbitt bushings are employed. The timing gears are in a separate forward compartment with aluminum cover, the crank shaft gear being of steel and the cam shaft and auxiliary shaft gear of bronze, all being of 6 pitch and 1½ inch face.

All valves are interchangeable and of solid 5 per cent. nickel steel, with flat seats and 2 inch opening. The inlets are in the middle and the exhausts on the outside. The helical valve springs are of conical form, and readily removable. A three bearing, integrally forged cam shaft is employed, the bearings being bronze bushed and 3½ inches long by 2¼ inches in diameter. Straight line cams are used, and the push rods are in very long, hardened and ground dust guarded steel guides, the lifters themselves being of Norway iron. A clamp is provided for each pair of guides. Both inlet and exhaust manifold are on the valve side, the former being of the water jacketed type, and recently described in these columns. The manifolds seat in the ports on copper gaskets, two clamps being used for this purpose.

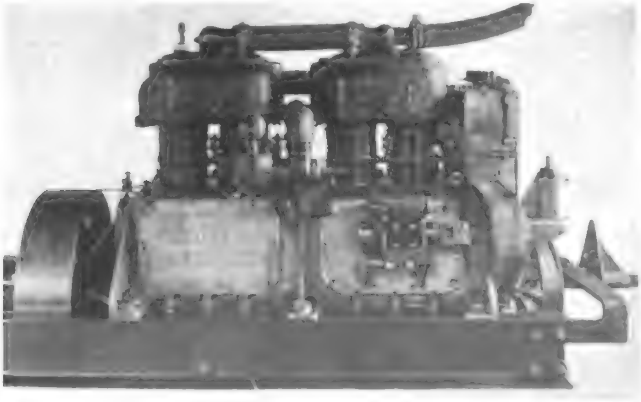
The 1½ inch Schebler carburetor is carried on the right hand side, and is provided with a balanced piston throttle. It is supplied from a 10 gallon tank, located on the dash, the feed being by gravity. Fuel is periodically supplied to this tank from a 26 gallon cylindrical steel reserve tank, hung from the right frame member, under the influence of air pressure created by a hand pump located under the running tank. All gasoline and air piping is of annealed copper tubing of one-quarter inch pipe size, standard one-quarter inch Lunkenheimer fittings being used. The piping is held in place by wood cleats. The reserve tank is fitted with a draw-off cock and 1¼ inch filler cap, as well as a settling pocket, and a gauze strainer is interposed between the reserve and the running tank.

Lubrication is by means of crank case splash and direct feed from a ten lead Lavigne oiler located at the front of the motor and driven therefrom by means of a vertical spiral gear shaft. A single sight feed is located on the dash. Three oil feeds go to the crank shaft bearings, one to each cylinder wall, one to the magneto drive shaft, one to the cam shaft compartment, and one to the case of the planetary gear. The inside walls of the crank case are ribbed in such a manner as to lead the splash to the main bearings, and an oil cock is fitted to the crank case to show when the correct oil level is reached. Two high "breather" tubes are also fitted to the case. In the oil line to each cylinder is interposed a small glass oil cup through which the lubricant passes. These act as a second visual indication of the feed, and also provide for the feeding of an excess quantity of oil if desired.

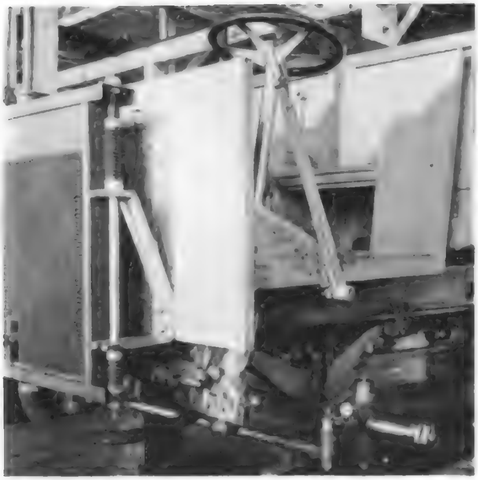
Ignition is by means of a Bosch magneto, universally driven, and located on the right side of the motor. No provision is made for advancing the spark, as extensive experiments have demonstrated that a certain fixed advance can be found which will secure a high torque through a wide range of speeds and still involve no starting difficulties. The magneto is covered with a waterproof boot, and the wiring is led through fibre tubes to the Renault plugs over the inlet valves. A simple short circuiting switch is located on the dash. Provision is made for the installation of a timer or distributor, if the purchaser so desires, but it is not a part of the regular equipment. The manufacturers recommend that a duplicate magneto be carried, and the arrangements are such that in case of damage to the magneto it can be very readily removed and the spare one be substituted, the timing being automatically adjusted by the coupling device.

Cooling is effected by means of a Livingston radiator, of very ample capacity, which is held in a pressed steel frame. This frame is provided with a spring support to guard the radiator against shocks. Two side brackets, forwardly projecting from the dash, guide the radiator frame on spiral springs, and the arrangement is such that the radiator in its frame may be removed without disturbing any other parts. Water connections are of 1¾ inch non-collapsible Diamond rubber hose, with a fabric covering which renders it oil proof. Circulation is effected by means of a centrifugal pump, gear driven from the shaft, which operates the lubricator through a universal connection. The radiator fan is carried upon a bracket rising from the front cross member of the frame, the fan shaft being carried in two Timken bearings in an oil chamber. A 1¾ inch flat belt is used for the drive. The fan pulley on the crank shaft is on a left hand thread, and the starting crank ratchet goes on outside of this on a right hand thread, making a very secure arrangement. The starting crank is permanently attached. The muffler is mounted under the left hand countershaft. It is extremely easy to get at the engine. Its location is further forward than in most designs, thus sacrificing a minimum of useful space, being just between the two box seats. These seats are separately removable, being held in position by hasps. A sheet metal bonnet, strapped into place, covers the upper part of the motor, and its removal renders accessible the valve and spark plugs. Removing the seats fully exposes both sides of the engine.

Connection between the motor and planetary gear is made by means of a dumbbell type of universal joint, the jaws of which are internal and external spur gears with specially cut teeth allowing of about 5 degrees angular difference between the connected shafts. The universal shaft is of 1½ inch diameter. Upon its removal the engine or planetary may be separately lifted



HEWITT FIVE TON ENGINE—RIGHT SIDE



Driver's Position and Radiator Support of Hewitt Five Ton Truck.

off the frame. The two speed and reverse spur planetary gear of the two shaft type is assembled upon its special frame, making it a complete unit, and then bolted to the subframe. The gears are of 1½ inch face and of six pitch and the ratio between the low and high is about 1 to 3.2. New Departure ball bearings with oil cups are used for both front and rear bearings. The reverse and low gear straps are steel castings lined with Raybestos. These are floated at their backs and spring cleared to avoid dragging. The tightening device is a very ingenious cam device which does away with all complicated linkage. A cone clutch faced with Raybestos engages the high gear, and the maximum pressure of engagement is limited by springs between the male member of the clutch and the setting device, which is of the spool and finger type, the spool being bushed on the shaft, the fingers carrying hardened rollers and the parts being fitted with oil retainers.

Pedals are employed exclusively for gear changing, the depression of any pedal automatically throwing out any other gear which may be engaged. In starting the car the low gear pedal is pressed, and when the car has gathered momentum it is only necessary to depress the high gear pedal, when this gear is engaged and the low automatically thrown out. Throttle control is also by means of a treadle of liberal width, operating a push pedal. Between the planetary gear and the bevel gear and differential unit is a dumbbell universal exactly as used between the engine and the planetary. The bevel gear casing is cast in two main sections, separating on the bearing line, and a removable cover plate is provided. A Timken roller bearing is used, one each side of the bevel pinion on the longitudinal shaft. The pinion is hardened and is cut with sixteen four pitch teeth. It meshes with a hardened bevel gear on the differential case, which has sixty-four teeth, thus giving a reduction between the planetary and the countershafts of 4 to 1. The differential is of the three pinion bevel type, the gears having twenty-four teeth and the pinions sixteen teeth, all of four pitch. A steel casting forms the differential frame. The countershafts are on two Timken roller bearings each, and the case is bolted between two cross members of the frame, making a very rigid construction. The countershaft brackets, which carry the outside Timken bearings, are massive, heavily ribbed steel castings, bolted to the side members between the two cross members above referred to. An extreme degree of rigidity is secured by the gear box, the two countershaft brackets, the main frame members and the two cross members, rendering the alignment of the countershafts unalterable. The sprockets are tapered and keyed onto the countershaft ends and take Whitney roller chains of 1¼ inch pitch and 1 inch width, the usual ratio being 14 to 56 or a 4 to 1 reduction, although this is changeable at the desire of the purchaser. The rear sprockets are each secured to the wheel spokes by fourteen nickel steel bolts. The front ends of the distance rods are steel castings, with turnbuckle adjustment, pivoting on a pin (with oil cup) passed through a boss on the countershaft bracket. The rear portions of these distance members are of pressed steel, with drop forged fittings, which fit into a crucible steel bronze bushed spider acting as the main rear axle bearing and the bracket for the brake band pins and also as the dust pan for the brake drum. The thrust of the distance rods is in line with the outboard Timken bearing of the cross shaft.

The two hub brakes are actuated by means of a pull lever at the left of the operator, working over a hardened ratchet. Their shoes are 3⅛ inches wide, Raybestos faced, and act on a 20 inch cast steel hub drum. The brake shoe pins are bronze bushed, and the shoes are cam actuated.

Effective braking is also obtained from the use of the low and reverse gears. This chassis is stated to weigh 7,000 pounds and is designed for a speed not exceeding twelve miles per hour. The wheel base is 138 inches and the overall length is 225 inches.

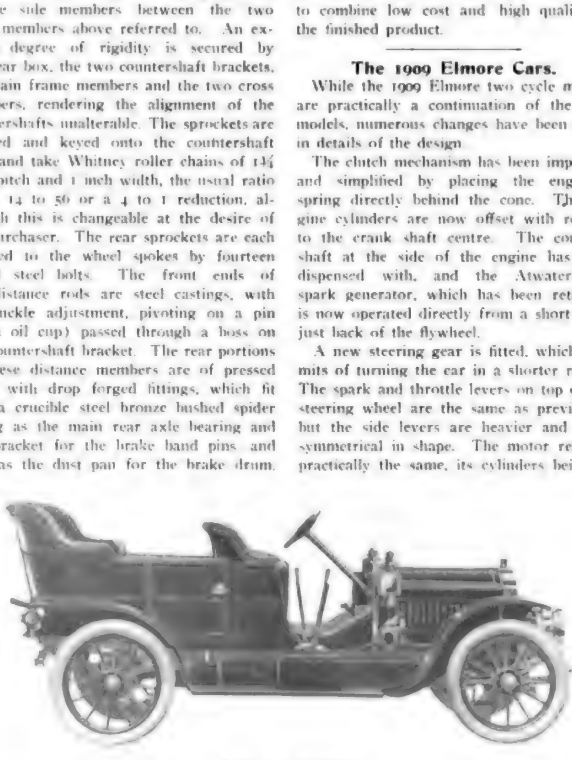
The design of this truck has been worked out very carefully by the engineers of the Hewitt Company, in the light of extensive experience in commercial car practice, all the elements being specially designed for the required service. It is the policy of the company, however, very largely to leave the carrying out of its designs to production specialists of the highest grade, rather than actually to produce all parts in their own factory. The engine and transmission are built in their own shops, but recourse is had to the best outside specialty manufacturers whenever possible in order to combine low cost and high quality in the finished product.

The 1909 Elmore Cars.

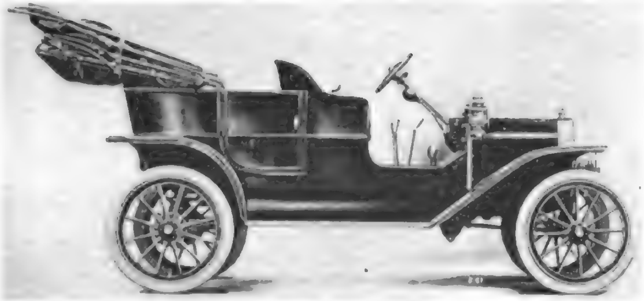
While the 1909 Elmore two cycle models are practically a continuation of the 1908 models, numerous changes have been made in details of the design.

The clutch mechanism has been improved and simplified by placing the engaging spring directly behind the cone. The engine cylinders are now offset with respect to the crank shaft centre. The countershaft at the side of the engine has been dispensed with, and the Atwater-Kent spark generator, which has been retained, is now operated directly from a short shaft just back of the flywheel.

A new steering gear is fitted, which permits of turning the car in a shorter radius. The spark and throttle levers on top of the steering wheel are the same as previously, but the side levers are heavier and more symmetrical in shape. The motor remains practically the same, its cylinders being of



The 1909 Elmore.

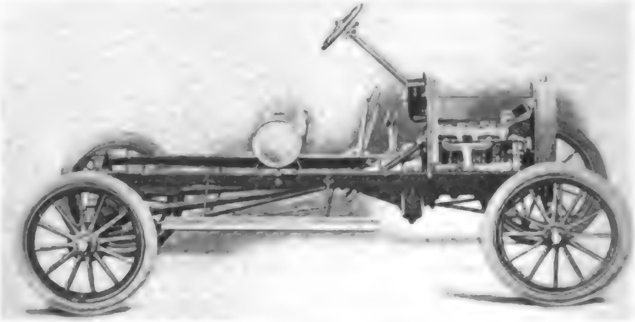


Ford Model T, With Touring Body.

4½ inch bore and 4 inch stroke. The Elmore Company uses its own make of float feed, automatic carburetor. The engine is lubricated by feeding oil into the intake pipe.

The brakes are of the same general arrangement, but of increased power. There is no change in the axles and wheels, except that the front axle is so formed as to lower the frame about 2 inches. On the propeller shaft a double annular ball bearing is now used. The rear platform spring is retained, but a new design with more and thinner leaves is used, giving improved riding qualities. No change has been made in the change speed gear and the universal joints, both of which are of stock pattern.

The body of Model 33, the three cylinder car, remains of the straight back type with round corners. The tonneaus of both the three and four cylinder models have been lengthened, the former 1 inch and the latter 2 inches. Special attention has been given to the upholstering of both models. The dash and trimming on the three cylinder model are of mahogany, and the four cylinder model of Circassian walnut. The height of the radiator has been increased 1½ inches, with the object of making the outline of the bonnet more symmetrical with the other lines of the car. A new model added to the line of 1909 is a landaulet on a three cylinder chassis, which is claimed to very satisfactorily take the place of a limousine. Considerable changes have been made in the roadster body, which will be furnished the coming season with interchangeable rumble seats, a single rumble and a double rumble seat, which enables the car to be used either as a two-passenger car with flat deck behind, as a three-passenger car with single rumble seat and luggage box, or with double rumble seat and luggage box.



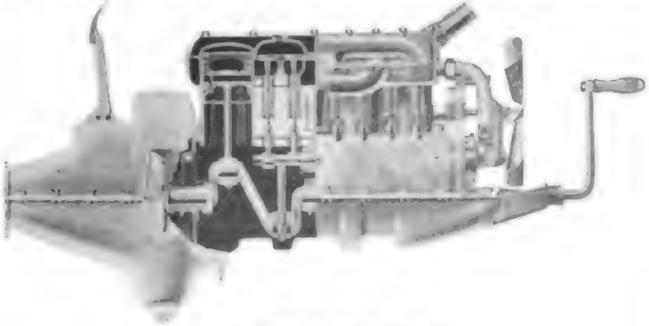
Ford Model T Chassis.

The Ford Model T.

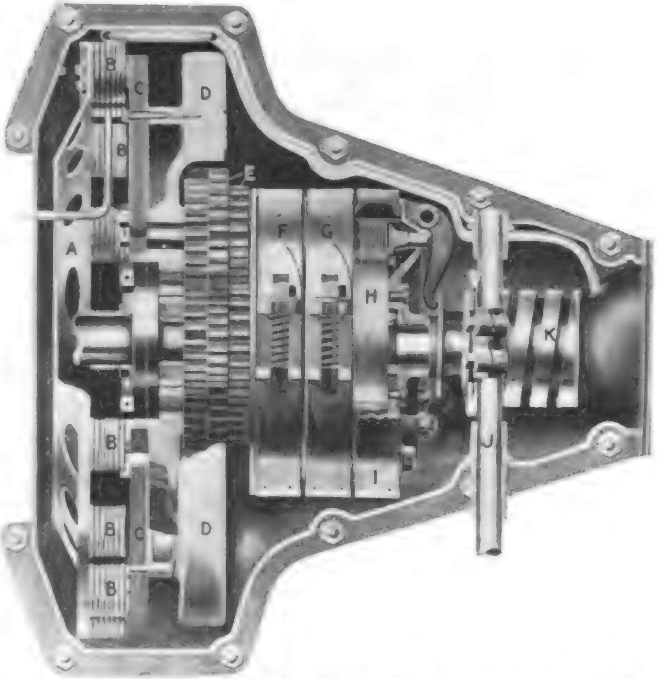
In addition to their well known low priced four cylinder runabouts, which are continued unchanged, the Ford Motor Company, of Detroit, Mich., have placed a larger four cylinder car upon the market. This new machine, which is known as Model T, is primarily a touring car, but is also furnished with runabout body for such customers as may wish a larger runabout than the earlier model. It is a new car all the way through and departs widely from standard practice in many details. These departures are made with three objects in view: to render the parts more accessible, to make the car lighter and to reduce the manufacturing cost and hence the price. The motor is a four cylinder vertical with 3¾ inch bore and 4 inch stroke. All four cylinders and the upper half of the crank case are cast together. The water jacketed cylinder heads are a separate casting, however, being screwed to the main casting by twelve bolts. The valves are in pockets on the right side, so by removing this head casting, which covers cylinders and valve chambers, all the valves and pistons are exposed to view. The valves and tappets are of the plain, non-adjustable, mushroom type, similar to those used on the smaller car. The cam shaft and crank shaft are one piece forgings, each with three ample bearings. The only unusual feature of these parts of the engine is that the upper half of the crank shaft bearings are formed in the cast iron of the crank case, while the caps are babbitt bushed. The pistons are 4 inches long and have four rings. The connecting rods are light I section forgings.

The cooling water is circulated by a gear driven centrifugal pump; the water enters the cylinders at the front end of the valve pockets, passes to the head casting at the back side of the rear cylinder, and returns to the radiator from the front of the head casting.

The lower half of the crank case is formed of pressed steel, and it extends back to enclose the bottom of the flywheel and the movable spherical casing which surrounds the universal joint. Another pressed steel piece, bolted to the top of this, completes the enclosure of the flywheel, change gear and spherical joint.



Power Plant of Ford Model T



A, support for magneto coils; B B B, magneto coils; C C, permanent horseshoe magneto; D D, flywheel; E, planetary pinions; F G, low speed and reverse brake bands; H, disc clutch for high speed; I, transmission brake; J, clutch rocker shaft; K, high speed clutch spring.

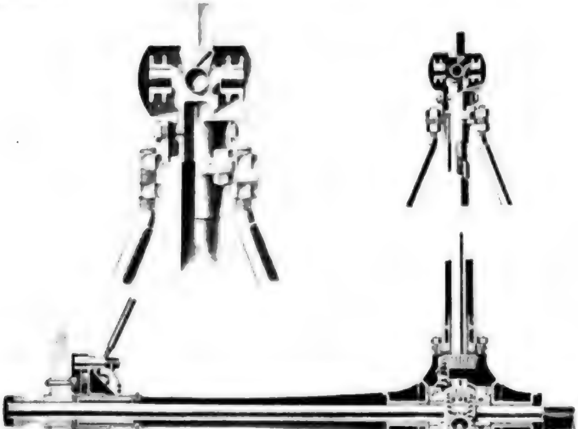
Permanent magnets, substantially U shaped, are bolted to the forward face of the flywheel. Close in front of their outer ends is a series of insulated coils, mounted in a circle of practically full flywheel diameter with their axes parallel with that of the crank shaft. They are supported upon a stationary spider. As the flywheel revolves this magnet and coil combination, which is similar to that used upon some types of large alternating current generators, produces a current which is used through a four unit coil and timer to cause the ignition spark.

To the rear side of the flywheel are attached the planet pinion sets of the two speed and reverse charge gear. The drive is from these to pinions on the central shaft, thus reversing the usual order This arrangement permits the use of large diameter gears without additional weight for encasing, and, it is claimed, eliminates the noise usual in spur planetary gears. The low speed and reverse clutches are spring steel bands, fibre faced. The high speed clutch is composed of a number of steel discs. All these parts are fully enclosed in the oil-tight, pressed steel case.

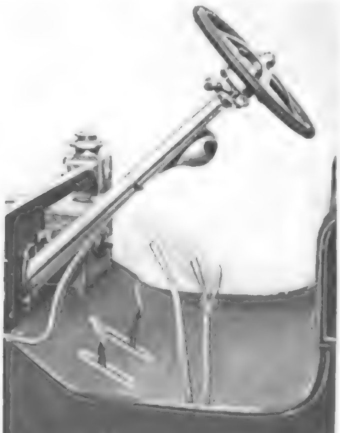
The rotation of the flywheel supplies oil for the engine, change gear, universal joint, drive shaft, etc. This oil is fed through a system of channels to the bearings and compartments. After the required level is reached the excess returns to the flywheel case.

The rear axle casing is made of pressed steel, in two halves, joined in the vertical centre plane of the gear housing. As in previous Ford models, angular braces connect the outer ends of the axle housing to the forward end of the propeller shaft casing near the spherical joint.

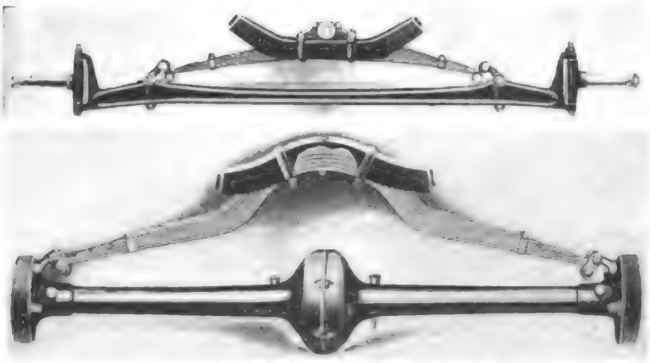
The spring suspension is unique. It consists of two semi-elliptic springs mounted crosswise of the car directly above the axles. These springs are linked to the axles, and their centres are firmly held in and clipped to the inverted U shaped front and rear cross members of the frame, which are curved to fit the spring arch. The axle alignment is maintained by diagonal



Universal Joint and Final Drive



Control.



Front Axle and Spring.
Rear Axle and Spring.

braces from front and rear axles, which are ball jointed to the flywheel casing. This arrangement gives an exceptionally flexible running gear, and the weight of the car is carried so near the wheels that the stresses in the axles are very low. The frame is a typical pressed steel construction.

The two forward speeds are controlled by one pedal, while the transmission brake is operated by the other. Expanding brakes acting on the rear wheel drums are operated by a hand lever, while a second hand lever controls the reverse. Spark and throttle levers are under the steering wheel rim within easy reach. The steering gear is of the Ford planetary type, and its shaft is enclosed in a pressed steel case which also covers the spark and throttle control shafts. The carburetor is adjustable by a handle on the dash.

Thirty by 3½ inch tires are used in the rear, and 30x3 inch in front. The wheel base is 100 inches, while the thread is 56 inches. Owing to the use of heat treated vanadium steel in every forged part and to the special constructions employed, the weight of this car is only about 1,200 pounds, with five passenger touring body.

This car is an even better manufacturing proposition than the smaller model, and the writer who has seen the cars in process of construction can easily see that there will be a good margin of profit even at the low price quoted, for all parts of the machine are well adapted to production in large quantities.

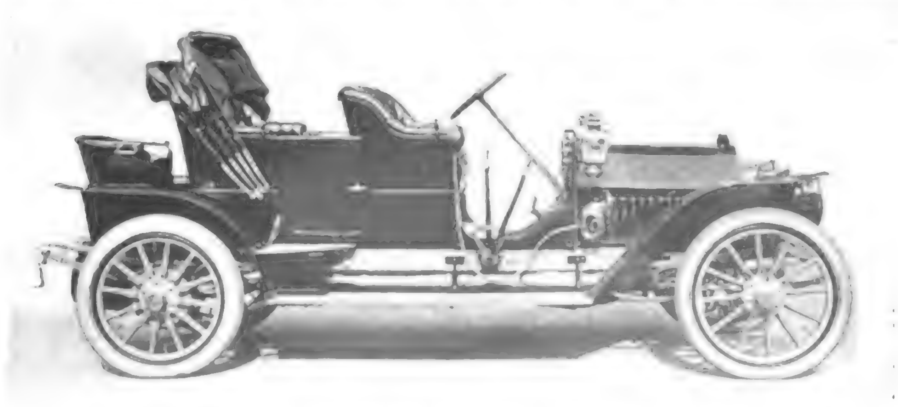
The American Locomotive Close Coupled Car.

Following the demand for a four-passenger car on which, if the owner desires to drive himself, the mechanic may be carried on a "dinkey" seat at the rear, the American Locomotive Automobile Company, of Providence, R. I., has brought out a special close coupled body, shown in the illustration on a 40 horse power chassis. The car thus fitted is said to provide the advantages of a runabout with a carrying capacity of four, which the runabout does not give. The passengers in the rear seats are placed between the axles, thus distributing the weight between the front and rear springs and eliminating any "buckboard" effects, as when the rear seats are over or in the rear of the rear axle. The consequence is that a variation of one or more passengers in the load does not affect the riding qualities of the car appreciably. The space aft of the rear seats is provided with longitudinal walls, so that parcels, etc., may be put there without being spilled. The "dinkey" is entered from the rear and its support forms a convenient box for sundries, etc.

The only changes in the 1909 American Locomotive car are in the rearrangement of the oiling system on the 22 horse power, this being now the same as on the 40 horse power model. The oil tank is carried at the left side of the crank case, just under the horizontal web connecting the case with the frame, the filler cap projecting up through the case. The oil is forced from the tank to sight feeds on the dash by means of a small gear pump driven from the cam shaft by special gears. The two sight feeds have micrometer adjustment, the oil flowing by gravity to the crank case. In other respects the four models marketed for 1909, viz., a 16 horse power taxicab chassis, 22 horse power town car chassis, and 40 horse power and 60 horse power touring chasses, are exactly the same as those built in 1908.

The Schacht Runabout.

The Schacht Manufacturing Company, of Cincinnati, Ohio, manufacture a high wheel type of automobile, a description of which was inadvertently omitted from our Runabout Number. The motor is of the four cycle, two cylinder, opposed, water cooled type, set crosswise in the body at the rear. It has a bore and stroke of 4 inches and is rated at 16 horse power. The cylinders are cast with integral heads and water jackets, with the mechanically operated inlet and exhaust valves in a pocket in the upper side of the combustion chamber. The



American Locomotive 1909 Model, with Close Coupled Body

SCHACHT MODEL K RUNABOUT.

cooling water is circulated by a gear pump to the radiator set in front in place of the dash. Ignition is by high tension jump spark, with spark coil and batteries. Power is transmitted through an aluminum friction disc—secured to the end of the crank shaft—to a paper covered friction pulley secured to the differential housing, but free to slide back and forth thereon. The differential is on the countershaft, which runs on roller bearings, and final drive is by side chains to the rear wheels. The body is reinforced to carry the power plant, and is supported on two long side springs of the Concord type, connected at the ends to the front and rear axles. Reach rods connect the axles together. One set of brakes is used, acting on the hubs of the rear wheels and operated by a pedal. The wheels are fitted with 1⅜ inch solid rubber tires and run on Schacht patent ball bearings. Steering is by wheel through rack and pinion. The control is by one pedal for the brakes and a side lever, which shifts the friction pulley on the differential casing, thus giving the different speeds forward and reverse. The wheel base is 74 inches.

The Moore Direct Reading Automobile Power Meter.

This instrument, the invention of C. R. Moore, Professor of Mechanical Engineering at Purdue University, is being put out by the Central Laboratory Supply Company, of Lafayette, Ind. The meter is designed to show directly the horse power given off at the wheels of an automobile at any and all speeds, and also the speed in miles per hour.

Referring to the figures, it will be noted that two wheels, A, spaced equal to the tread of the automobile, project slightly above the floor line of the testing room. The automobile to be tested is placed so that its rear wheels rest on these two wheels. The front wheels are blocked, and the machine is securely locked to a post in the rear. The two wheels A are mounted on a shaft B, running in roller bearings at D. When the automobile is started, it itself cannot move, but it drives the two wheels A. To place a load on the engine, an absorption brake F is connected to the end of the shaft. The power required to drive the brake is changed or adjusted by means of a hand wheel which is within reach of the operator. The power meter B is connected between the shaft B and the spindle of the brake. The power meter consists of two discs, C, one fastened to the shaft B, the other to the shaft of the brake.

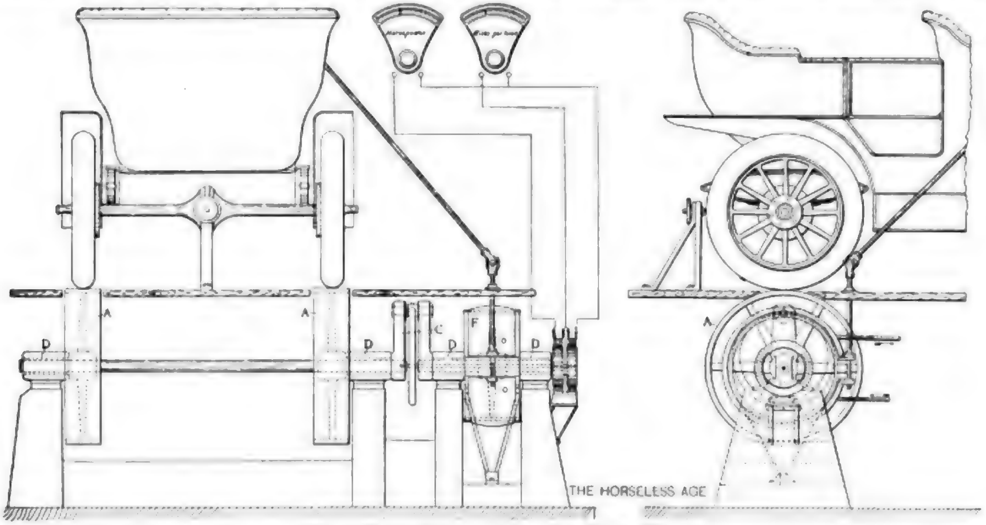
These two discs are connected by a spring. All of the power developed by the machine is transmitted by the rear wheels to the wheels A, by them to the shaft B, then through this spring to the brake. The spring is of special design, made so that twice the sine of half the angle of deflection is proportional to the "torque" or "twist" deflecting the spring. Now, when the brake is applied the spring is deflected by the power developed and transmitted through the spring.

Connected to each of the discs of the power meter is a small revolving field alternating current generator. The generators are exactly similar, and produce nine sine waves of voltage, and at the same potential.

It is well known that when two alternating currents of the same voltage and wave form are directly opposed to each other no current will flow, but if the alternating waves are displaced, then a current will flow proportional to twice the sine of one-half the angle of displacement. The alternators are connected so that they exactly oppose each other when there is no power being transmitted when there is no deflection of the spring.

A voltmeter is placed in the circuit between the two small generators, and since no current flows when the spring is not deflected, it shows no reading, or zero power.

When power is transmitted by the spring it is deflected, and the two alternators are thrown out of step by an amount equal to the deflection of the spring. The torque is proportional to twice the sine of half the angle of deflection of the spring. Also the



MOORE DIRECT READING AUTOMOBILE POWER METER.

current through the voltmeter is proportional to twice the sine of half the angle of displacement of the two alternating currents, which is also the deflection of the spring, so that the current through the voltmeter at a given speed is directly proportional to the "torque" or "twisting" effort.

Here is where the advantage of using electrical means of indicating comes in. The horse power transmitted is proportional to the torque multiplied by the speed. Likewise the voltage of the little generators also changes with the speed as well as the deflection of the spring, so that increasing either the speed of the twist will increase the reading correspondingly. Therefore, the voltmeter gives a reading proportional to the product of the speed and the torque; i. e., it reads the horse power transmitted. This is the only instrument of the kind which has been devised to read horse power directly on the scale of an instrument without any mathematical calculations whatever.

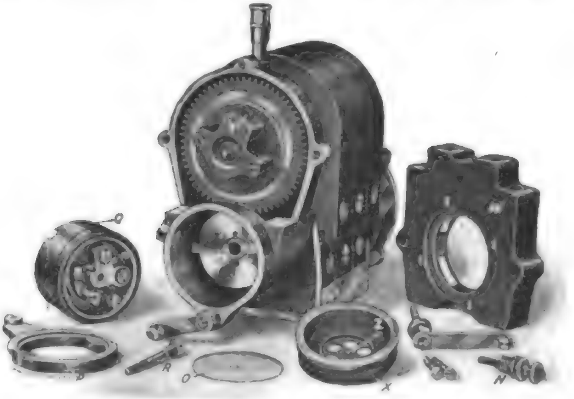


FIG. 1.—MAGNETO WITH INTERRUPTER AND DISTRIBUTER

Further than this, since the voltage of either one of the alternators alone is proportional to the speed, by connecting one directly to a voltmeter, the miles per hour or revolutions per minute can be read directly on the instrument. The shaft, wheels, brake, etc., are all placed below the floor, so as to be out of the way. The instruments for reading horse power and speed can be placed on a table; or, better yet, mounted on the wall.

The use of revolving field alternators for indicating the displacement of the spring does away entirely with contracts, brushes and moving electrical connections, which makes the apparatus reliable and unlikely to get out of order. Recording voltmeters may be used instead of, or in connection with indicating instruments, so that a complete record of the test is made.

The range of the power meter can be quickly changed by removing the spring and inserting another of greater or less strength. The brake is supplied with an attachment so that if need be the spring can be quickly calibrated. All of the springs are sent out with the instrument standardized, so that this procedure is seldom necessary.

The meter is easy to operate and care for, and is adapted to the use of gasoline, gas or heavy oil engines, as well as to automobiles, by suitable connection between the flywheel and the drum on the meter.

The Unterberg & Helmle Magneto, Type LE.

The magneto shown herewith is unique in that the intensity of its starting spark is a maximum, whether the crank be turned slowly or fast. This is an advantage, aside from the saving of physical effort which it brings. Some carburetors produce an uncertain mixture on priming, and if the engine be stopped for a short time and restarted the good mixture remaining in the cylinders is pumped out by the act of spinning the crank, and there is some chance of the carburetor failing to furnish the right mixture at once. The arrangement of this starting mechanism has been described in a previous issue of THE HORSELESS AGE.

PEERLESS
Specialty Comp
NEW YORK

PEERLESS SPEEDOMETER.

The improvements in this new model are in the interrupter and in the condenser. In Fig. 1 the interrupter and distributor are shown. N is the ground connection to the switch, O is the cover plate over the interrupter, P the ring carrying the interrupter cams, Q the housing of the interrupter, R the central screw which holds the interrupter in place, S the platinum contacts, and T the fibre "roller" (which is not a roller at all, since it does not turn). The ring P is bronze and the cams are of hardened steel, and consequently non-wearing against the roller T. If T were to turn as a roller it might wear flat in spots and work irregularly, but since it does not turn this is impossible. The object of using steel cams is to guard against the possibility of unequal wear and consequent unequal timing.

The interrupter is located and driven by a crosswise key in the back plate against which it screws. The removal of the screw R makes it easy to take out the interrupter for examination, cleaning or adjustment, and avoids the uncertainty of working in cramped quarters in the dark.

The condenser V is set into the back of the housing Q and is held by the threaded disc U. It may be replaced in a moment.

The molded insulation W of the distributor has four contacts embedded in it, against which rubs the carbon brush Y. W is removed by undoing three screws. The safety spark gap consists of a metal point, connected to Y, from which the spark jumps to the point Z in the cover X. A mica

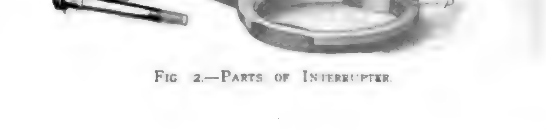
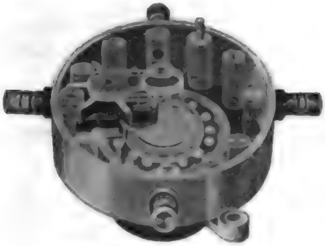


FIG. 2.—PARTS OF INTERRUPTER.



The New Roch-O Timer.

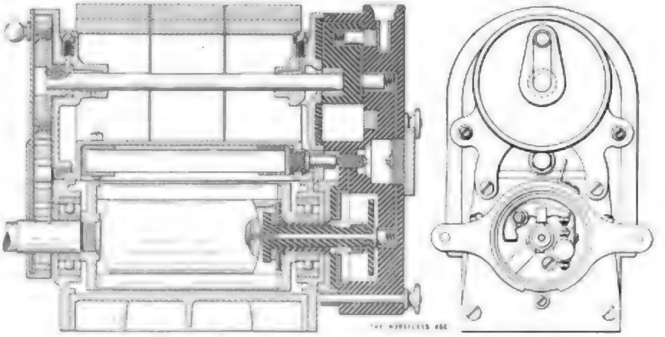
window in X permits the spark to be seen without risk of exploding gasoline vapor. A turn of the spring clip seen permits X to be removed, thus exposing the distributor for cleaning.

The Peerless Speedometer.

The Peerless Specialty Company, 1876 Broadway, New York, are manufacturing a speedometer of the centrifugal governor type. As the cut shows, the instrument has three dials, the circular one of which shows the speed. The indicating hand shows the speed at which the car is traveling, and the other the maximum speed attained. This hand can be set back to zero at the will of the operator. Both hands are non-fluctuating, being operated by a centrifugal governor. At the top of the instrument are the mileage dials, the right hand one indicating the miles for the trip, being capable of being set back to zero at any time, and the left hand dial indicating the total mileage of the season. The driving cable is strongly constructed of sixteen steel wires woven in four layers of four wires to the layer. It is enclosed in a flexible brass tube lined with steel. The instrument itself is finished in polished brass and once installed requires no attention. This company makes a specialty of repairing all makes of speedometers.

The Swiss-Komet High Tension Magneto.

Frank J. Wende, of 350 Wabash avenue, Chicago, Ill., is marketing the Swiss-Komet high tension magneto for either four or six cylinder motors. The instrument combines the primary and secondary windings on the armature, so that no coil is required. The field consists of three permanent magnets secured to a bronze base. The make and break device is operated by the armature, which latter is provided with a steel collar having two spurs upon it at 180° from each other. These "wipe" a block fastened to the breaker arm, and separate the platinum point on this arm from a stationary platinum button. A curved spring holds the arm in contact when not actuated by the spurred collar. The distributor is fitted above the make and break, and consists of a circular vulcanite block having a brass arm and spring pressed carbon brush which makes contact with four (or six) brass blocks in the vulcanite casing enclosing the distribution mechanism. Leads are taken from these blocks to the respective spark plugs in the cylinders. The driving gears for the distributor are fitted at the opposite end, and the distributor shaft passes inside the arch formed by the magnets, and runs in two plain bearings which are kept dust tight by means of spring pressed balls. To oil these bearings it is only necessary to push the balls downward with the spout of the oil can, and inject the oil. All gearing is provided with dust tight covers. The time of ignition is regulated by oscillating the casing containing the make and break, a handle being fitted for the purpose. The condenser is placed in a separate casing above the armature casing, and is connected by solid strips or plugs to the windings, no wiring being used within the instrument except that of the primary and secondary windings. The armature shaft runs on imported ball bearings, and oil tight washers are fitted to prevent any oil getting into the armature casing. Access to the condenser connections is obtained by means of a circular threaded plug, which also forms part of the secondary circuit from the winding to the distributor through the vulcanite casing. If the timing lever (attached to the make and break casing) be thrown back to the fully retarded position, contact is made between a short circuit spring fastened to this lever and the distributor piece for the condenser, and the primary circuit is closed, thus preventing a secondary current being generated. Great accessibility is a feature of this magneto, the distributor being laid bare by removing three finger screws and lifting off the vulcanite distributor casing, exposing the make and break device at the same time. Access to the driving gears for the distributor is obtained by simply pulling a knob on the metal plate covering the gears, which will then immediately come away, exposing the gears and the ball bearing on the armature shaft.



Sectional and End Elevation of Swiss-Komet Magneto.

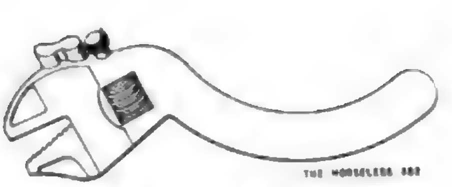
K-W Magneto Fitted to Ford Car.

The New Roch-O Timer.

The Rochester Timer Company, Cox Building, Rochester, N. Y., have brought out a timer of novel design, of which an illustration is shown herewith. The shaft or revolving portion of this timer is provided with two laterally extending arms, between the ends of which two star wheels are carried. When the shaft rotates these star wheels engage with a series of contact posts spaced around the circumference of the timer immediately inside the shell or housing. The teeth of the star wheels are so proportioned as to give a sliding or wiping effect at the point of contact. A particularly interesting feature of the design is that the contact is established by one star wheel and broken by the other, so that any sparking which may occur in the timer will not affect the contact surface where contact is first established.

Special K-W Magneto for Ford Runabouts.

The K-W Ignition Company, 32 Power avenue, Cleveland, Ohio, have a new magneto known as the Model F, which has been designed especially for use on four cylinder Ford runabouts, but which can be used on any automobile. The makers claim that it will start any engine that can be turned over by hand without the aid of batteries. The accompanying illustration shows the



Billings & Spencer "S" Pipe Wrench.

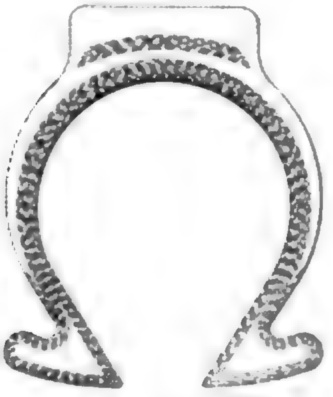
method of mounting this magneto on Ford Models N, R and S cars, by bolting it to the frame of the car. It is equipped with a pulley and driven from the flywheel by means of a one inch belt, the makers advising the use of a stretchproof and waterproof belt, such as they claim their Aquab belting to be. They also recommend this magneto for use in connection with their K-W master vibrator.

Billings & Spencer Improved Adjustable "S" Pipe Wrench.

This wrench is a new product of the Billings & Spencer Company, and in general design follows the lines of their regular adjustable "S" wrench, but has a serrated jaw for use on pipe. Every part is a drop forging from steel, and the jaws are hardened. The sliding jaw is fitted in a double groove, which adds greatly to the strength of the tool. The patent thumb screw on the adjusting curl securely locks the jaw at any desired opening. The wrench is made in three sizes, 6 inches, 8 inches and 10 inches.

The Courtney Tire.

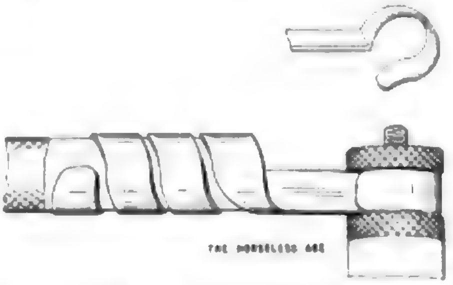
The Courtney Rubber Company was incorporated some months ago with a capital stock of $100,000, to manufacture pneumatic tires of the flat tread type only. They have their headquarters at 1976 Broadway, new York city, and a factory at Plainfield, N. J. This tire, which they term "Extra Heavy Flat Tread" type, as shown in cut, is built up of nine layers of fabric near the beads and eight layers under the tread, the whole being firmly vulcanized together. In the tread itself are incorporated five layers of fabric with an intervening layer of rubber about one-eighth of an inch thick between them and the inner wall. By this construction, it is claimed, an extra long life is given the tire, as it can be easily retreaded a number of times, the inner wall being built strong enough to stand long use. These tires have been tested on the road, the company stating that they obtained a mileage from a 36x4 inch tire of the round tread type which they made at first of 6,336 miles, and after retreading 1,500 miles more, when the tire was cut up for exhibition purposes. This tire was on a car weighing 5,000 pounds. These tires are made in both American and metric sizes and weigh from two to five pounds more than the ordinary types. The company also make inner tubes with the inner circumferential wall considerably heavier than the rest, thus strengthening that part of the tube which is always subject to considerable damage from contact with the rim, etc.



Cross Section of Courtney Tire.

The Mosler "Pull Push" Connector.

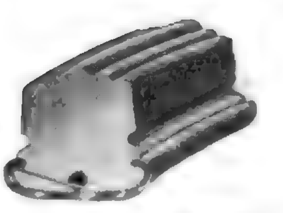
A. R. Mosler & Co., of 163 West Twenty-ninth street, New York City, are bringing out the "Pull Push" connector for spark plugs, an illustration of which is here given. The connector is made of flat brass strip, about one-quarter of an inch wide, bent to a hook at one end and twisted to a spiral at the other. The insulation of the cable is cut away and the strands of the cable are bent backward, the cable being then screwed into the spiral, which holds it firmly. The connector is simply drawn on the tightening screw at the top of the spark plug, the hook taking around the smaller collared portion of the tightening screw and forming the contact. To disconnect the connector is simply pushed forward, when it leaves the screw at once. The connector is adapted only to Mosler spark plugs.



Mosler "Pull Push" Connector.

Swinehart Motor Buggy Tire.

To meet the strong demand for a special motor buggy tire, having increased traction in mud and sand over the ordinary carriage tire, the Swinehart Clincher Tire and Rubber Company, Akron, O., have placed on the market a special motor buggy tire of their regular clincher auto design. This tire permits the use of clincher rims, which they claim is the most secure fastening on the market, and allows the tire to wear down to the rim before coming off. It is made in sizes larger than the ordinary carriage tire, of specially compounded and cured rubber, which is claimed to give it increased resiliency, and the grooved side design permits a wider tread, which affords added traction in mud and sand.



Swinehart Motor Buggy Tire.

Government Bulletin on Dust Preventives.

We have received a copy of Bulletin No. 34 of the Office of Public Roads, dealing with the subject of "Dust Preventives." It was written by Provost Hubbard, assistant chemist of the office. In preparing this bulletin a careful review of all the available literature on the subject was made, and this was supplemented by results secured from actual experiments conducted by the office. In a preface by Allerton S. Cushman it is stated that the problem of dust prevention and road preservation is not isolated, but is clearly connected with all other problems pertaining to the construction, maintenance and use of roads in general, and the author's aim has been to bring out these interrelations. The bulletin contains a number of very clear halftone illustrations, printed on heavy coated paper, showing the effect of automobile traffic on ordinary macadam roads, and the methods of application of various dust preventives.

California Endurance Run Postponed.

The proposed endurance run between San Francisco and Los Angeles, Cal., and return, a distance of about 1,100 miles, has been postponed from September of this year to the spring of 1909. The run arranged by the owners of tourist cars over the same route this fall was so successful that at least a hundred entries are expected for the free for all tour next May. The contestants are to leave San Francisco on April 29, proceed east into the San Joaquin Valley and stop for the night at Fresno, near the head of the valley. The following day the cars are to cross the Tehachapi Mountains and make the run to Los Angeles, returning in the same length of time over the route that follows the coast of the Pacific Ocean and emerges from the valleys of the coast range at Santa Cruz. The various automobile associations will endeavor to induce the different counties along the route to repair the damage to the roads caused by the winter rains before the date of the run.

COMMUNICATIONS

On Some Points of Runabout Design.

Editor Horseless Age:

My study of the runabout commenced with a popular make of the vintage of 1902, a crude affair in design, workmanship and material. It was a water cooled single cylinder, with that mechanical paradox, a planetary transmission (the first thing the demonstrator told us was to use the slow speed as little as possible). Brakes were on the transmission and the differential, the latter, a thin ribbon of steel, surrounding the excessively lubricated drum. Its application always seemed to accelerate speed. The gasoline feed was through a gauze wick, controlled by a needle valve operated from the seat. The air gate was also operated from the seat, and as there was no means of holding it where placed, the vibrations of the vehicle would cause it to close in a short time, necessitating frequent readjustment. The enumeration of all its faults would be tiresome. That the manufacturers succeeded in getting innocent purchasers to accept and use such an imperfect mechanical product can only be explained by the fact that the buyers were suffering badly from automobile craze, and by the generally prevalent ignorance of the simplest mechanical principles.

Slowly the makers improved mechanical details in their machines just enough to keep prospective buyers in line. Their progress has been very slow, inexcusably so. What excuse can there be for the utterly inefficient brakes on one of the most popular runabouts of today? The improvements in design have been mostly limited to the motor, the single cylinder giving way to two or more, thus adding to the power and improving the torque, and making it practical (with smaller bores) to cool them with air instead of water. I believe there are but two single cylinder cars of merit made in this country, though the single cylinder voiturette seems to be popular in France, and justly so, judging from their remarkable achievements in the Grand Prix race.

Some four years ago a high wheel runabout was put on the market which was remarkably original in design. Aside from the high wheels which enabled it to ride over obstacles more easily, it had a simple two speed transmission (selective gears constantly in mesh), and double rope and pulley drive to rear wheels. The slippage of this rope enabled the designer to dispense with the differential, and gave the further advantage of lessening the damage to the vehicle from road shocks. The latter is quite evident, though the makers do not seem to lay much stress on it. This vehicle was looked upon as a freak for a time, but since then a large number of high wheelers have been brought out (one by a large industrial concern) having the two speed planetary and sprocket chain drive to rear hubs, pinning their faith to the high wheels to cover all the ills of automobile design. One prominent maker on these lines frankly discarded the planetary and substituted a two speed sliding gear, and has now added a spring drive. In general the runabout of today, with the exception of the buggy type, has extremely low wheels, which are fit for use only on perfect roads, and the two speed planetary gear we had from the beginning.

The difficulties and annoyances incident to using the prevailing type of runabout, aside from starting and motor troubles, are largely due to the low wheels and pneumatic tires; the inability to get maximum power on low speed for any length of time, necessitated by use of the planetary, and the absence of a yielding element between the engine and driving wheels, which rigidity subjects the whole mechanism to the damaging effects of road and other shocks, causing frequent repair bills and making the life of the car extremely short. Spring drive has been thoroughly tried out and found remarkably efficient, evening up the torque and saving the gear and tires, even permitting the successful use of solid rubber tires on wheels of comparatively small diameter. The need of this yielding element in the transmission can readily be seen by any intelligent person who will note the difference in the effects upon a car driven over an obstacle with gear in, and when coasting, and will analyze the cause.

The need of a yielding element between the front wheels and the steering wheel or tiller is too often ignored. Some years ago the maker of a well known runabout substituted a steering wheel with irreversible gear for the old tiller without in any way increasing the strength of the spindles or connecting rods to meet the greatly increased strains. The breaking of some part in the steering mechanism from crystallization is the most serious accident that confronts the automobilist. "Sudden and unaccountable loss of control of steering gear" is the stereotyped verdict in accidents from this cause. A yielding control and vigilance in its care is the price of safety. Will some of the manufacturers kindly tell us how long their steering gears will stand the incessant hammering to which they are subjected before crystallizing, and when it will be safer to have the parts annealed or replaced?

The dangerous hand cranking nuisance is still with us, and no relief in sight. Abroad, particularly in France, starting devices are commonly used in the best cars, and are found quite efficient.

It is evident that the ultra conservatism of our manufacturers is not in keeping with the spirit of rapid progress, though it may be good business policy at present. Betterments and improvements in runabout construction will come only through persistent demands from prospective purchasers.

J. O. Hobbs.

The Vagaries of Lightning.

Editor Horseless Age:

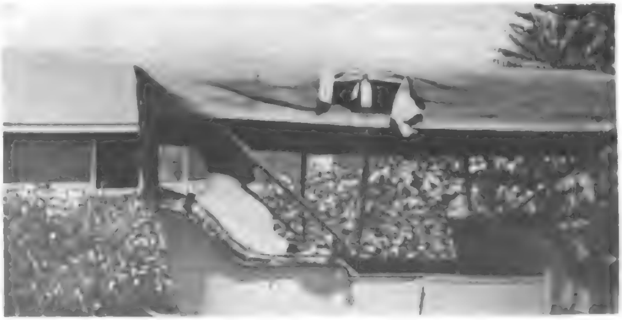
I enclose a photo which may be of interest to you. Our car was struck by lightning over our heads during a storm up near Brewster, N. Y. The bolt bounded off and went into the ground at the foot of a sapling beside the road. The bow of the top was wood, which was chewed up and splintered for quite a distance back from the place where the lightning struck. If it had been steel I presume the bolt would have traveled down through it, and the metal body of the car and off to the ground somewhere else. We were stunned, but not hurt. No other damage was done to the car. It is the first case of this kind I ever heard of.

Clair Foster.

Picric Acid—Cork Inserts for Brake Shoes.

Editor Horseless Age:

I have seen somewhere that if a small proportion of picric acid is mixed with the gasoline used in automobiles it will increase the speed of the vehicle. I have an idea that it might prove disastrous to the motor, but don't see just why. I under-



Car Top Struck and Damaged.

stand picric acid is used in connection with the manufacture of explosives. But it is just the reason why that I don't understand. Is it a common practice to use this acid or not?

The use of cork inserts in cone clutches is becoming very common, but I have not seen any reference to the use of same in brake bands. Can you name a case where cork inserts are thus used? H. L. A.

[Picric acid is an explosive, and is therefore dangerous to handle. It is an "oxygen carrier," and by its addition to the fuel a somewhat greater amount of oxygen is introduced into the cylinder during the suction stroke, consequently more fuel can be burned per cycle. With the greater charge the pressure developed on explosion is, of course, greater, and all working parts of the motor are strained more than they were intended to be by the designer. We believe that the admixture of this acid with automobile fuel is a very uncommon practice. Competent chemists have warned against the dangers of the practice. When you are using the acid you have an explosive in your fuel tank, which is not the case if you use gasoline, which lacks the oxygen necessary for its combustion.

Cork inserts in brake shoes have been used by the F. B. Stearns Company, the Matheson Motor Car Company and the Chadwick Engineering Works.—Ed.]

Pope-Waverley Plant Sold.

By order of Judge Anderson, of the Federal court at Indianapolis, the Waverley plant of the Pope Motor Car Company in that city was sold to a party of Indianapolis capitalists on Friday, September 25, the price paid being $200,000. The deal was negotiated by H. H. Rice, manager, and Wilbur C. Johnson, assistant manager, of the plant, and who are identified with the new concern, which has been incorporated with $225,000 capital stock as the Waverley Company.

Those who are interested in the new company are William B. Cooley, Carl von Hake, Hugh Dougherty, William F. Kuhn, William Kothe, Jr.; John R. Love, Hugh M. Love, Joseph C. Schaf and Burton E. Parrott. The company has organized with Mr. Cooley as president, Mr. Rice vice president and general manager, Mr. von Hake treasurer, and Mr. Johnson secretary and assistant manager. The new management states that there will be no radical changes for the present. The company wil continue to manufacture the present models of Waverley electric pleasure vehicles, delivery wagons and trucks. It is understood the new company will take charge as soon as the transfer can be made, which will be within a few days.

Herbert H. Rice entered the employ of the Pope Manufacturing Company in Boston in 1892, taking charge of the advertising department. In 1895 he moved to Hartford with the sales department, and three years later took charge of the Providence branch. He has been at the head of the Waverley branch since 1904. During his sixteen years' connection with the Pope organization he has acquired a wide experience in the manufacture of all types of automobiles, gasoline, steam and electric.

Mr. Rice has always been identified with the more serious side of the automobile business and automobile organizations, as distinguished from the advancement of the automobile in the realm of sport. He was a delegate from Rhode Island to the Chicago convention when the American Automobile Association was formed. As secretary of the Rhode Island Automobile Club, and later with the Indiana Club, he has been a very active worker for just and fair laws affecting the industry.

W. C. Johnson entered the employ of the Pope Manufacturing Company at Hartford in 1893, and had two years of factory training in connection with the manufacture of the Columbia bicycle. Later he entered the sales department. Upon the organization of the American Bicycle Company he went to New York, taking charge of the domestic sales department as assistant to the vice president, later having charge of the Eastern distributing branch at New York. When the Popes bought out the American Bicycle Company, he was given charge of the agency department at Hartford. In 1903 he spent six months in Europe closing out the Pope foreign branches. He came to the Waverley branch as assistant manager in 1904. While Mr. Rice has had the general management of the Waverley branch, Mr. Johnson has been in charge of the sales end.

New Firm to Handle Pope-Hartford Cars in New York City.

The Pope-Hartford Auto Company, recently incorporated, will handle the Pope-Hartford car in New York city and vicinity. The officers of the company are H. E. Holt, of New York city, president; B. E. Fincke, of Newark, N. J., treasurer, and C. A. Dickson, of Newark, secretary. The latter two have been engaged in the automobile business in Newark for some time. The new company has secured quarters at 1853 Broadway, the store in which the Wayne agency was formerly located.

A Third Pope Dividend Ordered.

Vice Chancellor Howell in Newark, N. J. has directed the receivers for the Pope Manufacturing Company to make application for the transfer of sufficient funds to pay a third dividend of 25 per cent. on all allowed claims against the company. Chancellor Howell has also signed an order authorizing the receivers for the Pope Manufacturing Company to settle the so called Unzicker claim of $575,000 against the company by the payment to the Unzickers of $100,000. The Unzicker claim grew out of the abrogation by the Pope receivers of a lease of the Pope Manufacturing Company of a factory property in Chicago owned by the Unzickers. The lease was for twenty-five years, at a rental of $25,000 a year, and at the time of its annulment had still seventeen years to run. The sum of $80,000 was set aside by the receivers to allow for the claims when the second dividend was paid to creditors. This sum will now be paid to the Unzickers, who will receive the remaining $20,000 at the time the fourth, or last, dividend is paid.

New Garage for Ohio Town.

The Auto Sales Company, Findlay, Ohio, has leased the building formerly occupied by Harry Bennett at the corner of Front and Main streets, and very extensive alterations are being made, a full cement floor being laid down in the main building, which is 44x90, one story, frame, and a concrete block addition, 24x44, is being erected, to be used exclusively as machine shop. A charging room and a supply store room are being provided. The improvement in the major portion will be completed and the machine shop will be ready by October 1. A general machine and repair business will be carried on, and Bert L. Marvin will be manager. Efforts are being made to secure the agency for Ford cars.

An Incandescent Mantle Lamp for Automobiles.

The *Autocar* describes a new lamp known as the Tito Landi, manufactured by D. Vorms et Fils, 14 Edmund place, Aldersgate street, London, in which gasoline vapor is used to heat an incandescent mantle. The general form of the new lamp is similar to the regular acetylene lamps on the market. The base is a double tank, the inner one holding the fuel and the outer one forming a protecting case for it. A lining of felt is placed between the two tanks to further protect the inner one from damage. The upper part of the base is similar to the ordinary incandescent lamp burner with the exception that gasoline vapor is used instead of coal gas and that the lamp must be heated before it is ready for use. For heating the lamp a special torch is used, which is lighted and placed at the base of the Bunsen burner, the time required for bringing the lamp to the required temperature for the generation of gas being from one to three minutes. At the end of this time the gas is turned on and a match applied to the top of the mantle, as with the ordinary burner, and the air valve regulated until the greatest brilliancy is obtained. Several tests of the lamp have been made which have shown it to be satisfactory as to the amount of light projected. The mantle seemed to stand up very well under the vibrations of the car, although its life is still to be determined. The manufacturers state that these lamps should be placed as far away from the engine as possible, and recommend the dash as a suitable place for them, special rubber cushions being supplied for attaching them. If a durable mantle can be made these lamps should find favor with motorists.

LEGISLATIVE and LEGAL

Legal Pointers.

Compiled by X. P. Huddy, LL. B.

RIGHT OF WAY.

Automobiles have no right of way over other vehicles.—Lorenz vs. Tisdale, 111 N. Y. Supp. 173.

OVERTAKING AND PASSING.

An automobilist, on overtaking and attempting to pass two heavily loaded trucks on a road, drove his automobile between the rear truck and a passing carriage, cleared the rear truck, and struck the head one, resulting in injury to himself and his automobile. The drivers of the trucks had stopped their horses to rest them, and the head truck was nearer the centre of the road than the other. Because it was dark and the road curved sharply and was on a grade, the automobilist's lights did not disclose the trucks until he was upon them. Held that the accident was caused by the automobilist's own negligence.—Lorenz vs. Tisdale, 111 N. Y. Supp. 175.

LEAVING HORSE ON STREET

One who leaves a horse unhitched on a city street takes the risk of what the horse may do. It was held in Henry vs. Klopfer, 147 Pa. 178, that such an act raises a presumption of negligence, and puts on the party doing it the burden of showing circumstances which justified or excused it. How strong the presumption will be must depend largely on the circumstances. If the horse is young, skittish, nervous or unused to the sights and sounds of a city street, the presumption would be strong, while, if he is old, staid and accustomed to city life, it might be very slight. But even a staid and veteran horse may be liable to sudden fright. It is a matter for the jury.—Stevenson vs. U. S. Express Company, Pa. Leg. Intel., July 3, 1908, Sup. Ct.

DUE CARE IN DRIVING.

A driver of a vehicle in a street must exercise care to prevent reaching a point from which he is unable to extricate himself without colliding with another vehicle, and, omitting such duty, the greatest vigilance on his part when the danger arises will not avail him.—Altenkirck vs. National Biscuit Company, 111 N. Y. S. 284.

PASSING.

The rule that one who attempts to pass another on the highway going in the same direction has the right to do so in such manner as may be most convenient under the circumstances, and where damage results to the person passed the former must answer for it, unless the latter by his own carelessness brought the disaster on himself, is applicable to one attempting to pass a standing vehicle which he approaches from the rear.—Altenkirck vs. National Biscuit Company, 111 N. Y. S. 284.

"RIDING" AND "DRIVING" INCLUDE AUTOMOBILING.

The words "ride" and "drive" are not confined to animals. They are not limited in any manner whatsoever. Anything capable of being ridden or driven comes within the purview of those terms. They are apt words in the case of bicycles, motorcycles or automobiles, when ridden or driven.—State vs. Smith, 69 Atl. Rep. 1061; State vs. Thurston, 28 R. I. 205; 66 Atl. 580.

DRIVING AUTOMOBILE FASTER THAN COMMON TRAVELING PACE.

A most interesting legal question has just been decided by the Supreme Court of Rhode Island. An automobilist was prosecuted under an old Rhode Island statute which prohibited persons driving vehicles faster than "a common traveling pace." Just exactly what a common traveling pace is or should be was the fact for determination by the court. Since we have in our automobile laws specific prohibitions against unreasonable and dangerous driving, the decision of the Rhode Island Supreme Court is important and instructive. The opinion of the court says:

> It is clearly evident that the safety of the traveling public was the object sought by the act. Such safety could not be attained by permitting each vehicle, each horse or other thing, which could be ridden or driven, to go at a traveling pace possible to it. There could not be, with safety to the traveling public on foot, on horseback or in carriages, a traveling pace for each individual who rode in the streets or highways, fixed only by the rate of speed possible to the animal or thing which he rode or drove. Safety could not be attained only by requiring all to use that prudence and caution in the matter which was ordinarily used by prudent and reasonable men when driving in the streets or highways of thickly settled towns; that is, a pace which was reasonable and proper, considering the place and circumstances, a pace which was recognized by reasonable men as a common traveling pace.—State vs. Smith, 69 Alt. Rep., 1061.

PENNSYLVANIA LAW APPLIES ONLY TO OPERATORS.

The Pennsylvania automobile act of April 19, 1905, P. L. 217, applies to the operator of an automobile and not to the owner.—Comm. vs. David, 33 Pa. Co. Ct. Rep. 12.

IDENTIFICATION OF OFFENDER.

There can be no conviction for violating the speed law where the only evidence to connect the defendant with the case is the fact that according to the automobile register a machine having the same number as the one used in violation of the law belongs to the defendant.—Scranton vs. Hawley, 0 Lack. (Pa.) 65.

LIABILITY FOR CHAUFFEUR'S ACTS.

Where the chauffeur commits injury while driving for himself his employer is not liable.—Sawyer vs. Mitchell, 35 Supr. Ct. (Pa.) 69.

PLEADING.

In an action for negligence of the defendant's chauffeur in driving an automobile, a statement is sufficient which avers that the approach of the automobile frightened the plaintiff's horses, which fact the chauffeur must have seen, yet he continued to drive toward the horses at a high rate of speed, causing them to break from the plaintiff's control and run away.—Rupp vs. Snyder Automobile Company, 21 York (Pa.) 177.

Pennsylvania Good Roads Bills.

The Pennsylvania Motor Federation, a member of the A. A. A., is responsible for three bills to be presented to the Pennsylvania Legislature, all three having been drawn up by Joseph H. Weeks, of Rutledge, chairman of the A. A. A. good roads committee.

The first bill is constructed on Senator William C. Sproul's main highway bill, and provides for the appointment by the Governor of three citizens of the commonwealth, to be known as a State Highway Board, whose duty it shall be to determine the location of the State's main highways, and also to pass upon the application for State aid roads. The bill further provides that where main highways are constructed by the State, either telford or macadam, that a preservative substance shall be incorporated in the final layer of stone or superimposed thereon. This, it is said, will prevent the blowing away of roads as fast as they are built. Roads constructed of brick will not require the preservative.

The second bill provides that the State shall construct and maintain at its own expense all main highways, and that it should liberally aid townships in constructing and maintaining local roads.

The third bill provides that all money received by the State from automobile licenses be used for placing preservative substances on State aid roads that are built entirely of stone or shall be built hereafter.

A new automobile bill has been presented by S. Boyer Davis, chairman of the legislative committee. It provides for an increase in the automobile license. As a result of this bill it is estimated that in 1910 the State will receive at least $150,000 from licenses.

French Exports.

The French exports of automobiles have held up quite strongly during recent months, for while there was a decline of 13,000,000 francs in the exports for the first five months of the year, as compared with the same period in 1907, the decline for the first eight months is only about 8,000,000 francs. The exact figures are 80,547,000 francs for the first eight months of 1908, and 97,106,000 francs for the first eight months of 1907. Besides Russia, Algiers and Turkey, Great Britain, too, has increased its purchases of French cars, having taken machines to the value of 43,250,000 francs during the first eight months of this year, or substantially one-half of the total French exports. France's imports of automobiles dropped from 6,126,000 francs for the first eight months of 1907 to 5,010,000 francs. The decline in the imports was wholly at the expense of Italy, whose exports to France dropped from 2,004,000 francs to 1,052,000 francs.

Dissatisfaction with Indiana Road Law.

There is a movement on foot at the special session of the Indiana Legislature at Indianapolis to repeal the three mile gravel road law. Under this law, road improvements aggregating $10,000,000 have been made in the State during the last two years. It provides that upon the petition of fifty residents of a township a gravel or other improved road not exceeding three miles in length shall be built, provided it connects two other improved roads. Objection is being raised to the law by farmers because small towns and cities are taking advantage of the law by ordering paved streets under it, the law providing that the expense shall be equally distributed among taxpayers of the whole county.

Graft Charges Defeat Road Bond Proposition.

By the resistance of the voters of the incorporated cities and by the charges of graft in connection with the sale of the good road bonds of a neighboring county, a proposed bond issue of $615,000 for better highways was defeated in San Bernardino County, Cal., during the last week in September. The defeat was the first break in a series of bond victories throughout southern California, where the automobile has proven itself the most powerful factor in the creation of a network of passable and permanent roads. The defeat of the bond issue in San Bernardino County was largely due to the canker sore of corruption which has been festering in California politics for years. The neighbor of San Bernardino County, Los Angeles County, voted an issue of $3,500,000 in July, largely because an advisory committee composed of men of unquestioned integrity was to supervise the county supervisors in the spending of the money. A few days before the date of the San Bernardino bond election three of the Los Angeles supervisors, who had been beaten at the county convention for renomination, sold the entire issue to a Los Angeles banking firm at a private sale without asking for competitive bids and at a very low premium. As a consequence of the hue and cry raised by the newspapers the advisory committee obtained an injunction restraining the supervisors from perfecting the sale, but the harm was done and San Bernardino's bond issue failed to receive the required two-thirds majority. As a result of the defeat the county's tax rate was raised from $1.90 per $1,000 to $2.20. Next year another road bond election is to be called, and a million dollars will then be asked for.

Another Indiana Endurance Contest.

The second sealed bonnet, endurance contest of the Indianapolis Automobile Trade Association will be run Thursday and Friday, October 1 and 2. It is expected that about sixty cars will be entered, as a large number of entries have already been made. Leaving Indianapolis, the route will be to French Lick the first day, returning to Indianapolis over a different route Friday. The first day's run will be 131.2 and the second day's run 122.2 miles. The rules of the recent Glidden Tour will be employed and a different observer will be assigned to each car each day. There will be three classes, as follows: Cars costing above $2,500, to run 18 miles an hour; cars costing $1,500 to $2,500, to run 16 miles an hour, and cars costing under $1,500 to run 14 miles an hour.

Club Notes.

The Bay State Automobile Club formally opened its new quarters at the Hotel Carlton, Boston, on Tuesday night, September 22.

About a dozen automobile owners of Allentown, Pa., held a meeting on September 18 with the object of forming a local automobile club. Robert L. Stuart presided at the meeting and W. D. Schantz acted as secretary. Another meeting will be held.

The Bucks County A. A. was formally organized at a meeting at the Bucks County Country Club, Langhorne, Pa., recently. Dr. Harry Lovett was elected president, and Elwood Watson secretary and treasurer. Committees on bylaws, membership and incorporation were appointed at the meeting.

Automobile agents and private owners of Madison, Wis., have formed the Madison Automobile League, with W. E. Petrie as president; Dr. Frank Smith, vice president; A. E. Austin, secretary, and M. H. Conklin, treasurer. The league intends to hold an automobile day at the Dane County Fair, and has appointed a committe to look after the motor privileges on the drive around the Four Lakes, built by the Madison Park and Pleasure Association.

The Buffalo A. C. has concluded an arrangement with the Canadian Customs Department whereby members of the club may hereafter enter Canadian territory with their cars without being required to put up a bond. The privilege is limited to entrance along the Niagara frontier and to a stay of three days. It is necessary, however, to take out an Ontario motor vehicle license and to leave Canadian territory by the port of entry. By doing away with the bond requirement the club saves each member from $3.50 to $5 per year.

Legal Notes.

The Massachusetts Highway Commission has decided upon white letters on a blue background for its 1909 automobile license plates. It has been decided to issue a special license plate, bearing the letter D, to diplomats sojourning on the North Shore during the season, they being exempt from the automobile regulations under the International Code. A contract is to be let this week for 35,640 number plates, of which 5,000 individual plates and seventy five dealers' plates are to be delivered by December 15 and the remainder by February 1, 1909.

The attorney for the Chicago Motor Club and the Chicago Automobile Trades Association has advised the two organizations to pay the Chicago wheel tax under protest and then wait for the decision from the Supreme Court regarding the validity of the ordinance.

A considerable number of automobile speeding cases came up for hearing in the Court of Special Sessions at Jamaica, L. I., on September 22. Robert C. Vendeventer, of New York city, who was convicted of speeding for the second time, was condemned to a fine of $75 by Justices Forker and Ryan. Presiding Justice Wilken dissented from the ruling of the majority, having previously declared that he would send all second offenders against the speed law to jail.

Commercial Notes.

The People's Auto Car Company, of Calumet, Mich., have placed in commission a twenty-five passenger, 45 horse power Reliance motor bus.

The Hollidaysburg Motor Car Company, Hollidaysburg, Pa., are operating a daily automobile service between that place and Bedford, carrying both passengers and packages.

Chief Gardener Charles F. Murray, of Washington University, St. Louis, Mo., is using a runabout to haul a lawn mower for cutting the grass on the 150 acre campus of the University.

The Dan Canary Taxicab Service Company has been organized to operate a taxicab enterprise in Chicago. Arrangements are being completed for placing fifty taxicabs on the streets of the city in the near future.

The Mid-Missouri Transportation Company, on September 23, started an automobile service between Clayton and Gumbo, Mo. Two five-seated vehicles are used, two round trips are made per day and the fares charged at the rate of three cents a mile.

The Indianapolis post office has asked the Overland Automobile Company for an estimate of the cost of two automobiles it is planned to place in mail collecting service. It is proposed to have these automobiles meet the regular collecting wagons at certain points and rush the mail to the post office. Under the present arrangement the horse drawn wagons carry the mail collected over a large area of territory before delivering it to the post office.

The Common Council of Milwaukee has voted to purchase a touring car to cost not more than $3,500, for the use of Chief of Police John T. Janssen and the department. The department has been paying more than this sum each year for hiring automobiles for the use of detectives. Most of the other city officials of Milwaukee are already equipped with automobiles, and the council committee reported that it had found a saving in the use of motor cars of from one third to one-half.

MINOR MENTION

The Maxwell Taximeter Company is planning to erect a 45x140 building of brick, stone and reinforced concrete in Washington, D. C.

Walter Scott and Alexander Keeble, Lawrence, Mass., have begun the manufacture of "Brigham" motors in the Pillsbury Building in that city.

The Oakland Motor Car Company, of Pontiac, Mich., has been elected to membership in the American Motor Car Manufacturers' Association.

The Windsor Carriage and Delivery Wagon Works, 100 London street West, Windsor, Canada, has begun the manufacture of a buggy type of automobile.

The Peerless Motor Car Company has established a salesroom at its factory in Cleveland, where the cars can be shown to prospective purchasers and agents.

According to an item in a Detroit newspaper, the Cadillac Motor Car Company is putting on a very large force of men and is operating its factory with day and night shifts.

The assets of the Albany Automobile Company, New Albany, Ind., have been appraised for the Muncie Trust Company, receivers, at $1,891.34. It is the intention to sell the property.

The Cadillac Motor Car Company has moved its Detroit retail branch from the corner of Jefferson avenue and Brush street to a location on Woodward avenue, adjoining the factory.

The total number of automobiles assessed in the State of Minnesota this year is 3,516, the average valuation being $410. Last year 2,215 cars were assessed at an average value of $463.

The Reo Motor Car Company, Lansing, Mich., will turn out two models for 1909, a $500 runabout and a $1,000 touring car. The former will be a single cylinder and the latter a double cylinder car.

The Detroit branch of the Diamond Rubber Company will occupy the store on Jefferson avenue recently vacated by the retail department of the Cadillac Motor Car Company. They expect to move into the building about the 15th of October.

W. H. Donaldson, 405 South Centre street, Joliet, Ill., has invented an automobile headlight support which causes the cone of light to turn with the steering wheels of the car, thus always lighting up the road ahead in the direction the car is moving.

Only 530 motor cars, with a total valuation of $260,010, were found by Milwaukee assessors in their annual search. Another search brought forth that there were 666 cars. W. F. Hooker, tax commissioner, says that there are too many tax dodgers among owners, and believes the assessors should have found at least 2,500 assessable machines.

It is reported that Logansport (Ind.) capitalists have subscribed to $30,000 worth of the stock of the Bendix Automobile Company, of Chicago, and it is now probable that the Bendix plant will be located there.

According to a report filed by appraisers, the assets of the R. O. Williams Automobile Company, of Columbus, O., which is in the hands of a receiver, are worth $9,574.03. The assets consists of chattels, $2,306.50; cash, $694.64; accounts due, $6,572.80.

The H. H. Franklin Manufacturing Company report that there is a great demand for tops this season, at least 95 per cent. of the cars shipped being so equipped, and they have been obliged to devote considerable space in their recent addition to the top department.

The storage building of the Oscar Lear Automobile plant, in Springfield, Ohio, was destroyed by fire on September 23, resulting in about $10,000 damages. The building was a plain wooden structure, and contained three newly completed automobiles, several engines and other parts.

The following entries had been received for the Savannah race of the A. C. A. up to Tuesday, September 29: Two Mercedes, three Benz, three Fiats, one B. L. M. and one Lozier. Entries at the original fee of $750 close on October 1, at which time the fee will be raised to $1,000.

One of the Fifth avenue motor buses, as the result of a skid on the wet asphalt last week, crashed into an electric-light pole at Fifth avenue and Forty-fifth street, breaking it off close to the ground. Although some of the passengers on the roof seats were thrown out, none was seriously injured.

In the twenty-four hour race held at Milwaukee on Friday and Saturday of last week a Locomobile driven by Robert Brach and Fred Leiser proved the winner, covering a distance of 902¾ miles. A Mitchell was second, with 808¾ miles, and a White steamer secured third place with 712 miles.

The Holcomb Company, who operate a garage at 97-115 Goffe street, New Haven, Conn., have just completed a new automobile supply store at 290-292 Wooster street, in that city. The store is completely fitted up in Mission oak and all the stock will be behind glass, which is thought to be a new feature in this line of business.

The Duplex Motor Company, of Chicago, are negotiating with the Ottawa Development Association, of Ottawa, Ill., with a view to locating in that city a plant for the manufacture of a friction and double shaft driven car. R. N. Hansen is president of the concern, C. M. Hansen secretary, and Edward Torgenson treasurer. The promoters expect the business men of Ottawa to subscribe to $10,000 worth of the stock of the firm. If the stock can be sold the plant will be located on the second and third floors of the three story garage building occupied by the Illinois Valley Motor Company.

A new automobile factory is being erected at Muncie, Ind., for a company to be incorporated with a capitalization of $200,000. Thomas F. Hart and Claude E. Cox, the latter formerly with the Overland Automobile Company, are at the head of the new enterprise. Both runabouts and touring cars will be turned out.

The Fetzer Automobile Manufacturing Company, whose universal joint and four wheel drive were described in a recent issue of The Horseless Age, have secured a building in Galion, Ohio, corner of South Columbus and Walnut streets, where they will begin the manufacture of these parts as soon as the necessary tools can be installed.

The Berrodin Rubber Company, which is to be incorporated in Pennsylvania by Frank X. Berrodin, Saunders Levy, J. William Nock, Harry K. Buck, Willard A. McCalls, Martin E. Brigham and Robert Maynes, has bought out the Philadelphia Auto Tire and Rubber Company and its Buffalo branch, and will continue the G & J tire agency in these two cities.

Members of the Indianapolis Automobile Trade Association entertained the County Commissioners' Association of Indiana State at Indianapolis, on September 25. Sixty-five touring cars and drivers were placed at the disposal of the county commissioners and a trip was made through the city. A banquet was served on the bridge to the commissioners and members of the Trade Association. Mayor Charles A. Bookwalter presided as toast master.

Secretary of State James A. Frear, of Wisconsin, has issued certificates for 5,935 cars this year, of which number about 2,750 are owned in Milwaukee. The number of certificates does not, however, indicate the true number of cars owned in the State, as garages in some instances have ten or twenty cars registered under the same number, and it is estimated that there are 7,500 cars in Wisconsin at present. The number of 5,935 is an increase of 30 per cent. over last year.

California Registrations.

Between August 1 and September 1, 1907, there were 221 registrations of motor vehicles in the office of the Secretary of State, at Sacramento, Cal., but during the same period this year there were 436 registrations, without counting transfers. Between September 1, 1906, and September 1, 1907, 5,909 motor vehicles were registered; while from September 1, 1907, to September 1, 1908, 4,043 licenses were issued. This decrease is accounted for by the financial stringency. The registrations for the coming twelve months are expected to break the record.

Garage Notes.

A. R. Moreland is planning to erect a garage on North Main street, Austin, Minn.

W. H. Munson, Boone, Ia., is erecting a two story brick garage, 75x100 feet, to cost $10,000 to $12,000.

A garage is being erected for the Winton Motor Carriage Co. at 16 to 22 North Eighth street, Minneapolis, Minn.

R. M. Maxfield has bought the interests of W. C. and W. R. Rice, in the firm of Maxfield and Rice Brothers, Minneapolis, Minn.

A Brooklyn branch for the sale of Buick cars will be opened about October 1 at 42 Flatbush avenue in charge of Frederick Culver.

A fire which is supposed to have been started by a short circuit on the charging board located in the basement did about $200 worth of damage to the Weed Garage at 232-234 Ontario street, Toledo, Ohio, on September 22.

Fire on September 24 completely destroyed the garage and storage building of David Young in Muncie, Ind., as well as three automobiles valued at $5,000, belonging to F. R. Wachtell, a dealer. The total loss is estimated at $8,000. The building was a frame structure.

The Butler Auto Co. has been formed in Hamilton, Ohio, by Charles Schmitt, of the West Side Motor Co., of that place. The new firm will operate a garage on North C street, and will handle licensed cars. The West Side Motor Co. has decided to handle unlicensed cars.

John H. Brooks and Ralph A. Amerman have purchased the property of the Scranton Garage Co., Scranton, Pa., and will conduct it under the name of the Scranton Automobile Co. The Scranton Garage Co. was run on the co-operative plan, having thirty-seven stockholders.

John S. Johnson, Northwestern agent for the Winton Motor Carriage Co., has had plans prepared for a new garage building at 16-22 Eighth street North, Minneapolis, Minn. It will be a one story building. The site is 66 feet wide on Eighth street and has a depth of 95 feet.

R. M. Maxfield, of the firm of Maxfield & Rice Brothers, automobile dealers in Minneapolis, Minn., has purchased the interest of his two partners in the firm, and will henceforth conduct the business alone. He will continue to handle the Kissell and Mason cars, at 1401 Hennepin avenue.

The Capitol Machine and Auto Co., Sacramento, Cal., has moved from 700 L street to its new garage on J street, between Twelfth and Thirteenth streets. The new building is of cement blocks, and is provided with large plate glass windows for the showroom. The building is divided into a garage room and a repair shop, and also contains waiting rooms for customers.

Fire said to have originated in the Crescent Garage at Fond du Lac, Wis., destroyed property worth $[illegible] on Friday night, September 25. The garage was totally destroyed, including seven cars, among which was the touring car of Lieut. Governor William D. Connor, of Wisconsin, who had put it up at the garage for the night.

Roy A. Mainwaring will shortly open his new garage at [illegible] North Twenty-ninth street, Philadelphia, Pa. The building will accommodate [illegible] cars, and will have a complete repair shop in which all the machine tools will be fitted with individual motor drive. A general sales and repair business will be conducted in addition to the storage facilities.

R. C. Hamlin, who has the Franklin agency at Los Angeles, Cal., has under construction a new building on Olive street, with a frontage of [illegible] feet and 60 feet deep. The building will be T shaped and have a double entrance. The salesroom, with 2,[illegible] square feet of floor space, will have a maple floor, a beamed ceiling and 4½ foot wainscoting.

An exchange of locations has been made by the Cadillac Automobile Co. and the Knickerbocker Automobile Co. in Indianapolis, the former company moving to 24 East Ohio street and the latter company moving to [illegible] East Market street. The Cadillac Automobile Co. has the Indiana agency for the Cadillac, while the other company does an exclusive repair and storage business, with the exception that it handles a few second hand cars.

Jubert & White have opened a modern garage at 45 Warren street, Glens Falls, N. Y.

The capital stock of the Standard Garage Co., Buffalo, N. Y., has been increased from $10,000 to $75,000.

The Glens Falls Automobile Co., Inc., 47 Glen street, Glens Falls, N. Y., formerly owned by Irish & Harris, has been bought out by Griffith & Leland.

Fred A. and Edgar M. Marvin plan to erect a 60x40 foot frame garage in Elizabethtown, N. Y. It will have a cement floor and an iron roof. Overhauling of cars will be made a specialty.

J. P. Schneider, the well known Detroit dealer, has removed from the corner of Jefferson avenue and Bates street, two blocks east, to the corner of Jefferson and Brush. This location is only temporary, however, as he will soon move into a new garage at Woodward and Bagg.

The new garage erected for the White Company at 122 Marietta street, Atlanta, Ga., is practically completed. Atlanta is to be the distributing centre of the company for the South, the territory of the Southern branch including Tennessee, North and South Carolina, Florida, Georgia, Alabama and Louisiana. E. W. Gans will be manager of the branch.

Trade Personals.

George Bensley, formerly foreman of the Miller Cart Co., Goshen, N. Y., has resigned to become foreman of the Goshen Automobile Co.

F. L. Thomas, for some time acting manager of the Franklin Automobile Co., 1450 Michigan avenue, Chicago, Ill., has been made permanent branch manager.

W. P. Pfaff, formerly with the Pope Motor Car Co., of Waverly Park, N. J., on the sales force, is now with the Fritchle Automobile and Battery Co., of Denver, Col.

Charles B. Rose, who was recently engineer for the American Machine Manufacturing Co., has accepted a similar position with the Velie Motor Car Co., of Moline, Ill.

William F. Smith, manager of the Philadelphia Rambler branch, has been appointed district sales manager of the Maxwell-Briscoe Motor Co. at Philadelphia. He will assume his new duties on October 1.

Harry Pence, of the Pence Automobile Co., Minneapolis, Minn., is making a three weeks' trip through the East to look up the latest ideas in garage construction, his company having decided to erect a $75,000 building in the near future.

Trade Literature Received.

Rochester Timer Co., Cox Building, Rochester, N. Y.—Circular of the Roch-O timer.

George A. Weaver, Newport, R. I.—Circular of the Weaver Pathfinder automobile axle.

The Four Traction Auto Co., Mankato, Minn.—Circular of the "Kato" four wheel drive delivery wagon.

Hoyt Electrical Instrument Works, Penacook, N. H.—"The Hoyt Voltammeter for Ignition Testing."

Grabowsky Power Wagon Co., Detroit, Mich.—Catalogue of the Grabowsky motor delivery wagons and trucks.

The Kissell Motor Car Co., Hartford, Wis.—Folder giving specifications and illustrations of 1909 Kisselkar models.

New Incorporations.

Wilson Automobile and Garage Co., Wilson, Kan.—Capital, $5,000.

New York [illegible] Battery Co., New York, N. Y.—Directors, Herman M. Underwood, Fred S. Ashley and Jacob G. Lazarus.

Frawley Taxi Co., New York, N. Y.—Capital, $[illegible]. Incorporators, P. J. Frawley, H. Keilershon and P. J. Kiernan.

Long Island Auto Supply Manufacturing Co., Brooklyn, N. Y.—Capital, $25,000. Incorporators, L. Handel, H. L. Carr, C. Knopf.

Multiont Gas Engine Co., Chicago, Ill.—Capital, $25,000. Incorporators, James J. Maloney, A. C. Gray and William L. Simonton.

High Standard Steel Co., New York, N. Y.—Capital, $100,000. Incorporators, M. Birmingham, W. P. Snyder and D. W. Birmingham.

Crescent Automobile Co., Nashville, Tenn.—Capital, $15,000. Incorporators, J. A. Wardlow, F. W. Wallace, S. B. Cook, C. N. Woodworth and W. G. Ward.

Ashton Motor Car Co., Bridgeport, Conn.—Capital, $10,000. Incorporators, T. R. Ashton, M. A. Hall and G. E. Morton. To manufacture and deal in automobiles.

Houlton Motor and Manufacturing Co., Boston, Mass.—Capital, $200,000. President, A. C. Morrison; treasurer, T. Le Baron. To manufacture and sell hydrocarbon motors.

New Agencies.

Fairmont, Minn.—J. H. Gorman, Ford.
San Diego, Cal.—F. B. Naylor, E.-M.-F.
Faribault, Minn.—Walter Scott, Buick.
Sacramento, Cal.—Phillips Drayage Co.
Wichita, Kan.—J. E. Garnett, Monarch.
Green Bay, Wis.—L. P. Larson, Mitchell.
Parkersburg, Ia.—G. Lindemann, Monarch.
Eureka, Cal.—J. A. Robinson, Chalmers-Detroit.
Denver, Col.—Harry M. Martinstein, Monarch.
Pittsburg, Pa.—Arlington Motor Car Co., Gaeth.
Louisville, Ky.—John Mason Strauss, Thomas.
Mount Pleasant, Ia.—Beckwith Brothers, E.-M.-F.
San Diego, Cal.—Hunt Automobile Co., Franklin.

Patents Issued September 15, 1908.

898,427. Igniter for Explosion Engines.—Henri Benoist, Paris, France. Filed September 24, 1907.

898,432. Nut Lock.—Thomas V. Boyle, Cleveland, Ohio. Filed April 9, 1908.

898,438. Engine Starter.—Clyde J. Coleman, Rockaway, N. J. Filed August 13, 1904.

898,481. Motor Cycle.—Walter C. Johnson, Colemans Hatch, England. Filed July 16, 1907.

898,494. Carburetor.—Louis P. Mooers, Cleveland, Ohio. Filed June 30, 1905.

898,495. Carburetor.—Louis P. Mooers, Cleveland, Ohio. Filed June 30, 1905.

898,497. Automobile Tire.—William Müller, Philadelphia, Pa. Filed September 27, 1907.

898,512. Process of Working Explosive Engines.—Karl E. Schreber, Greifswald, Germany. Filed November 27, 1903.

898,567. Gasoline Filter.—John Ellis, Lynn, Mass. Filed April 28, 1906.

898,665. Lens.—George A. Macbeth, Pittsburg, Pa. Filed May 21, 1908.

898,678. Casing and Cylinder Construction for Gas Engines and the Like.—Charles R. Piggins, Racine, Wis. Filed February 26, 1908.

898,714. Anchoring and Tension Device for Tire Protectors.—Samuel C. Wolfe, Angola, Ind. Filed November 14, 1907.

898,832. Elastic Tire for Wheels.—Felix J. Chary, Paris, France. Filed January 13, 1906.

898,850. Pneumatic Tire.—William Drury, Swansea, Wales, England. Filed April 14, 1905.

898,903. Rotary Gasoline Engine.—Charles W. Lindsay, Anthon, Iowa. Filed August 23, 1905.

898,913. Two Cycle Gas Engine.—Emil A. Nelson, Detroit, Mich. Filed March 16, 1906.

898,920. Carburetor.—George S. Pierson, Kalamazoo, Mich. Filed October 7, 1907.

898,945. Ball Bearing.—Josef Weibel-Mulisch, Zurich, Switzerland. Filed June 1, 1906.

Coming Events.

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

The Horseless Age

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Fan Belts.

By David Landau and Asher Golden.

There has been considerable discussion and editorial comment regarding the use of belts of triangular and trapezoidal section for driving radiator fans. The use of a belt of any section whatever has the advantages of simplicity and cheapness and ease of repair or replacement, and on this account the belt has many adherents. Owing to these considerations we believe that the belt for driving fans will continue in use for some time.

It is claimed that the triangular or trapezoidal belt will transmit a given amount of power with less belt tension than a flat belt. We have never seen a clear exposition of the reason for this claim. We believe that the advantage is not due so much to the section of the belt as to the employment of a grooved pulley, which is usually used with a belt of the section mentioned.

The following discussion is an attempt to make this point clear. It has been shown in The Horseless Age (issue of May 1, 1907) that the horse power required to drive a fan of the disc type is given by the relation

$$HP = \frac{d\,a\,v^3}{5{,}100{,}480}$$

where d = the density of air, or weight per cubic foot;

a = area of discharge in square inches;

v = velocity of the discharged air in feet per minute.

This is the theoretical horse power represented by the air which leaves the fan. If we divide the above expression by the efficiency of the fan, which may vary from .3 to .5, we obtain the actual horse power required to drive the fan. This is the horse power which the belt has to transmit. The horse power to drive fans of various sizes has been worked out in the form of a curve, which is shown in Fig. 1. These curves are based on the experiments of a well known fan manufacturer.

Having selected the size of fan and determined the speed at which it is to be run, we can find from the curves the horse power required, and from this the sectional area of the belt to transmit the required power and the forces acting on the belt.

The following notation will be used:

A = sectional area of the belt in square inches;

H. P. = horse power to be transmitted;

d = diameter of driving pulley in inches;

T_a = total tension in pounds in belt on tight side;

T_o = total tension in pounds in belt on slack side;

P = total turning force exerted by entire width of belt;

V = velocity of belt in feet per minute;

g = acceleration due to gravity;

ϕ = arc of contact of the belt with the pulley (in circular measure);

θ = angle of pulley groove;

u = coefficient of friction between belt and pulley;

e = base of system of natural logarithms;

C = centrifugal force;

w = weight per cubic inch of belt material in pounds;

n = r. p. m. of driving pulley.

t_a = tension in belt per unit sectional area on tight side;

t_o = tension in belt per unit sectional area on slack side;

p = turning in force per unit sectional area.

$$P = T_a - T_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In stationary practice, where the weights of belts and linear speeds sometimes reach very high figures, the consideration of the tension in the belt due to centrifugal force is of importance. In automobile practice the tension in the belt due to this cause is very low, as will be shown, and therefore may be neglected in the calculations. An example will make this point clear.

Let us take the case of the fan shown in Fig. 2, for which

d = 4 inches.

n = 1,300.

w = .035.

The tension due to centrifugal force is found from the formula

$$C = \frac{.000207\,w\,V^2}{d} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$V = \frac{3.1416\,d\,n}{12}$$

Substituting in equation (2), we have

$$C = \frac{.000207 \times .035 \times 1361}{4} = 3.35$$

It may here be remarked that the speed of 1,300 r. p. m. is the maximum speed at which this fan is to run.

From fundamental considerations we find

$$P = \frac{33000 \times H\,P}{V} = \frac{126000 \times H\,P}{d\,n} \quad \ldots\ldots (3)$$

It is shown in treatises on belting that

$$T_a = \frac{P\,e^{u\phi}}{e^{u\phi} - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$T_o = \frac{P}{e^{u\phi} - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

From these we determine the value of P given in equation (1). It will be easily seen that

$$A = \frac{P}{p} = \frac{T_a}{t_a} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$t_a = \frac{P}{A}\,\frac{e^{u\phi}}{e^{u\phi} - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$t_o = \frac{P}{A}\,\frac{1}{e^{u\phi} - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

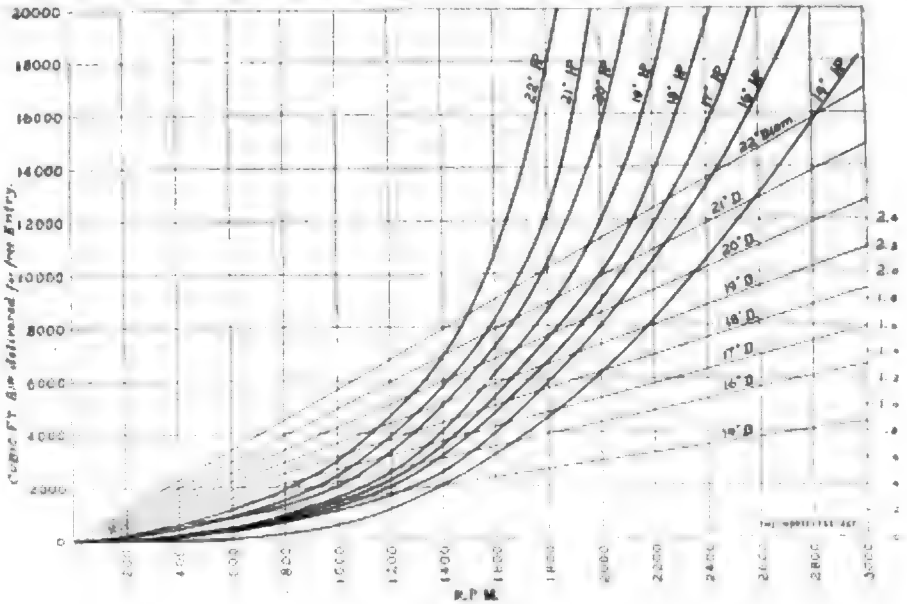


FIG. 1.

Taking the case of Fig. 2, we have

t^n = 300 pounds (value found in good practice);

n = 1,300 r. p. m.;

d = 4 inches;

ϕ = 180°;

u = .2 (assumed, for slightly oiled belt).

The figures given above are fairly representative of average practice. Making the necessary substitutions in the foregoing formulæ, we find

$$P = \frac{33000 \times 12 \times HP}{3.1416 \times 4 \times 1300} = 24.2 \times HP \text{ pounds}$$

$$A = \frac{24.2 \times HP}{139} = .175 \times HP \text{ sq. in.}$$

$$T_a = \frac{24.2 \times HP \times 1.875}{.875} = 52.2 \times HP \text{ pounds}$$

$$T_o = \frac{24.2 \times HP}{.875} = 28. \times HP \text{ pounds}$$

The factors 1.875 and .875 are the values of $e^{u\phi}$ and $e^{u\phi} - 1$ for 180° arc of contact and $u = .2$.

Now, referring to Curve 1, we find that to drive an 18 inch fan at 1,300 r. p. m. requires .6 horse power; this is the actual power required to drive the fan. Hence, the sectional area of the belt to transmit this power is

$$A = .175 \times .6 = .105 \text{ square inch.}$$

It is therefore seen that a belt having a width of 1 inch and a thickness of .105 inch (or better .125 inch) will be needed.

The turning force or frictional resistance in this case is found to be 24.2×.6 = 14.5 pounds. It is advisable to have the belt tight enough to bring P up to at least 20 pounds per horse power in order to prevent slipping of the belt when the car is traveling uphill with the motor running at maximum speed, under which condition it is desirable to have the fan deliver its maximum output.

GROOVED PULLEYS.

For the determination of the tensions T_a and T_o in this case the angle of the groove θ must be taken into consideration; these tensions are found by substituting in equations (4) and (5) the value $u\phi \operatorname{cosec} \frac{\theta}{2}$ in place of $u\phi$.

Referring to Fig. 3, we see that the pressure against each side of the groove is

$$R = \frac{P}{2} \operatorname{cosec} \frac{\theta}{2}$$

This expression is derived as follows: Referring to the diagram of Fig. 3, we see that

$$\frac{P}{\sin \theta} = \frac{R}{\sin \frac{180^\circ - \theta}{2}}$$

or

$$\frac{P}{2 \sin \frac{\theta}{2} \cos \frac{\theta}{2}} = \frac{R}{\cos \frac{\theta}{2}},$$

from which the value of R is readily obtained.

The total pressure against both sides of the groove is

$$2R = P \operatorname{cosec} \frac{\theta}{2}$$

From this it is evident that as the angle θ decreases the pressure against the sides of the groove, or the effective frictional resistance, increases, so that for the transmission of a given amount of power we can employ a lower normal pressure; or, what amounts to the same thing, a slacker belt.

The groove angle usually employed in practice varies from 45° to 60°. Substituting in the last equation we find that

For $\theta = 60°$ $2R = P \operatorname{cosec} 30° = 2P$.

and $R = P$.

For $\theta = 45°$ $R = 1.3\ P$.

For $\theta = 30°$ $R = 1.93\ P$.

We see that for a groove angle of 60° the normal pressure need be only one-half of that required for a flat belt.

It is seen that the pressure R is independent of the form of the belt section, so that, neglecting wear, a round belt will transmit the same power as a trapezoidal or triangular belt. In the case of the trapezoidal or triangular belt, however, a greater contact surface is brought into action, so that the wear will be considerably less. The circular belt having practically a line contact, the specific pressures are much higher, and the belt tends to wear itself down to a trapezoidal form.

It may be remarked that while we have shown that advantages are to be gained through the use of a grooved pulley, there are, nevertheless, disadvantages. If, for example, the angle θ be made too small the wedging action becomes very great and any possible advantages are offset by the undue gripping of the belt. It is claimed, however, by those who use the V pulley that the belts last considerably longer in spite of their action, as noted above. We readily concur in this opinion, and for the reason that there is less slip with a V pulley, and therefore less heating of the belt.

Any increase of tension above that necessary to transmit the given amount of power is equally divided between both sides of the belt, and therefore does no useful work.

It is of interest to know the factor of safety in belt transmission. The ultimate strength of leather belting runs from 3,000 to 5,000 pounds per square inch of sectional area, with an average value of 4,000 pounds. Experiment shows that the strength of the laced joints is only about three-tenths of the ultimate strength, or 1,200 pounds per square inch. Therefore, using these belts under a tension of 300 pounds per square inch gives us a factor of safety of 1,200/300 = 4. With belts of which the ends are cemented the factor of safety is usually higher. It is safe, however, to say that under ordinary conditions the factor of safety is not higher than 4.

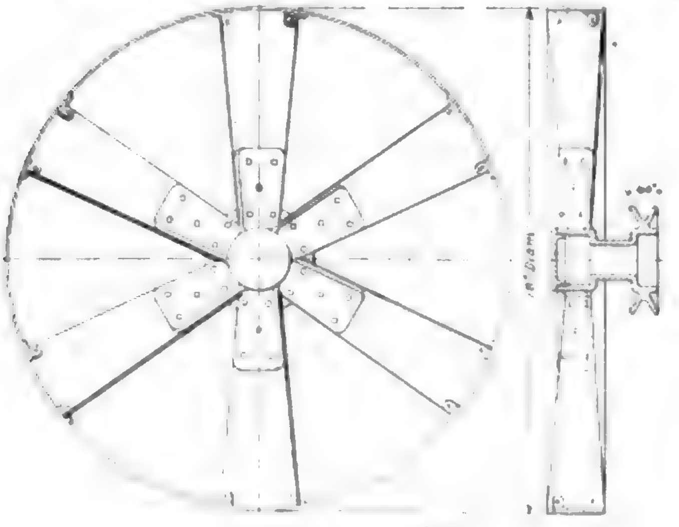
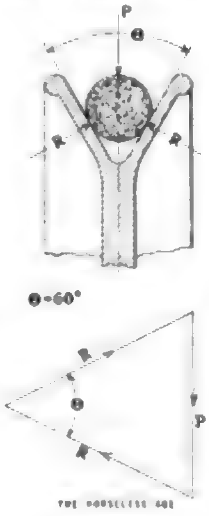


FIG. 2.



Imports and Exports for August.

The month of August shows a considerable increase in the number of cars imported into this country, as compared with the same month of the previous year, which is probably due to the arrival during that month of a large equipment of taxicabs. There were imported during August, 1908 179 automobiles valued at $280,970, and parts valued at $49,676 as compared with 69 automobiles valued at $229,704, and parts valued at $42,570, in August, 1907. Of the cars imported last August 143 were from France, 27 from Italy and 6 from the United Kingdom. During the eight months ending with August, 1908, there were imported 737 cars valued at $1,451,594, and parts valued at $348,431, as compared with 628 cars valued at $2,057,294 and parts valued at $509,207 during the same period of the previous year.

There were exported in August, 1908, 156 cars, valued at $346,796, and parts valued at $44,074, a total of $390,870. During the same month of 1907 there were exported 256 automobiles valued at $437,468, and parts valued at $60,054, a total of $506,522. During the eight months ending with August, 1908, there were exported 1,684 cars valued at $3,560,062, and parts valued at $434,849, a total of $4,004,811, as compared with 2,308 automobiles valued at $4,263,437, and parts valued at $488,577, a total of $4,752,012. The greatest decline in the exports has been to Mexico, the West Indies and South America.

Air Leaks in Gasoline Engines.

By Albert L. Clough.

Air leaks are a most prolific cause of irregularities in the operation of vehicle engines of more than one cylinder. In fact, it is not too much to say that a very considerable portion of the obscure troubles manifesting themselves by the erratic action in one or more cylinders are traceable to this cause. Oftentimes carburetor action and ignition are wrongly blamed for the skipping or weak running of a particular cylinder or cylinders.

Since the proportion of air to fuel is correctly fixed by the carburetor adjustments, or is a least supposed to be, the entrance of additional air into the charge results in a weak mixture. A leak may be so located as to affect one cylinder or all cylinders to a variable extent. The weakened mixture, resulting from the leak, is slow burning and for a given degree of spark advance, the cylinder in which it exists suffers from late ignition, which may be so much delayed that combustion is not over before the next charging stroke, in which event a "pop back" through the carburetor is likely to occur. The explosion is a weak one under these circumstances and noticeably different from those in the unaffected cylinders. The air leak may be sufficient to reduce the quality of the mixture below the explosive point, in which event the cylinder or cylinders affected will miss.

WORST AT SMALL THROTTLES.

The effect of an air leak is serious mainly at low throttles, for several reasons. When the throttle is wide open there is but a slight degree of vacuum existing in the cylinder during the suction stroke, as the incoming gas is unobstructed and flows in readily to fill the piston displacement. With the throttle completely closed, and assuming a tight condition of piston and valves, there is nearly the full atmospheric pressure acting between the inside and outside of the cylinder. At very small throttle openings, such as are used when the engine is idling or running slowly in the level, the gas inside the cylinder is at a pressure very considerably below atmosphere and the ingress of air through any leak is at its maximum, while, with wide open throttle it is at its minimum. Not only is the actual amount of air leaking in very large when the throttle is closed, but it bears a much larger proportion to the whole weight of the small throttled charge then sucked in than it does to a full charge taken at open throttle.

Furthermore, when an engine is run very closely throttled the proportion of dead clearance gases to the small fresh charge admitted is very large, and the resulting mixture is often very near the limit as to combustibility. The addition of accidentally admitted air to this very imperfect gaseous mixture is often sufficient to prevent regular ignition, although the cylinder may "eight cycle"—that is, fire on every other power stroke, the burned gases having been scavenged during the inactive portion of the cycle.

As the compression realized when running on low throttle is very slight, the ignitibility of the charge is reduced and only a slight reduction of its richness, due to an air leak, is required to cause a "skip."

At full open throttle the effect of an air leak, unless it be a very bad one, is usually not obvious, or at least not serious. In the case of any motor showing faulty running of a certain cylinder, a leak of this kind should be searched for as soon as the spark and valve action has been shown to be faultless.

RENDERS STARTING DIFFICULT.

As a rule, the presence of an air leak renders an engine difficult to start without excessive priming of the carburetor, as most carburetors tend to deliver a rather weak mixture when the motor is turned over by hand. The admission of accidental air will often weaken this below the point of inflammability.

An air leak may occur either on the cylinder side of the inlet valve, in which case the particular cylinder will be affected, or it may be outside the inlet valves, in which event the action of all the cylinders may be interfered with more or less. It is this former kind of leak that is most apt to produce missing or weak explosions in a certain cylinder, and it is the latter which makes an engine hard to start or renders its action generally erratic, especially at low throttle openings.

WHERE LEAKS OCCUR.

The following are some of the points at which leaks of the first description may develop. After considerable service, especially if, as is often the case, good lubrication is not provided, the inlet valve stem may become quite loose in its guide. A considerable space is thus created through which air may enter the inlet valve chamber and dilute the charge. In such a case as this the leak is so near one particular cylinder that the diluting effect is mainly felt therein, although the leak is into a space which has connection with the other cylinders. If the valve stems are bushed and the wear is found to be mainly confined to the bushing itself, a new bushing is the obvious remedy; but if the stem is guided in the metal of the housing, the hole requires to be bored out and a special bushing made and fitted. Many instances of weak and irregular action in a particular cylinder are due to this cause, and this is especially true now that engines are required to be able to turn over so slowly when idling.

Unless the caps which screw in over the inlet and exhaust valves are perfectly tight there is a chance for the outside air to be sucked in at these points. Occasionally, when a cap has been screwed in and out several times, the copper gasket which is used for packing becomes roughed up or broken, and a leak takes place past it and the thread. Graphite should be applied to the thread and a new gasket supplied. There is also a possible chance for a leak around the cage containing the valve in case a "caged" construction is used. The ground joint between the cage and the cylinder may not seat perfectly or, if a gasket is used at this point, it may not be tight.

Not infrequently a spark plug will be found which has an imperfect thread, which cannot be made tight in the plug hole. A very small leak at the plug or around the inlet valve cap is especially bad, as the diluting air is admitted so close to the spark points that the mixture is diluted at the very point where it should be most easily ignitible. Another derangement, which, while not strictly an air leak, may yet be spoken of here, is the imperfect seating of the exhaust valve. This allows of exhaust gas being drawn into the cylinder during the suction stroke, not only diluting but fouling the charge. Under the same head may be mentioned leaks around the piston rings. This is less serious, as regards the regular running of an engine (unless of very large amount), than most other kinds of leak, as the foul gas or air drawn in during the suction stroke enters the lower end of the cylinder space and does not so directly interfere with ignition.

Leaks around the plugs, cages, valve caps, exhaust valve and piston rings, are manifested by reduced ability to maintain compression in the cylinder affected, but a leak around a valve stem is not. Oil or soap suds flowed around the valve caps will show bubbles during the compression stroke if a leak exists. Especially in the case of air cooled cylinders there is the possibility of a crack having developed in the cylinder head or in the passages thereto. With a water cooled cylinder such a defect will manifest itself by the entrance of water into the combustion space, and usually by steam in the exhaust.

SYMPTOMS OF LEAKS.

Any lack of tightness between a branch of the inlet manifold and its port flange on the cylinder allows excess air to be sucked in therethrough. If the leak is very slight only the cylinder supplied from the branch in question is usually affected, but if it is at all large a weakened mixture may be supplied to all the cylinders, and it may be next to impossible to start the motor unless the carburetor is adjusted for a very rich mixture—so rich, indeed, that satisfactory running on full throttle will become impossible on account of a gross excess of gasoline in the mixture. Such a defect as this is not evidenced by any lack of compression, as the trouble is outside the valves. If the suspected joint can be gotten at, oil or soap suds flowed around it will be seen to be sucked in during the charging stroke. Sometimes, too, the faulty joint, when taken down, may show blackening, due to the slow it at the beginning of the succeeding suction stroke. These joints are now usually ground in or made with copper gaskets, some form of clamp holding device being employed. Formerly they were often made with bolted flanges.

A BAFFLING CASE.

The writer recently noticed a case of "air leak" which entirely prevented the regular action of one cylinder and somewhat affected the others, and which could not be located at once. In this engine the valve housings of two adjacent cylinders were contained in a single casting, which carried taper nipples that seated in the inlet ports. This double valve arrangement was held in place by a bolt which passed through the solid part of the casting between the two housing portions and between two cylinder heads, thus securing the arrangement to the side of the combustion spaces. After wasting considerable time in testing the ignition and looking over the valves of the refractory cylinder, the double inlet valve housing was taken off, when the cause of the difficulty was discovered. The hole for the holding bolt had been drilled very considerably off centre, so much so that it had left a very thin fin of metal between it and one of the valve chambers. Vibration or some such cause had broken this through, allowing of communication between the bolt hole and the inlet valve space. As the bolt was a very loose fit in its hole, in order to permit of the free seating of the inlet nipples in their ports, a large leak of air was permitted through the bolt hole and into the inlet valve space of the "sick" cylinder. A new valve housing casting cured what was a baffling trouble and one that could not be located by ordinary inspection methods.

Inlet manifolds being very thin castings and rather difficult to produce without imperfections, sometimes contain foundry defects which have to be plugged before the manifold can be successfully installed upon an engine. Occasionally these defective points open up in service, allowing of an air leak. If there are joints of any kind in the main mixture pipe between the carburetor and the branched portion of the manifold a leak may develop, due to the loosening up of these connections. There is always a joint where the carburetor is attached to the piping, and it has sometimes happened that when the carburetor has been taken off the gasket used in the replacement has not insured a tight joint. A gas leak at this point tends to make it difficult or impossible to start the motor, and causes spasmodic running at any but quite large throttle openings, poppings in the carburetor being frequently heard.

There is much complaint in Paris about the reckless speeds at which the taxicabs are being driven, and a member of the A. C. of France, M. Japy de Beaucourt, has proposed in the papers that all taxicabs should be fitted with a shrill whistle which would be automatically blown as soon as the speed limit was exceeded.

Maintenance and Repairs

A Rear Axle Repair.

By 6663 Mich.

The designer of the axle in question showed neither common sense nor a regard for the laws of mechanics. The bevel gear housing was made from two similar steel castings, bolted together in the vertical centre plane of the propeller shaft. A tube, marked B in the figure, encased the shaft. At its front end was the fork for the universal joint. The other fork of the joint was on the rear end of the change gear shaft, and no sliding member was used.

With a single jointed propeller shaft supported in this manner the side strains on the casing are considerable; to brace against these, diagonal rods, G G, extend from collar C to the rear axle. This collar was split and held in place by the clamp bolt. Brazed to the outside of the rear end of tube B was a short piece of tubing which was held in the rear axle housing only by its fit in the bore and by set screw A.

The natural result of such a combination was that the driving, torsion and braking strains soon loosened the brazed joint, the set screw, and the clamping collar. This left the shaft free to shift a little endwise, throwing the bevel gears out of mesh, and putting considerable end thrust upon the roller bearing at the rear.

This end thrust soon wore out the cage for the rollers. The short piece of tubing surrounding the rollers began to turn, the joint between this and tube B got loose, so that the shaft was thrown out of "square" with the axle. From this combination of effects the rollers wore the cold rolled driving shaft so that the bevel pinion took on a sort of planetary motion, with about one-quarter inch orbit. Naturally the teeth of the bevel gear, which were not hardened, wore out of shape, although the hardened teeth of the pinion showed little wear.

In this condition the axle was useless. It was decided that what was needed was to hold the tube solidly in place between shoulders. So tube D was driven over B and riveted to it, then the collar E was riveted to both D and B. Two washers, F F, were put on loose, so that they could be ground to the proper thickness to mesh the gears. A new disc was made for the thrust bearing, large enough so that it bore against burning mixture having blown out through the rear end of tube D. This left the roller bearings free from thrusts, and when rods G were tightened the assemblage was solid.

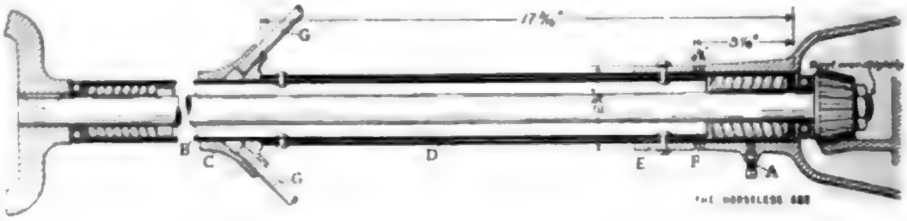
A similar construction had been used in the rear bearing for the change gear: This was a roller bearing, and the two ball thrusts bore against the ends of the casing for the bearing. This casing was held in the gear housing by a set screw. Of course, the screw did not hold against the thrust action from the axle, so the casing was soon floating around. New discs were made for the thrusts, large enough so that they bore against the gear case and relieved the set screw from this thrust stress.

Although the bevel gear had been badly worn, it was smoothed and straightened as well as possible by filing. After the repair was completed it ran as quietly as a good gear, although probably it was not very efficient.

The strains in the housing of a shaft of this character are much greater than one is apt to imagine, and it is still too common to see tubing used which is not stiff enough to keep the torsion load from bending the shaft. Fortunately, however, very few cars have been built with this tube so inadequately fastened as in the case just discussed. This car was produced several years ago, in 1904 or 1905, I think, and its makers probably learned better after one season's experience.

A Curious Loss of Power and Its Cause.

After using his touring car for three years a Harlem owner decided to have it overhauled, the cylinders rebored and new pistons put in. As the valves had been removed only one month before these were not replaced, but merely reground. Accordingly, the cylinders were dismounted and rebored one-sixth of an inch larger, and new pistons were put in, and after the motor was reassembled it was "run in" for twenty-four hours. Upon replacing the motor the car was taken out on a trial run and it was found that it only ran 18 miles per gallon instead of 21 as formerly. A small increase was expected, as the reboring would naturally raise the power, but not such an increase as this. By very close carburetor adjustment 18.4 miles per gallon was obtained, but the motor would then run only at from 60 to 75 revolutions below the normal speed. The compression was tested and found correct in each cylinder, the valves seated finely and were in time



Rear Axle Repair Job.

and the ignition was correct, so that the case was a puzzling one. The car was taken for a 150 mile run without a stop, and the motor now made nearly 19 miles to the gallon. Everything appearing satisfactory, the car was put into service once more, but in about a month the fuel consumption had increased again, so that 18 miles per gallon could only be gotten. A rigid test of all parts of the motor was now instituted, and the cause was discovered. A repair man in testing for leakage while the motor was running happened to put some kerosene on the lower end of one of the inlet valve guides and observed a suction between the guide and the valve stem. Upon investigation it was found that all the inlet valve guides were worn oval and that air was drawn in between the stems and guides. The guides were of the driven type and fitted into seats which were thoroughly water cooled, so that the leaks did not occur when the motor was warmed up and the valve stems and guides expanded to a closer fit. New guides being unattainable it was decided to insert bushers in the old ones rather than make up new ones. Accordingly the guides were removed and bored out slightly larger with a taper, and similarly tapered bronze liners were inserted. The motor when tested out after the liners were placed ran without trouble and ran faultlessly, developing its normal power at the original fuel consumption.

An almost parallel case in Philadelphia was corrected by the insertion of guides fitted with stuffing boxes as in steam engine practice. The valve springs in this case were exchanged for others of larger spiral so as to clear the hexagonal heads of the glands, which were slightly larger across than the diameter of the original guides.

Safeguards for the Change Gear Lever.

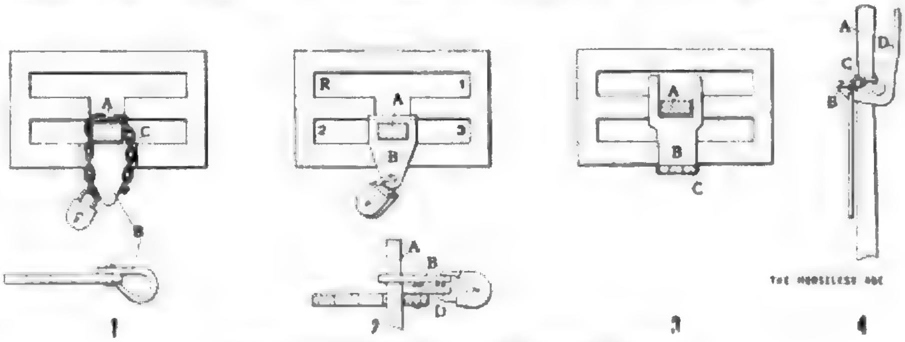
The idiot who pulls the lever of a car standing at the curb is still with us, and is particularly prominent in our larger cities. On a recent occasion a member of this class forced in the low gear of a car standing unattended, and then took to his heels; the car, of course, started away, but, luckily, was boarded and stopped before any damage was done. To present such occurrences the change gear lever must be locked in the neutral position, and this may be accomplished in a number of ways, some of which are here illustrated. In Fig. 1 A is the change gear lever shown in the neutral position of a selective quadrant and held by a chain C, which passes under a hooked plate B bolted to the outside of the quadrant. The chain in this device is removable, and while easy to put on will not always be at hand when wanted, as on the other devices shown. The hooked plate will, of course, be bolted to the quadrant on the side opposite to the hand brake lever, so as not to interfere with the application thereof.

In Fig. 2 a plate B is fastened to the lever, so that when the lever A is in the slot between positions 2 and 3 a hole pierced in the plate checks up with another hole in a plate D fastened to the quadrant. To lock the lever all that is necessary is to pass the hasp of a padlock through the holes and close the padlock.

These two devices are perfectly foolproof, while that shown in Fig. 3 is not proof against deliberate meddling, but serves its purpose sufficiently against the great majority of persons given to handling things. It consists of a plate B having two horns which allow only a limited sidewise movement of the change gear lever A. This plate is hinged at C, so that it may be swung upward to clear the quadrant and allow the gear lever to be operated in the regular manner. In the application of this device to the Hotchkiss cars B lies very closely on the quadrant and can only be raised by inserting the finger under one of the horns.

For planetary gear levers this device may be used as well as for the selective sliding type. In this case the plate is placed so as to hold the lever in the neutral position; but of course in the case of cars fitted with a separate pedal for the reverse and low speed it would not prevent either of these gears being engaged unless devices were fitted to the operating pedals themselves. For the progressive type of steering gear, a piece B (Fig. 4) having a hole therein is fastened to the arm of the plunger operating lever D and a chain C is fastened as shown over the grip of lever A. The chain passes through the hole in B and necessarily must be kept taut, so that the latch or plunger cannot be depressed and the lever moved to shift the gears.

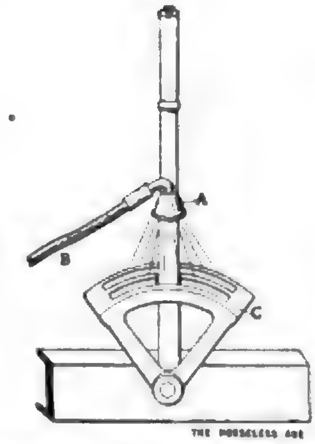
The devices illustrated are shown applied to a number of forms of levers and quadrants, and in cases where other forms are fitted to cars the ingenuity of the driver or garage man will suggest suitable modifications. For instance, for a four speed selective gear the device of Fig. 2 is the best, or that of Fig. 3 may be used. The suggestions are given as a guide to those desiring to apply such safeguards to their cars.



FIGS. 1 TO 4—GEAR LEVER LOCKING DEVICES.

A Change Gear Quadrant Inspection Lamp.

Only few motorists change gears of the selective type by "feeling," the majority invariably glancing at the quadrant when making the change to assure themselves that the lever is placed in the proper slot. This is particularly the case in connection with gears giving three speeds forward instead of four. The writer suggests the use of a small two volt electric bulb fitted within a casing attached to the change gear lever and placed so as to illuminate the quadrant. This will assist the driver in changing the gears, as he can then see the slot to be entered to mesh the desired gears. The method of suspending the lamp is shown in the accompanying cut. A is a two volt electric bulb fitted within a tin reflector which is fastened by a clip to the change gear lever so that it illuminates the quadrant C. A pair-wire flexible connection B conveys the current from the source of electricity, two or three dry cells being sufficient. A switch should be interposed in the line between the battery and the lamp to enable the light to be shut off when not needed. A similar lamp could be clipped on the steering pillar above the change gear lever when it is located upon the pillar, but this should be operated only when the hand takes hold of the lever to make a change, as if the lamp was kept lighted at all times the light would be reflected into the driver's face, which would be objectionable, and the dry cells would soon be exhausted. Various ways of effecting this lighting will readily suggest themselves, the simplest being the pressing of a blade switch upon a button or strip in the hand automatically when it grips the lever to make the change.



A CHANGE GEAR QUADRANT INSPECTION LAMP.

American Touring in Britain in 1908.

The writer has just returned from an eighteen days' tour through a considerable portion of England and Wales, and in the course of the journey visitors from the United States were much in evidence at the various hotels. Inquiries among hotel porters, garage keepers, etc., showed an enormous increase in the number of parties hailing from America who were viewing the better known picturesque districts and towns per motor car, as compared with 1907 and preceding years. Hitherto the tendency of most American tourists has been to rush from London to Edinburgh, then back to Stratford-upon-Avon and Oxford, and so again to London in four to five days, and go away with the impression they had seen all that was worth troubling about. This year there is conclusive evidence that information of other districts has been better disseminated, with the result that parties have been spending from fourteen to twenty-one or more days traversing Scotland, the Lake district, North Wales and the lovely country in Devonshire and the West of England. The "rushing" sort of journey, with the sole object of crowding as many miles as possible into the hours of daylight, has about died a natural death, saner methods prevailing in the way of moderate pace and consideration for other users of the highway. It is pleasing to recall that in quite out of the way places, where one would only have expected to have come across drivers with local knowledge, plenty of names could be traced in the hotel books as coming from America. Further, the class of tourists traveling by automobile was not confined to those who in the past have earned for the average visitor from the United States the reputation for prodigal expenditure and such reckless disbursement of "tips" to hotel servants as to make it difficult for other of their compatriots to do the thing at a moderate cost. In previous years the various parties have, in the majority of cases, been made up of men, but most all those seen or noted in 1908 have numbered at least one woman.

American cars have been few and far between, the plan of shipping a car to Europe for an extended trip being apparently restricted to the Continental countries, perhaps owing to the mistaken impression that it is not worth while to go to the expense of reshipping a car across to England from France after exploring the roads in France, Germany, etc. This is a great mistake, for it is quite unnecessary to "box" a car for transport across the English Channel, it being possible to run a car alongside the quay at Havre, Calais or Boulogne and have it slung on deck within a couple of hours, with but very few formalities, and provided twenty four hours' prior notice has been given per post of intention to ship the car by any fixed time service. The total cost by the short route to Dover or Folkestone does not exceed $25, inclusive of everything, and is even cheaper by the longer route from Havre to Southampton, which occupies about four and one-half hours. There are no customs duties, stamps or fees of a similar nature payable when a car is landed at any port in Great Britain, the only formality to comply with being the signing of a simple declaration as to the country of origin of the vehicle. Once on shore owners are warned that the machine must be registered and carry number plates front and rear before it can be driven on the public highway, the cost of registering being $5, while the actual driver must procure a driving license, valid for twelve months, at a cost of $1.25 (an inland revenue tax of $8.50 is annually payable to the Government, but this is not enforced upon machines not remaining longer in Britain than twenty-eight days).

Quite an extensive business has sprung up for the particular purpose of hiring machines to American touring parties, and during the past summer it has been nothing unusual to see quite a line of cars waiting close to the landing stages at Liverpool and Southampton to pick up visitors who had made prior arrangements to this end in New York. In fact, so extensive is this class of business that the Cunard Steamship Company has established a special department at its New York office solely to arrange for the complete conduct of automobile tours for those of its passengers who prefer this mode of seeing the country. A first class and up to date machine of about 24 horse power, with Cape cart hood and wind screen, accommodating four persons, exclusive of driver, can be hired for a single day at a cost of $25, this charge including a skilled driver, gasoline and everything. For extended trips on a moderate powered car an agreement can be made for about $20 per day, but the food and sleeping accommodation for the driver have to be paid in addition. For a man owning his own car and driving himself, it is more economical to ship the machine to and from America, if a sufficiency of spare parts and replacements is carried on the car, as there is no possibility of procuring anything of the kind in England for American machines other than for the few makes regularly handled here, viz., Ford, Cadillac, Reo, White steamer and Stanley steamer.

Members of the A. C. A. and subscribers to its bureau of tours service have the privilege of using the really wonderful knowledge possessed by the touring department of the Royal Automobile Club, whose courteous officials at 119 Piccadilly, London, W., will take any amount of trouble in mapping out routes, giving information concerning suitable hotels and supplying maps at the published prices. Absolutely the very best maps published are those known as "Bartholomew's" new reduced survey on a scale of 2 miles to the inch, which show the hills and valleys by various shades of color, and indicate first, second and third class roads by an ingenious and immediately distinguishable plan. Three styles are sold —25 cents on paper, 50 cents on cloth and 55 cents on cloth dissected, the last being the best. England and Wales are covered by thirty-seven sheets, and Scotland by some twenty sheets, the amount of ground included in each sheet being 60x50 miles.

The writer came into contact with many American gentlemen in the course of his recent journey and learned, much to his astonishment, that it is the usual thing to plan a tour before leaving home, and once arrived in England stick to it from beginning to end. This is a big mistake, and it is preferable to defer fixing the actual route until arrival on this side, thereby avoiding the annoyance of traveling over uninteresting roads. With local information at their command tourists can reach places of historic interest and the widely known beauty spots through charming scenery and over roads with first class surface. One final word of warning is tendered to those who may bring their own cars along: carry at least four new tires as spares, because the regular stock sizes of American rims, made to 30, 32 and 34 inch measures, will not take the millimetre sizes of tires that are sold in England and on the European Continent.

Reversed Sprags.

For motor cars operated in mountainous countries, or in fact anywhere where there are steep grades, a sprag is necessary and is commonly fitted to the majority of cars. This sprag prevents backward motion of a car when ascending a grade, enabling the brakes to be rested and cooled if they have been subjected to considerable use. But suppose the car is coming down a steep grade and the drive shaft parts, or one of the bevels in the differential or bevel drive fails. There are only the hub-brakes left to depend on, and the wire ropes which actuate these brakes are much given to parting or coming loose when a sudden application is made. To prevent a serious accident a sprag to prevent forward motion of the car when the brakes fail or the drive shaft parts is suggested by a writer in the *Allgemeine Automobil-Zeitung* as a very desirable improvement for motor cars, even if the motor has a device whereby it can be made to act as a brake. The sprag is to be hung in the usual way to the frame, except that it points forward instead of backward.

The Automobile Club of France, upon request of the Paris Building Contractors' Association, will organize a contest for motor tractors suitable for hauling carts and trucks in the transportation of building materials. Many of the Paris contractors are said to be anxious to substitute motor traction for animal traction. The A. C. of France has advised the manufacturers to take up the construction of such tractors, for which there will undoubtedly be a considerable market, as in Paris alone 5,000,000 tons of building materials are transported annually

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Some Matters of Policy.

Like all trade publications endeavoring to maintain a high character in their reading pages, we have had a constant fight with publicity promoters. The duties of these men include the sending out to all newspapers and trade publications running automobile columns of news matter relating to the particular firms they represent. The amount of "stuff" that is thus being doled out to publication offices in the interest of automobile firms is almost incredible; but, unfortunately, quantity and quality are in many instances at opposite extremes. We do not object to having this matter sent to us, and in the rather rare instances where we find therein any information of news or technical interest we gladly make use of it. What we object to is that the authors of these effusions often think, and, in fact, insist, that because they are running an advertisement in our columns they have a right to demand that their products be printed verbatim in our reading pages. Recently there has been more pressure brought to bear along this line than at any time since this paper was founded. The probable reason is that since automobiles have come to be extensively advertised in newspapers many of the big metropolitan dailies print no end of superficial nonsense furnished them by publicity men—matter that would not be considered for a moment if it concerned a trade not regularly advertising in the newspapers—and the publicity promoters have gradually formed the idea that they can dictate to any publication in which they advertise, and can get anything they like into the reading columns. Within the last few days a veiled attempt was actually made to get us to agree to print verbatim all the "publicity copy" that might be furnished, in consideration of an advertising contract. Such proposals are regarded as little short of impudence in well regulated publishing offices.

We also hear a great deal about "doing favors for advertisers." The term itself appears perfectly innocent, as it is eminently proper that the same spirit of courtesy and mutual helpfulness should prevail between advertiser and publisher as between any other classes of business men having dealings together. But when it is used in the sense that a hint from an advertiser should be sufficient to cause either the suppression or insertion of reading matter it is a most pernicious thing. A paper conducted along such lines is entirely unreliable and an insult to the intelligence of its readers. The idea that the reading pages are a sort of appendix for booming and jollying advertisers, and that space in them is "thrown in" with contracts for advertising space, is becoming entirely too prevalent. Unfortunately the way in which some of the cheaper trade papers are conducted has given this idea a certain justification, but the popularity thus gained is apt to be of short duration.

We want the advertisements of all legitimate concerns in the automobile business, but we will not prostitute our reading pages to obtain them. Advertising is solicited for THE HORSELESS AGE solely on the ground that it circulates widely among a sensible class of purchasers of automobiles, parts and supplies. We are right now taking from 150 to 175 subscriptions per week at the regular fixed rates, without offering special inducements of any kind or working any kind of catchpenny schemes. We have never agreed to give space in our reading columns in consideration of advertising contracts, and our advertising representatives have strict instructions to make no such promises. All matter submitted for use in our reading columns is considered solely with respect to its value and interest to our readers.

It is perhaps natural that in following out such a policy we should meet with many obstructions, especially in a new industry of pronounced boom proclivities. But the policy has succeeded for thirteen years, and will be strictly adhered to in the future, no matter what pressure may be brought to bear or to what length our competitors may go in debasing their reading pages with puffs and personalities. We are firmly convinced that there are enough broadminded and discriminating men in the automobile industry to support at least one self-respecting publication.

Consolidation Their Only Salvation.

Although the prospects of the automobile market for the coming season are generally analyzed as quite satisfactory, it is gradually dawning upon the smaller concerns making big cars that in competition with the big establishments in this line making cars by the thousands they will have a very difficult problem. The time has passed when a couple of exclusive features can be depended on to catch the fancy of the purchaser, the standard type of car having many times proven its qualities in contests and in the hands of private users, and it is obviously impossible to compete with the big concerns on the basis of price. Of course, some few of the smaller firms, having succeeded in establishing a reputation for their particular makes of cars, may continue to meet a good demand; but there is no gainsaying the fact that a great number are even now feeling the pinch of increased competition, and the coming winter will in many instances bring matters to a climax.

The smaller concerns so affected may be well organized, and may have as good or better designs as their big competitors, whose competition is forcing them to the wall. They are simply suffering the effects of the great economic law, that production on a big scale is cheaper than production on a small scale. The only way in which these small firms can save themselves is for quite a number of them to consolidate and then confine themselves to one or two models, which can be produced and sold in large numbers at a low price. In this way they can reduce administration or office expenses, cost of production and advertising expenses—in short, meet their competitors on even terms. The advantages inherent in this plan of consolidation have appealed even to some of the biggest manufacturers in the past, though their plans may not have materialized. The need of consolidation is, of course, much more apparent among the small makers. But to bring together a number of rival firms and organize them successfully requires organizing talent of the highest grade. As the number of officials would necessarily have to be greatly reduced, such a plan would meet much opposition from within the companies; but it it is to be presumed that the interest of the stockholders would in the end prevail. That this consolidation is ultimately bound to come few will deny. It is most desirable, however, that it should come before the resources of most of the small firms have been exhausted by excessive competition.

The Three Cylinder Vertical Engine.

Some years ago this type of engine bid fair to become popular. As it is scarcely ever used at present, except in the two cycle type, a discussion of the probable causes which led to its being discarded may be of interest.

While three vertical cylinders are the smallest number which give a perfect rotating balance, the combination has the disadvantage of possessing an unbalanced couple in the fore and aft vertical plane. If the pistons are heavy this couple may give rise to disagreeable vibrations. At the time when the three cylinder engine was popular pistons were made much heavier than they are at present. It is probable that with the light pistons which every good maker now knows how to make this vibration would not be annoying for most purposes.

Two other features of this type of engine may be instanced which very likely worked against its popularity. The first relates to the ignition. When one cylinder of a three cylinder engine "misses" the effect is very disagreeable, while with the four cylinder engine it is not felt nearly as much. The great improvements which have been made in ignition apparatus during the last two years have rendered this objection much less serious than it was formerly.

The difficulty of making accurate crank shafts with the pins at 120 degrees has often been mentioned as an objection to the manufacture of this type of engine. But where they are produced in large quantities no doubt the expense can be greatly reduced. Then, too, if the crank is to have bearings between adjacent pins it is very probable that a welded crank which will prove satisfactory for many purposes can be produced by some of the recently developed methods.

The foregoing are the principal objections which have been made to the three cylinder engine. It appears that while most of them had very good foundation at the time when they were first put forward, they have now lost much of their former force.

Technically, at least, there remains no reason why this type of engine should not be revived. But whoever considers doing so will, if he be wise, remember that a construction which has once lost popular favor, or, to use a slang term, "got a black eye," is often difficult to sell. So anyone who produces a car with a three cylinder, vertical, four cycle engine in the near future should be prepared to meet with a good deal of opposition.

Horse Power Rating.

Renewed interest has recently been created in the subject of motor rating formulæ, which was widely discussed a few years ago and temporarily settled by the adoption of standard or official formulæ by a number of automobile organizations. The chief cause for this renewed interest in the subject is the fact that in a number of this year's races and touring contests the bore of the engine was limited, and this led to the construction by some manufacturers of engines with what are considered unduly long strokes. In fact, the Prince Henry Cup contest in Germany was won by a car with a bore of 110 mm. and a stroke of 180 mm., which was the greatest proportion of bore to stroke for any of the competing cars. Since that time numerous attempts have been made by technical writers to derive a formula that should take the stroke into account, and the British Society of Motor Car Manufacturers and Traders has actually issued such a formula.

As compared with the precision possible in predetermining the power of steam and electric motors, the gasoline motor is not yet subject to such exact predetermination of its maximum output. From the automobile standpoint this is of no great consequence, however, because the engineer does not know in advance precisely how much power will be required to propel a car of given weight under the most exacting conditions, and a liberal surplus of power must be provided in any case.

Another thing that needs consideration in this connection is that by lightening the reciprocating parts and increasing the area of the valves and ports the speed of maximum power in modern engines has been increased to such an extent that it is a question whether this maximum power is commercially available, owing to the rapid wear at such high speeds and the heavy strain on all moving parts. We have heard the remark made by a manufacturer that the power of his engine increased with the speed up to the limit to which the tests had been carried, and in recent issues of an English contemporary we have seen diagrams and data of different motors showing that the power of these motors increases in almost direct proportion to the speed up to quite high values of the latter. Thus a recent test of a 4x4½ inch engine by the A. C. of Great Britain and Ireland showed a horse power of 40.85 at 1,600 r. p. m. and 46.2 at 2,000 r. p. m. Presumably this engine would show its maximum power at about 2,500 r. p. m., but at such a speed the inertia stresses would certainly be great, and presumably the frictional wear on the cylinder bore would also be very much increased at a linear speed approaching 2,000 feet per minute. For practical purposes, so far as the motor car is concerned, there does not seem to be any advantage in a further gain in power as a result of an increase in linear speed, or, in other words, in a further extension of the straight portion of the speed torque curve. Designers of motors for commercial vehicles already recognize the advantages of a fairly long stroke, moderate rotative and linear speed, and though light weight is a more important consideration in a pneumatic tired pleasure car, its advantages are also limited when it is purchased at the price of increased motor speed, and consequently increased stresses and frictional wear.

Coming Events.

October 7—200 Mile Endurance Run, Fairmount Park, Quaker City Motor Club.

October 10—Long Island, Long Island Motor Parkway Sweepstakes.

October 17—Hill Climb, Avon Mountain, A. C. of Hartford (Conn.).

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 27 to March 3—Hartford, Conn., Annual Show, Automobile Dealers' Association.

The Automobile on the Pacific Coast.

By E. Favary.

BUSINESS CONDITIONS.

The great San Francisco disaster of April, 1906, which completely tied up all public conveyances, forcibly demonstrated to Californians the great advantages and usefulness of the automobile. Immediately after the fire many persons who could afford it bought a machine, as automobiles and carriages were for a long time the only means of transportation. At first the heavy touring car was the best seller, as the rich were the first to recuperate from the effects of the disaster, and they naturally wished the best that could be had. Soon after, when the man of smaller means recommenced business, the runabout was in great demand by virtue of the smaller first cost as well as the smaller cost of upkeep.

For about eighteen months after the fire the sale of automobiles was very brisk, and this naturally caused almost every make manufactured in this country to be represented in the city. As the competition increased, agencies were established throughout the State, and thus the automobile was brought to the attention of the country people as well, and many doctors and farmers immediately availed themselves of the opportunity and bought machines, especially runabouts.

In the fall of 1907 the sale of automobiles diminished very rapidly, and the following winter, which was extremely quiet, brought the following facts clearly to the attention of all in the industry on the Pacific Coast: The greater percentage of wealthy people who could be interested already owned machines; others had found the heavy touring car too expensive, and the runabout inadequate for their requirements. The financial depression, which first struck the East, gradually progressed toward the West, and, besides, the lack of rain during a portion of the rainy season increased the pessimism regarding business prospects for the following season; consequently many who had contemplated buying machines deferred the matter, but in the meantime examined and investigated the merits of the different makes on the market.

At present sales are increasing, as the farmers are receiving the money for their crops; but it is not expected that business will be very good for the next few months. For the last few months a number of firms have been advertising their new models (roadsters as well as light touring cars), and this seems to have been one of the main reasons for the recent inactivity. Nine out of every ten prospective buyers say that they wish to wait and see the new models before purchasing. It would be well for manufacturers to remember this in the future, if they wish to sell their old models. Very often the new models make their appearance on the Coast only months after they appear in the East, and in the meantime, if the machine is largely advertised in the West, there is a suspense in the selling end, as the agents here have no new cars to sell, and the public will certainly not buy an old model if a new one of the same make, with many advantages over the old one, is said to appear shortly.

California is unquestionably the Mecca for the automobile, as in the larger portion of the State cars may be used almost every day of the year. One noteworthy feature of the business here is that all the machines, large or small, are sold for business purposes primarily, much more so than in the East. Banks, institutions, collectors, warehouses, drummers and others own machines. Ladies go shopping in them or pay their calls, usually driving their machines themselves. In San Francisco machines are used by business men to go to the city every morning, as in the summer they are living in the country *to get warm*. They are also used for hunting tours, and especially by farmers, doctors, real estate dealers and miners; but of these we shall speak later.

RUNABOUTS.

The ordinary country roads of California and the other Pacific Coast States are a great deal worse than those of the East, and the distances between adjacent cities and villages being far greater, the machines best adapted for the East are not those that give the best satisfaction in the West. I shall divide the runabouts in use into three different classes, and give the merits of each as found from actual experience:

1. Light high powered runabouts, weighing about 1,100 pounds.

2. Light low powered runabouts, weighing about 1,100 pounds.

3. Heavy high powered runabouts, weighing 1,500 pounds or more.

The light high powered runabout has rapidly come into favor, on account of its hill climbing ability and its speed over good roads. Tire troubles are reduced to a minimum, and so is gasoline consumption, while repairs are usually higher. It is also found that over very bad roads (contrary to frequent criticism) the light car will pass easily *at low speeds*, for when passing over stones or other obstructions it will come down more gently than a heavier car. The disadvantage of this type is the vibrations at high speeds, especially on bad roads. In such instances the vibrations will cause considerable damage to the mechanism and the body, besides being unpleasant for the occupants. Yet for the careful driver this is the most satisfactory low priced type, as the reserve power is there when wanted on long, steep hills, and gear changes have not to be made so frequently. This type of runabout receives the most contradictory criticism, even by owners residing in the same locality, some claiming it to be the best and cheapest type on the market, and using it for several years with great success, while others will condemn it in a few months, their repair bills being enormous. The former comprise the careful drivers, who will not speed over about 15 miles per hour on good roads, and go slower on bad roads. The latter are the careless owners, who will always drive at high speeds. To these

THE LIGHT, LOW POWERED RUNABOUT

is the most advantageous, as they cannot drive very fast on account of the lack of power. Low first cost, low tire and fuel cost, besides low repair bills, are the strong points of this type. Its disadvantage is the low power, and consequently its lack of speed on the level, and especially on the hills, the gears having to be shifted for very slight grades. If the low gear is not low enough the car will absolutely refuse to climb steep grades, in which the Pacific Coast States abound.

THE HEAVY, HIGH POWERED RUNABOUT

is the most suitable for the man of means, on account of its smoother riding qualities. Its further advantages over the light, high powered type are the higher permissible speeds over good as well as bad roads, and the lower repair bills. The disadvantages are higher first cost and higher tire and fuel cost.

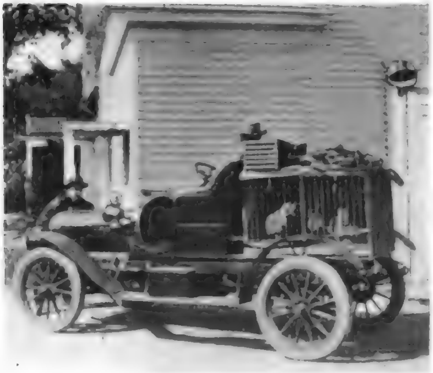
There are other models of ruanbouts that should be termed medium weight, medium powered types, and they give, as a rule, satisfactory service to the average owner.

I should think a medium powered, medium weight runabout, having a clearance of about 10 inches, and a wheel base of about 7 feet or more (clearance and wheel base are important points to the farmer), and selling for about $1,100 or $1,200, ought to find a very large sale. Another advisable construction would be a detachable rear seat, with plenty of space in the rear for a small delivery body. Such would be sought not only by farmers but also by country merchants, etc.

THE RUNABOUT IN USE BY THE DOCTOR.

The doctor of the Pacific Coast States, as a rule, finds his patients scattered over a wide range of territory, and if he has a large practice the question of rapid transportation is a most important one. In the country farms and ranches are usually some distance apart, and trolleys, if there are any, run at rather long intervals; besides, they are uncomfortable. The ordinary horse vehicle is too slow, and harnessing requires time; besides the horse requires attention after the destination is reached. The automobiles best adapted and in greatest demand by doctors are the light, high powered and the heavy, high powered runabouts. The former for the doctor of limited means and where the roads are good, the latter for bad roads.

Simplicity is also sought by the physician; he wishes something that will not often get out of order or that requires a great deal of attention. As regards cost of running an automobile, the doctor finds it much less expensive than a horse and buggy; furthermore, if he has a large practice he usually requires two horses, whereas with a ma-



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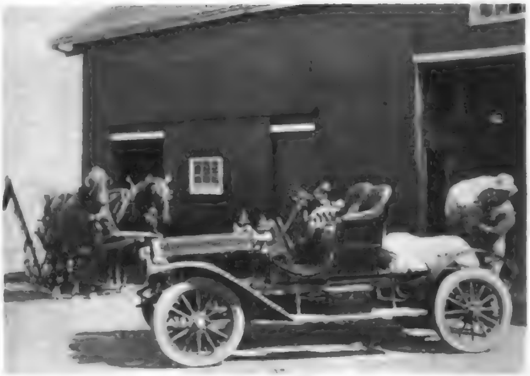

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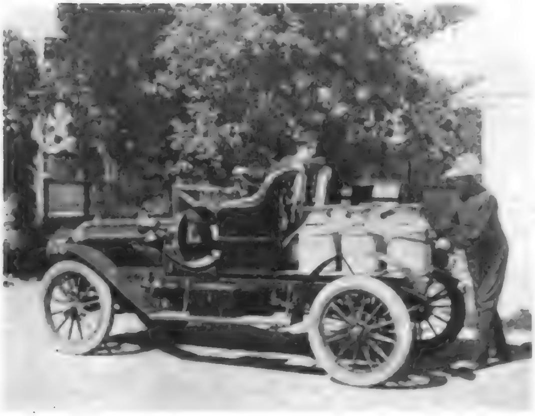

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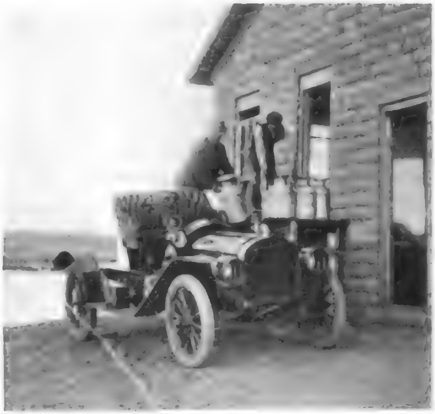

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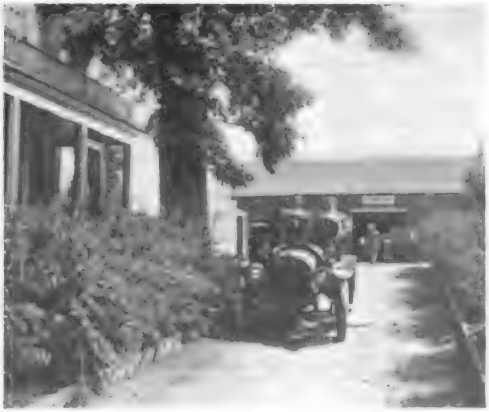

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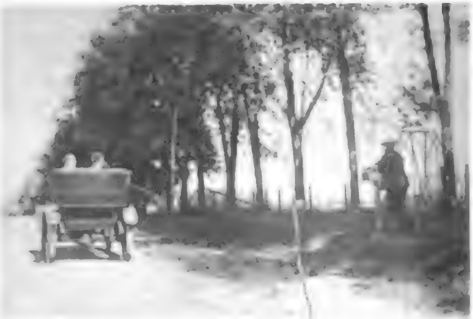


Fig. 6.

Use of the Automobile by the California Farmer.

chine he can cover 75 to 100 miles per day if necessary.

THE RUNABOUT AND THE FARMER.

The farmer is probably the person who can derive the greatest benefit from a machine. The time required to carry small loads of produce to the city would be too great, even if the horses could be spared from the field. In other words, the farmer spends too much time traveling, and yet he is greatly restricted as to distance, and the horse requires constant attention. By means of the automobile the farmer can, in his hours of leisure, visit friends at much greater distances and return the same day, and there will be no worry about the horses being too tired the next day for work in the field. While the horse will probably for some time hold his own in the field, on the road, the automobile is rapidly replacing him.

Many small farms are operated now some 40 or 50 miles from cities or villages, and have no connections with trolleys or railroads. The value of such farms has lately very materially risen in price, as on account of the advent of the automobile they have virtually been brought nearer to the commercial centres, and the farmer can make deliveries of small loads of produce daily. To such farmers the automobile is an absolute necessity, and when not in use it requires no feed or care.

The machine required by the farmers must be able to negotiate the steepest hills and the worst roads; high speed is not essential. A medium powered, heavy runabout with detachable tonneau is probably the most suitable for farm work, and such a vehicle can be used for many different purposes (see Figs. 1 to 4). When desired for pleasure, the tonneau is attached (see Figs. 5 and 6). Very often the farmer's wife will drive the machine to the city while her husband is at work on the farm, and a high speed car might be dangerous for her to drive, and, besides, as we have seen before, when driving too fast over bad roads the repair bills are too high.

The well to do farmers are in the market for light touring cars, but even they would prefer a machine with a detachable tonneau. Californians seem to be very favorably inclined toward an automobile made in their own State, they possessing considerable native pride in their home State. Then, too, the machine referred to is a medium weight, medium powered, low priced touring car, and exemplifies the general want in this State.

Californians want to see a car prove its merits on the Coast. That a car has done well in the East is no criterion to them. They insist on testing the machine over the roads they are going to use it on, as they generally even overestimate the difference in the roads of the East and the West.

REAL ESTATE DEALERS.

Real estate dealers and land developing companies find the automobile especially useful when laying out new towns and villages. Formerly one of the chief difficulties was to show prospective buyers the new land, and unless it was situated close to a railroad or car line the time consumed in this task was too great. At present land developing firms own large touring cars, by which they take their customers to the spot with the least delay, and they find the task of selling the new land much easier.

The ordinary real estate dealer, seldom having to carry more than two or three persons at a time, buys a roadster or a light touring car to show farms and building sites to his customers. Since the advent of the automobile all kinds of property have risen in price, and land that was formerly used only for grazing sheep or cattle, or that could not be sold for any price, is now finding customers and is being transformed into farms and orchards.

MINERS.

In mining districts, like those of southeastern California, and in the States of Washington and Nevada (the latter of which buys its machines largely from San Francisco), the automobile is finding ready sales. Frequently the automobile is the only means of communication between the different mining camps; it is used for prospecting, and a number of new mines that have been opened the last few years owe their existence to the automobile. When speed is essential and the roads are bad, the heavy touring car or the heavy runabout is used; otherwise the light car is employed. When the roads are in too bad a condition (very often there are no roads at all) the light car is preferred, because of the smaller amount of tire trouble, and also because it can be more easily lifted or pushed over obstacles.

Automobilism in South Africa—An Inviting Market.

By Cyril D. Bradford.

The general depression in business circles and the slump of "Africans" have made all classes of manufacturers fight shy of the South African market, but in no case can this be more truly said than as regards automobilism, as statistics show. Yet in spite of this want of confidence the use of the self propelled vehicle both for trade and pleasure purposes has steadily increased, and it is now no unusual sight to see a motor car in the most remote districts. Looking at the trade in a broad light, its rapid advance within the last three years is little else than extraordinary, seeing that no manufacturer has ever made any really serious efforts to introduce his goods. Some may say that I overstate the case in making such a declaration, but having been associated with the industry for over ten years, and in South Africa for the last five, I have never been aware of any manufacturer establishing a real live agency for his cars. I will grant that several makers have sent representatives to sound the strength of our markets, and in the majority of cases these representatives have stayed at our hotels a few days, fixed a local agency with some established hardware house or other equally unsuitable firm, and there the whole business has ended. This granting of agencies to persons wholly unsuitable to handle such a class of goods is greatly to be regretted, as the manufacturers, thinking they have fixed up a selling agency, trouble very little further in the matter.

RUNABOUTS.

At present there is a large demand for cars of the runabout type of anywhere from 10 horse power to 15 horse power, as is instanced by the sale in Natal alone of over a dozen in the last twelve months of 15 horse power Fords from the Canadian factory through the local agents of an American selling firm. Prior to the introduction of this make of car into this country the majority of automobiles used were either of English or French manufacture, but the excessive initial cost, as well as the expense of maintaining same both in gasoline and tires, owing to the unnecessary weight, greatly restricted the extensive use of cars for business purposes.

Owing to the fact that the American cars which were placed on this market some four or five years back not being by any means what they should have been, they have not had an enviable reputation. These could not be sold at any price, purchasers prefering to pay the extra cost and having the heavier and more extravagant foreign car. The reason these American cars did not give satisfaction was principally, I think, the want of testing and adjusting by the manufacturers before being shipped. I say this as I recently picked up a car of American manufacture for $200 (the original cost of which four years ago was $1,500), which had not run 100 miles, but after adjustment it gave every satisfaction. But the advent into this market of a few American runabouts (such as Fords, Reos, Maxwells, Cadillacs) by private importation has done much to refute this bad name, and has created a market for vehicles of this description.

Until within the last year the use of automobiles has been limited to a few of the richer doctors for professional use and one or two merchants as a hobby, but the last twelve months has witnessed a complete revolution of this. Without exception all the doctors in Durban and most of those in country districts have gone in for cars, and a large number of business men, notably agents, travelers, surveyors and architects, are finding that if they wish to keep up with the times they have to adopt this method of getting about.

With one or two exceptions it may be truly said that the South African market is one for runabouts, the majority of cars being used almost exclusively for business purposes. The bad state of the roads throughout the country other than in the larger towns absolutely forbids touring for pleasure.

CLASS OF CAR.

The class of car for which there is a large demand is one of anywhere from 10 horse power to 15 horse power, substantially built. When I say substantially built I mean strongly built, but with no wasted weight, as weight means tire wear, and tires are our greatest expense. As a standard the body should be two seated, capable of having a detachable tonneau fitted. Preference seems to be given at present to the vertical engine of either two or four cylinders, water cooled. It is absolutely essential that the system of cooling should be of the greatest efficiency, as the thermometer often stands at 100° Fahr. in the shade. We are also frequently blessed with a hot wind, as though it came from the gates of Hades, and I have known an engine to boil itself dry 30 miles from any place of replenishment. Magneto ignition, mechanical lubrication, cone or plate clutch, three speeds forward and reverse by sliding gear, Cardan shaft drive. There is a good deal of unwarranted prejudice against the planetary gear, I think, owing to the fact that the present local garage mechanic does not understand same, and once it goes wrong there is no one capable of putting it right again.

The following is an outlined specification of a runabout for which I am convinced there is a ready market to be found in South Africa.

Motor.—Two or four cylinder, cast in pairs, of from 10 to 15 horse power.

Lubrication.—Splash system, operated by gear driven pump, with sight feed on dash.

Cooling.—Water cooled, circulation maintained by gear driven pump through radiator of large capacity with fan at back.

Ignition.—H. T. magneto ignition of a good class is necessary, as only in the larger towns is it possible to get accumulators recharged. A supplementary system of ignition by coil and storage batteries is advisable in case of a break down of the magneto. All ignition devices should be kept high to allow of fording streams 2 feet 6 inches deep.

Carburetor.—Any of the usual automatic float feed types are suitable, and there is no necessity to heat same in any way, as unless a means is provided for cutting off the system of hot water or exhaust heating I have found the too rapid vaporization a continuous source of trouble owing to too rich a mixture being delivered to the motor. Carburetor should be kept as high as possible for the same reason as ignition devices.

Clutch.—Either cone clutch, leather lined, or one of the multiple disc class answers well; the former, being enclosed and thus free from sand and water when crossing unbridged rivers, is to be preferred.

Transmission.—The general preference seems to be for that of the sliding gear type with three forward speeds and reverse, operated by side lever with gate change. Speeds 6, 12 and 25 miles per hour, with motor at normal speed.

Drive.—Cardan shaft through bevel gear and differential to floating back axle. All joints to be covered to exclude dust, sand, etc., and made grease containing.

Steering.—Wheel steering, worm gear type, and owing to the strain of driving in sand and over boulders in river beds it must necessarily be substantial.

Brakes.—Foot brake on large size drum at back of gear box with contracting band fibre or thermoid lined, say 9 inch drum 2½ inches wide. Side lever brakes on hubs of rear wheels of the enclosed expanding type.

Frame.—Pressed steel channel section.

Axles.—Front, straight or slightly dropped forging, I-beam section; back, the differential and floating axle case forming supports of frame.

Springs.—Half elliptical back and front, and it is decidedly necessary to fit shock absorbers of approved design to rear wheels.

Wheels.—32 to 34 inches, all equal. The wire wheel is gaining great popularity owing to the dryness of climate in winter shrinking and loosening spokes in the ordinary artillery type.

Tires.—4 inches diameter, or 105 mm. of a standard pattern—Dunlop, Diamond or Michelin.

Bearings.—To engine and transmission phosphor-bronze white metal lined (as this class of bearing can be repaired at any wayside machine shop). Those to wheels either ball or roller.

Tank.—Gasoline under seat with capacity for from 12 to 15 gallons. This tank should be placed high enough for the fuel to reach carburetor on a 25 per cent. grade with tank half full.

Lubrication tank should hold about 1½ to 2 gallons, and be placed convenient for refilling.

Tread should be about 4 feet 6 inches; wheel base about 8 feet 6 inches.

Body.—The ordinary American pattern runabout body, with rumble seat at back, with tool box under, is a very popular type. The back rumble seat is almost a necessity, as most owners drive this class of car themselves and carry a Kaffir attendant, who occupies the rumble seat. Metal body paneling is preferable to wood, owing to the liability of the latter to warp and shrink under the fierce sun. Upholstery should be leather, not pegamoid or other imitation, as these substitutes do not stand our climate. The paintwork should be of the highest class, as the strong sun otherwise destroys it.

Weight.—A car of this description strongly built, but with no unnecessary weight, should come out at from 15 to 16 cwt., say 1,800 pounds.

Clearance.—There should be a clearance under the drop of the front axle of at least 12 inches, and the whole under gearing kept above this line, except, of course, the differential case.

Cost.—I think that a car could be built on the lines of the above specification capable of being sold in South Africa at from £240 to £300.

Demand.—From personal experience I can say that the specification I have given is also equally suitable for India and the Australian colonies, whose requirements are practically the same as ours. It would thus be possible to manufacture this class of car in large numbers with the certainty of ready sale for same.

CRITICISMS.

Having asked the opinions of many owners of American cars, and speaking from personal experience, it is only in minor points that faults can be found. The principal source of complaint against these cars is the careless manner in which they are shipped, such things as necessary spanners, etc., being omitted in the equipment; the neglect of manufacturers to test and adjust cars before shipment; the inadequate supply of water in the cooling system; axles and springs being far too weak to stand the strain of the local rough roads; the absolute uselessness of the usual dry cell equipment with which cars from the States are fitted for ignition purposes. Owing to these cells being fitted, the coils on these cars more often than not are made to work with a 6 volt current, and if these dry cells are dispensed with it is only possible to get a 4 volt accumulator, the current from which is not sufficient to give a good spark at the plug when under compression in the engine. The chief cause of dissatisfaction is that manufacturers have never made any effort to establish a permanent agency, and there is therefore no possibility of getting spares and replacements. For instance, I have known a car to be hung up for four months while a gear wheel was being sent from the factory.

As regards cars of makes other than American, the great objection to these is their excessive cost (about £450 for a 10 horse power car), unnecessary weight and consequent expense in upkeep for tires, gasoline and oil.

A car of French make has been modified to answer as nearly as possible the foregoing specification, and several cars of this pattern are running in Natal and Transvaal, and except for the expense aforesaid have given splendid satisfaction. These cars were specially built to my specification for well known medical men, and are today as good as ever, after running over 20,000 miles in all weather and over tracks that are not worthy of the name of roads.

A 15 horse power Ford is owned by a well known architect, who finds it very useful when inspecting works from time to time in progress. He has recently been appointed architect to the large dynamite factory which Messrs. Kynochs, Ltd., of England, are erecting at Umbogintwini, some 20 miles from Durban, at a cost of $1,000,000

This gentleman informed me not long ago that he could not possibly carry out his duties in Durban and also supervise his work at Umbogintwini without the aid of a car, and although he has only been using this pattern about six months the car has paid for itself twice over in the saving of time, as he can now do in three hours what would otherwise take him the whole day, the train service on the branch railway to Umbogintwini being very infrequent, and will not allow of one getting there and back under eight hours.

Herewith I give the comparison between the cost to a well known doctor of Durban, using horses and automobile. These figures were given to me by him and are accurate:

HORSES.

Three horses, average cost $125	$375
Harness	60
Trap	250
Stable boy and coach boy, $15 per month	180
Feed and bedding	340
Shoeing, vet. and repairs	170
	$1,225
Sold trap and horses at end of twelve months for	300
(One horse died of horse sickness.)	
Annual cost	$925

AUTOMOBILE.

Car and equipment	$2,250
Gasoline, oil, etc.	180
Tires	170
Repairs	40
Boy	90
	$2,730
Present value of car and equipment	1,800
Annual cost	$930

It is thus shown that in actual cost there is not much difference, but the practitioner informs me that he has used the car a great deal for pleasure, but not the horses. He says, also, that he is now able to get several afternoons a week off, whereas previously he could hardly cope with his duties and never had a moment's rest. He is therefore greatly improved in health and able to considerably extend his practice.

Points in which the American car scores over its foreign competitor are: Low initial cost, width of track (which is more suited to local wagon rutted roads) and low cost to maintain. Illustrating this I instance six months' maintenance, principal items only, of the Ford above referred to and one of the heavily built foreign cars before mentioned:

Ten horse power, two cylinder Gladiator, H. T. magneto; weight, 2,200 pounds; cost, $2,250. It was run for six months, covering a distance of 5,700 miles.

Two new tires, 810x90, at $40	$80
Two new tubes, at $15	30
Gasoline	100
Oil	40
	$250

Tires at end of six months in fair condition, good for about another 1,500 miles.

Fifteen horse power Ford; cost, $900; battery and coil ignition; weight, 1,250 pounds; run 5,000 miles in six months:

One new tube	$15
Gasoline	90
Oil	45
Accumulators, charging	10
	$160

Tires—rear ones want replacing; good for about another 500 miles; front good for another 2,000 miles.

It is striking comparisons such as these that are rapidly demonstrating the economy of the American runabouts and creating a demand for them.

CUSTOMS STATISTICS OF AUTOMOBILES IMPORTED INTO SOUTH AFRICA FOR 1906—1907.

Exporter.	1907.	1906.
United Kingdom	£54,000	£43,000
Canada	5,000	200
Austria	....	400
Belgium	6,000	1,000
France	23,000	26,500
Germany	14,000	20,000
Italy	500	200
U. S. A.	2,500	4,500

NOTE.—This seeming decrease in importation of cars from the United States is owing to the fact that a number of American manufacturers send cars to this country from their Canadian factories, and thus save 3 per cent. on the import duty. In going through the records I find that without exception the cars imported from America have been of the runabout type, costing anywhere from $750 to $1,500.

BUSINESS METHODS.

A glance at the figures shows at once that, though cars of American make are gradually gaining a larger sale in this market, American makers are not doing anything like the business they should, and I am convinced that this is solely due to the fact that they have not up to the present made any determined effort to catch the trade of the South African colonies. During the last two years determined efforts have been made by British manufacturers to establish an opening here for their surplus supplies, and at least three of the well-known makers of a car suitable for business purposes or a man of moderate means have sent representatives to these colonies with a demonstration car to establish agencies, and I am convinced that to this fact is due the increase in importation of automobiles of British manufacture. I would point out to manufacturers that up to the present the market here for the horseless vehicle has only been a scratch one, but to those makers who are prepared to build cars on the lines of the specification given by me, and to place same in the hands of a real, live, pushing representative there is a good harvest of orders to be reaped. In quoting terms to such a representative manufacturers must be prepared to fulfil contracts for payment thirty days sight draft through the bank, and, of course, discretion must be exercised in the selection of such agent, so that every confidence can be placed in him with a view to his fixing permanent agencies at the various seaports and larger inland towns.

ROADS.

The writer, who has had a large and varied experience of matters automobile, in the course of which he has covered nearly the whole of South Africa at various times, can speak from experience of the condition of the roads. As a general rule the roads are neither properly excavated nor constructed. They originated from the tracks made by the Boers' wagons while on trek, without any idea of grading whatever, and with no conception that they would ever be required for use by the modern automobile. In the dry season, from March to September, their condition is at its best, except for an occasional mile or two of deep sand; but in the wet season, from September till March, they are little else than quagmires, frequently cut up by spruits and rivers with sandy bottoms, and from 3 to 5 feet of water running in them. None of the roads outside the towns are macadamized, but the introduction of the horseless vehicle and the pressure that is being brought to bear on the various governments by owners of same is beginning to tell, and at an early date there is every likelihood of better conditions prevailing. In spite of these conditions the writer is so confident of the future of the self propelled vehicle in South Africa that he is contemplating an extensive tour through the country, covering some 5,000 miles, through Natal, Transvaal, Rhodesia, Orange River Colony and Cape Colony, with the object of demonstrating what can be accomplished, even under the before mentioned drawbacks, by the modern creation of our automobile engineers. In selecting his car for this purpose his choice falls on those of American manufacture, as he is convinced after an unparalleled experience that the manufacturers in America build the most suitable car for colonial use.

Spark Plugs Sparking Under Water.

An advertising war has broken out between two German automobile specialty dealers, both handling spark plugs which will spark under water. One of these is the firm of Sorge & Sabeck, in Berlin, which holds the German agency for the Reliance plug, made in Newark, N. J., and the other, the Auto-Bestandteil Company, in Strassburg, who handle the Mars plug. The latter is said to be based on an invention of M. Martinet, of Geneva, Switzerland, who took out patents on his invention in France, Switzerland and Germany, but according to the firm of Sorge & Sabeck these patents have been allowed to lapse. The possibility of sparking under water is said to depend on the fact that the central electrode secured into the insulator is cut off flush with the end of the insulator.

At the regular meeting of the trustees of the A. C. of Minneapolis (Minn.) on September 29 it was decided to build a private hill, constructed along scientific lines, for the holding of hill climbing contests.

The Limitations of the Universal Joint.

(Paper by H. Vanderbeck, read at the Cleveland meeting of the Society of Automobile Engineers.)

Although the universal joint originally known as Hooke's coupling has been widely used for feed mechanisms on machine tools, for driving drill spindles, and in agricultural machinery, it was not generally employed for the transmission of considerable powers until the advent of the bevel gear driven rear axle automobile. Fundamentally, the universal joint is a device for the transmission of rotary motion between two shafts whose axes intersect in a point, with varying angles with each other; and although modified forms of the device are made which allow for lateral displacement of the axes, it is the purpose of the writer to analyze the operation and determine the peculiarities and limitations of the universal joint in its true form; the modifications must necessarily be considered as individual cases, and are outside the scope of this article.

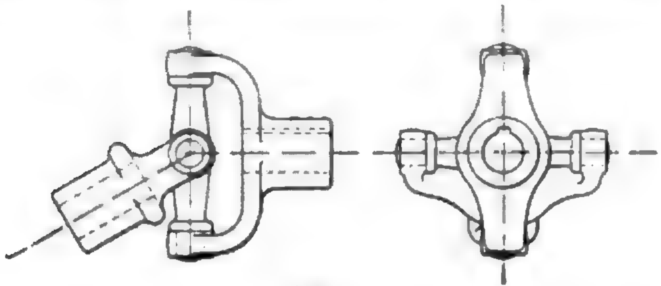


FIG. 1.

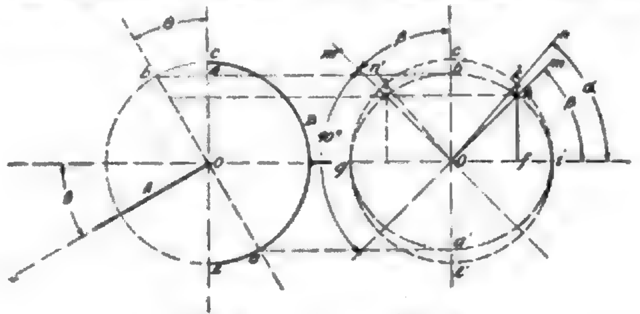


FIG. 2. FIG. 3.

In its simple form the universal joint consists of two shaft ends terminating in forks and connected to each other by a cross member having two bearing axes at right angles to each other, and which engage with corresponding journal bearings in the forks. This arragement is shown in Fig. 1, and although joints are made which differ in constructional details, the principles of this fundamental form apply in most cases. We will now proceed to the analysis of the movements of the several parts of the mechanism, when in operation, and for the sake of clearness we will construct the diagrammatic view, Fig. 2, of the parts in the same position as in Fig. 1, and also the side projection, Fig. 3.

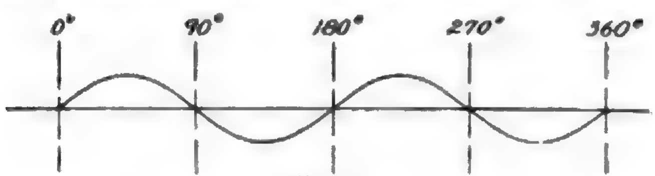


FIG. 4.

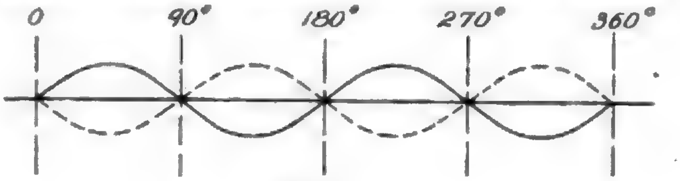


FIG. 5.

Assuming that the joint has a position as shown in Fig. 1, where fork B lies with its shaft axis and its cross axis both in the plane of the drawing and the fork A with its shaft axis in the place of the drawing, and making an angle of θ with the axis of B, then the cross axis will have a position perpendicular to the plane of the drawing. It is evident that in rotation the extremities of the fork B will always move in the line *c-e*, Fig. 2, and in the circle *c'-g-e'-i*, Fig. 3, while the extremities of the fork A will describe the line *b-a*, Fig. 2, and the projection of this trace, in Fig. 3, will e the ellipse, *i-b'-g-a'*. Starting from the position, *c'-e'*, as shown in Fig. 3, the fork B being at *c'* and *e'* and the fork A at *i* and *g*, we turn fork B through some angle β, then the trace of the point *i*, of the fork A will be along the ellipse and its location will be determined by the point of intersection of the ellipse and the line *o-m*, which is drawn at right angles to *o-m'*, since the projection of the cross axes must always be at right angles to each other, because the axes are themselves perpendicular to each other and one of them lies in the plane of the projection, Fig. 3.

We have then determined the projection, in Fig. 3, of the cross axis of A in its new position, but since this line in its true position lies in the plane *b-o-a*, it is necessary, in order to determine its actual position, to swing the plane *b-o-a* into the plane of Fig. 3, and we then find that the point *h* travels to *k*, and that *o-k* is the true position of the cross axis of A in relation to its shaft axis, and that the member A has moved through an angle α, while the member B has moved through an angle β.

It is now necessary to determine the dimensions of the angle α in terms of the angles β and θ.

From the properties of the ellipse we know

$$fk : fh :: oi : ob'$$

where *oi* is the semi-major axis and *o-b'* is the semi-minor axis, and from Fig. 3 we see that

$$fk : fh :: tan.\ \alpha : tan.\ \beta$$

therefore,

$$tan.\ \alpha : tan.\ \beta :: oi : ob'$$

but,

$$oi = ob \text{ and } ob' = ob\ cos.\ \theta .$$

Therefore,

$$tan.\ \alpha : tan.\beta :: ob : ob.\ cos.\ \theta$$

or,

$$\tan.\ \alpha = \frac{\tan.\ \beta}{\cos.\ \theta},$$

which is the algebraic expression for the angle moved through by B, in terms of the inclination of the shaft axes and the angle moved through by A. It will be noted that when $\alpha = \theta$, B = O and also that when $\alpha = 90$ degrees $\beta = 90$ degrees, or in other words, that four times in every revolution the two forks stand at 90 degrees with each other, and it is also evident that the maximum variation will occur midway between these positions.

Referring again to Fig. 3, and continuing the rotation of B for 90 degrees, we see that *o-n* of A will be at *o-n'* and is behind the member A an angular difference equal to the amount it was in advance in the former position, or in other words, its angular position is now negative, while it was positive before. (The angular position must not here be confused with the angular velocity.) From what we have seen we may conclude that this same angular relation is repeated in the two remaining quadrants of the cycle, and we may plot these relative positions as shown in Fig. 4.

In practical application of the above the maximum angular variation between the two members is probably of more interest than the angular velocity ratio, and in order to prevent this variation in concrete form the following table will be of value:

Angle θ Between Shaft Axes.	Maximum Angular Variation.	Length of Arc of Circle of 3" Diameter. Inches.
5°	6.57'	.00286
10°	26.35'	.01149
15°	59.60'	.0260
20°	1° 46.80'	.0466
25°	2° 49'	.0737
30°	4° 7'	.1077
35°	5° 41'	.148
40°	7° 37'	.199
45°	9° 35'	.251

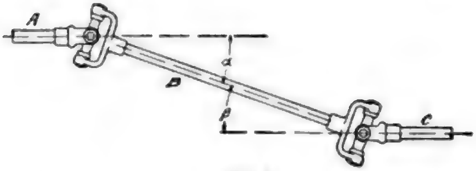


Fig. 6.

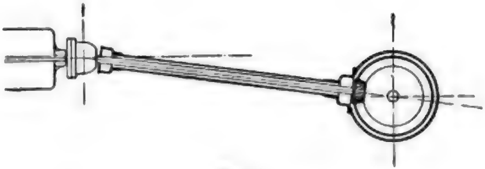


Fig. 8.

The angular variation and the length of the arc in the above are given as the numerical difference, which occurs, both positively and negatively, twice in every revolution.

Recognizing this defect in the operation of a universal joint, it is customary, where smooth running between driver and driven parts is desired, to use them in pairs; the effect of this arrangement is to correct the variation of one joint by the complementary variation of the other. The graphical illustration of the effect of using joints in pairs may be shown by referring to Fig. 4, and superimposing on this curve that of another joint, in phase with the first, but of opposite sign, as shown in Fig. 5. The resultant of which is a straight line.

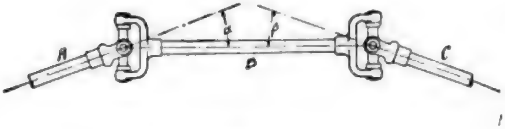


Fig. 7.

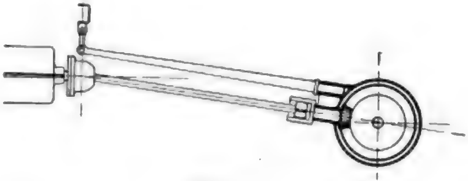


Fig. 9.

The conditions, however, which must be met in order to give this result are that the fork axes of the stems of the intermediate shaft B must lie in the same plane, and that the angle between both extreme shafts and the intermediate shaft shall be the same. This may be either as shown in Fig. 6, or as in Fig. 7, so long as the angle equals the angle. Evidently, the intermediate shaft B will have a varying angular velocity, but as this member is of small diameter and of light weight its non-uniform motion will cause no trouble in ordinary cases. It must be borne in mind, however, that we deal here only with that condition in which the axes of the driving and driven shafts, A and C, lie in some common plane; an analysis of the case where these shafts lie in different planes is more complex and is beyond the scope of this article. In the application of the universal joint to the main drive of automobiles, designers have commonly chosen one or the other of the arrangements shown in Figs. 8, 9 and 10.

The construction as shown in Fig. 8 includes only one universal joint, and the torsion resisting member is concentric with the extension of the pinion shaft. In Fig. 9, one universal joint is used at the forward end of the propeller shaft, and the connection with the pinion shaft is by means of a semi-universal, or more properly, a flexible coupling, which is universal only to a small extent, and its function is to allow for discrepancies in alignment and end motion, and it normally works practically in a straight line. Fig. 10 shows the use of two full universal joints, the torsion resisting member being independent, as is the case in Fig. 9.

It will be noted that in the construction, Fig. 8, the driving pinion will have the varying angular velocity of a single universal joint, and the amount will depend on the angle at which the joint operates. The effect of the arrangement, Fig. 9, is the same as that of the arrangement, Fig. 8, but in Fig. 10 it is possible by means of the double joint and proper setting to eliminate the variation, and the pinion will have a constant angular velocity ratio with the change gear shaft.

By referring to the table given above we may note directly the approximate variation from normal, at the pitch line of the driving pinion, for conditions such as shown in Figs. 8 and 9, the amount of the variation given having been calculated on the basis of a pinion diameter of 3 inches.

The foregoing calculations are not intended to discredit any one type of construction, but rather to indicate the laws which determine the practical limitations of this particular type of mechanism. In conclusion, it may properly be said that familiarity with the universal joint breeds respect, and although it seems to be called into service only as a last resort, the generous wearing surfaces, low rubbing speeds and smooth operation of a well designed universal must appeal as having mechanical virtues worthy of consideration. Given the same amount of time and thought in development which has been expended on the theory, design and manufacturing methods of bevel gears, it can easily be imagined that the universal joint would, in many cases, give a better performance than its accepted rivals.

Fig. 11 shows a model made by the author to prove his theories.

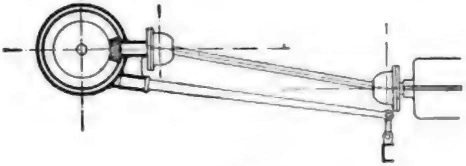


Fig. 10.

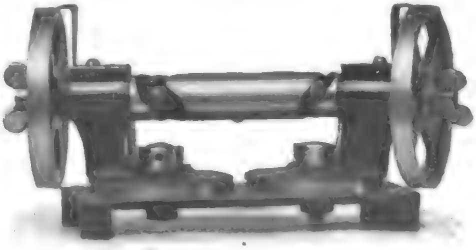


Fig. 11.

COMMUNICATIONS

Motor Truck for Compressed Air House Cleaning Plant.

Editor HORSELESS AGE:

The undersigned is engineer for the Compressed Air House Cleaning Company, of New Bedford, Mass. During one season we used a horse to haul the air compressor around from place to place, but we found that he was a great bother, because while we were cleaning a house we had to tie him in front of the house, that is if we didn't have to go a couple of blocks to find a post to hitch him to. We also heard numerous complaints about our "poor horse" standing on the street all day long, whether the weather was good or bad.

The idea then occurred to us that we would get a motor truck chassis and place our cleaning wagon body on this chassis, but on second thought the fact that if the motor truck should break down we would not be able to attend to our business led us to decide on the purchase of a truck for use as a tractor to haul the cleaning wagon around the same as the horse did So we sold our horse and bought a 2½ ton 30 horse power truck, and rigged up a device for fastening the cleaning wagon to the truck. We have had no further complaints about our "poor horse."

This is the second season that we are using the truck, and we would not go back to the horse for steady use for a good deal. We have used a horse several times to haul the machine around when the truck was undergoing repairs. Our repair and upkeep bills for the two seasons have been so small that the same sum would give a horse a rather poor living for the same length of time. J. LEWIS KNIFFEN.

On Brake Design.

Editor HORSELESS AGE:

We have read with much interest the articles by Morris A. Hall appearing in THE HORSELESS AGE relating to the manufacture of motor truck parts, and our attention is particularly attracted to that portion on brake bands with removable brakeshoes, drawings of which appear in your issue of September 16.

Mr. Hall suggests that the ability to replace a worn brakeshoe is a big talking point in favor of a brake so fitted, and further recommends that these shoes be covered with belting, a good but by no means the best construction

We beg to suggest that if these shoes are either cast iron or bronze, and made one-quarter inch thicker than is shown in the drawing, fitted with cork inserts and operated in oil, the original cost will not materially exceed the construction proposed by Mr Hall, while the results obtained will be enormously more satisfactory.

The corks passing through the shoe will act as a cushion between the brake band and brakeshoe, bringing about a tight, noiseless, although yielding joint, and the shoes can be replaced with equal facility, although changes will not often be necessary, as cork insert shoes running in oil are good for many thousands of miles, absolutely without wear, as is shown by metal to metal contact brakeshoes and clutches, which (according to licensees) have been used without material wear for distances varying all the way from 12,000 to 69,000 miles, as is shown by letters from our licensees, copies of which we will be pleased to forward to any person desiring a confirmation of this statement.

If it is possible to make a brakeshoe which is good for from 10,000 to 20,000 miles practically without wear, and which is acknowledged to be as, if not more, efficient than any other brake made, is not this a matter which is of vital importance to designers and manufacturers of commercial vehicles, taxicabs, etc.?

NATIONAL BRAKE AND CLUTCH COMPANY,
Lawrence Whitcomb, Treasurer.

Users of Cork Insert Brakes.

Editor HORSELESS AGE:

On page 477 of your September 30 issue we notice that H. L. A. states that the use of cork inserts in cone clutches is becoming very common, and asks if you can name a case where cork inserts are used in brake bands.

In addition to the companies mentioned by you as having used cork insert brakes, we desire to say that the Garford and Studebaker cars have been so equipped for two years, and that the Garford Company has notified us that it will continue to use them in its 1909 product, and we particularly wish to call his attention to the cork insert brakes used in the Premier cars, and the results obtained as shown by the report of the technical committee, which dismantled the Premier Century car after it had completed more than 12,000 miles, in which they say: "The corks were in good condition, and the brakes showed neither wear nor scratching."

NATIONAL BRAKE AND CLUTCH COMPANY.
Lawrence Whitcomb, Treasurer.

Crank Effort Diagrams.

Editor HORSELESS AGE:

I should be pleased if you would tell me how the formulæ

$$\frac{F}{a} = .00034 \frac{W}{a} N^2 r (\cos \theta + R \cos 2 \theta)$$

and

$$S = r \{(1 - \cos \theta) + \frac{1}{2} R \sin^2 \theta\}$$

are derived. See page 187, August 12, 1908. D. W. SHILSON.

[The author of the article, E. J. Bartlett, informs us that the formulæ were taken from C. E. Lucke's "Gas Engine Design." Pages 77 to 82 inclusive of this book are given up to the derivation of these formulæ, and the best plan for our correspondent, therefore, would be to get a copy of this work, which is published by D. Van Nostrand, 23 Murray street, New York. —ED.]

Frame Formulæ Criticized.

Editor HORSELESS AGE:

In the article on "Frame Side Members" (HORSELESS AGE, August 26, 1908), under the head of "Armored Wood Frames," the following equations occur:

$$\text{Eq. 1.} \quad Z_1 = \frac{B H^3 - b h^3}{6 H} = \frac{M}{f_1}$$

$$\text{Eq. 2.} \quad Z_2 = \frac{b h^2}{6} = \frac{M}{f_2}$$

"Where M is the maximum bending moment on the frame."

if M is the maximum bending moment Eq. 1 satisfies the conditions, as there is no further moment to be taken up by the wood core.

Assuming the above to be a "slip of the pen," the analysis is nevertheless incorrect.

A beam of the form in question should be calculated as follows:

The metal casing is figured for its load with a maximum fibre stress, also the corresponding deflection. The wood core is then subjected to a load of such magnitude that it will deflect only as much as the casing. From this load the fibre stress in the core may be calculated, therefore the moduli of elasticity are functions of the calculation for this type of beam.

Incidentally the last formula on the subject has its "wires crossed," viz.:

$$Z_1 + Z_2 = \frac{M (f_1 + f_2)}{f_1 f_2}$$

The formula

$$Z = \frac{39 W}{E L}$$

is objectionable for the reason that the length of the frame is omitted.

The coefficient 39 is a function of the factor of safety and length, and is therefore a variable, unless all automobile frames have the same length; furthermore it is derived from frames that have "stood up," which is no criterion that they were properly designed, as they may have been heavier than necessary. Nor could such a coefficient be ascertained unless the frames were tested to destruction, or at least subjected to an internal stress equal to their elastic limit. L. EIDLITZ, JR.

The management of the automobile show which is to be held in the Crystal Palace in Leipzig this month, and at which the members of the German Automobile Manufacturers' Association have decided not to exhibit, is retaliating by prohibiting these manufacturers and their representatives from visiting the show, to which they have a right under the German law. The manufacturers have been notified that in case of non-compliance with this rule they will be prosecuted for "creating a disturbance."

NEW VEHICLES AND PARTS

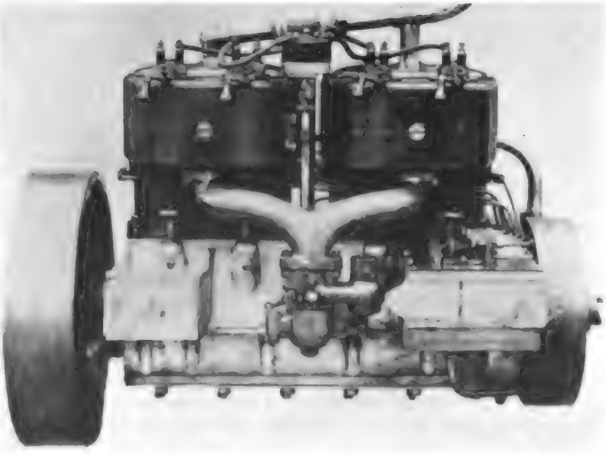
The Haynes Model X.

This new car is similar to last year's Model W of the Haynes Automobile Company, of Kokomo, Ind. It retains all the characteristic Haynes features, but embodies a number of changes in design, notably in the dimensions of certain parts.

The four cylinder motor, of 4¾ inches bore by 5 inches stroke (36.1 horse power according to the A. L. A. M. rating formula), is provided with a specially liberal water jacket space. The crank shaft is of the three bearing type, and turned from a solid bar of nickel steel, which has previously been roughly forged to shape. The crank shaft ends are carried on double sets of adjustable conical roller bearings (instead of single sets as last year). The centre bearing is of Parsons white bronze. The crank shaft, after being turned, is ground and polished by a special machine which insures perfect accuracy and balance.

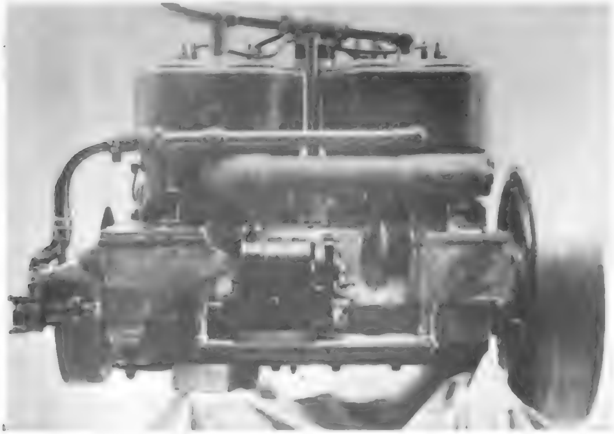
The inlet and exhaust valves are located on opposite sides of the cylinders; both valves are of the same size, 2⅝ inches in diameter. The nickel steel heads are electrically welded to the stems.

The connecting rods are I-section drop forgings. The crank pin end is fitted with a white bronze bushing, and the wrist pin end with an adjustable yellow bronze bushing. The crank case is of aluminum alloy, and is divided horizontally into three sections. The arms supporting the motor are cast integral with the upper section of the case. The right hand forward arm supporting the crank case is cast in box shape, and in it is embodied the McCord oiler, gear driven from the inlet cam shaft. The corresponding arm on the opposite side is used as an oil reservoir, and is connected with the oil pump proper through a small passage in the forward part of the case. This allows of an ample supply of oil to be carried for long drives. The crank shaft and both cam shafts are carried between the upper and middle portions of the base, and are suspended from the upper section. The lower section is divided into four separate pits for the cranks, and the divisions thus prevent the oil from gathering in the ends of the base on grades. The half time gears, together with the gear driving the oil pump on one side, and the gear driving the magneto and water pump on the other side, are carried in a separate compartment in the forward end of the crank case, which permits of these gears being packed in the heavy oil, reducing the noise to a minimum.



INTAKE SIDE OF HAYNES MODEL X ENGINE.

Note location of timer between cylinder pairs, flywheels at both ends of engine, manifold joints at bottom of valve chambers, mechanical oiler in crank case arm.



EXHAUST SIDE OF HAYNES MODEL X ENGINE.

Note drive for water pump and magneto, oil reservoir in crank case arm and magneto support.

The pistons are fitted with three composite rings and a plain wrist pin ring.

MOTOR ACCESSORIES.

The water pump is of the eccentric type, and the Haynes Company say that they have found from many years of experience that this type of pump has many advantages. It has comparatively few moving parts, and the motion of these parts is very slight. They found that it is just as good after many years of service as when first put in commission, and besides it has the advantage of giving a positive circulation.

Two entirely separate systems of ignition are provided. One system comprises a battery of dry cells, a distributor and a single unit coil. The other is a high tension magneto system. The plugs and wires of the two systems are absolutely separate, and are both placed directly over the inlet valves.

Lubrication of the motor is accomplished by the use of a McCord force feed oiler. There are five leads, one to each of the cylinders and one to maintain the oil level in the crank pits. The oiler is gear driven, and a separate reciprocating pump is provided for each lead. The pipes carry directly from the oiler to the point of delivery, doing away with sight feeds on the dash.

STEERING GEAR AND FRAME.

The steering gear is fastened directly to one of the crank case arms. It is of the irreversible type with worm and spiral gear. The worm gear shaft is carried in eccentric bushings, which admits of adjustment of its mesh with the spiral gear. The end of the worm gear shaft is squared and tapered. On this fits the drop arm to the ball joint. When the worm and spiral gear become worn this drop arm can be removed from the tapered square worm shaft, and the steering wheel turned so that a new portion of the gear comes in mesh.

The frame is of pressed steel, channel

section, and is reinforced by heat treated vanadium steel from the motor to the transmission. It is also lined with hickory from the forward end to the rear of the transmission.

CLUTCH AND CHANGE GEAR.

The clutch is of the contracting band type, and is similar in action to the ordinary brake. The clutch drum is of bronze, and is supported in the flywheel by four arms, which are forked at the outer extremity. These forks fit over lugs on the inner rim of the flywheel. Between the lug and the fork on either side coiled steel springs are placed, forming a shock absorber between the engine and transmission, to eliminate strains attendant upon the sudden engagement of the clutch. The clutch consists of a steel band supported by a heavy arm from its centre, keyed to the clutch shaft.

The change gear is carried in an aluminum case, and is of selective type with two sliding members, giving three forward speeds and one reverse. The third speed is a direct drive. The gears are of nickel steel, specially treated to resist wear. The master gear of the countershaft drives through a ratchet. With this device it is impossible to throw the momentum of the car on to the gears. In shifting from a higher to a lower gear it allows the car to run ahead of the engine until the car is retarded to the speed that the engine would drive it on the particular gear that is engaged. This device, the company state, has been found to practically eliminate gear stripping. The top of the gear case may be entirely removed by the removal of the retaining cap screws. The bearings of both the main shaft and the countershaft are specially designed rollers. They are fitted with stuffing boxes to prevent leakage of oil.

REAR AXLE DRIVE.

The universal joints are in three parts, consisting of two heavy steel yokes and a square steel block. The yokes have large flat surfaces on the inside of the forks. The case hardened steel block is ground to a perfect fit in these forks. Cross pins hold the block in place, but the pulling strain all comes on the broad surface of yokes and blocks. The universal joints are both covered with heavy leather boots, protecting them from the dust and mud of the road. Back of the rear universal is arranged a slip joint to compensate for the different relative positions of the rear axle and transmission caused by the action of the springs.

The method of power transmission at the rear axle is peculiar to the Haynes car, and is fully covered by patents. Instead of the usual bevel gear a roller pinion and sprocket are used. The driving member consists of a shaft with two integral flanges about 1 inch apart. Between these flanges, at proper distances, pass large steel pins. These pins carry ferrules or rollers of specially selected stock. As this member revolves the rollers engage large coarse teeth of the sprocket ring, which is fastened to the differential. The latter is of the spur gear type. The rear axle is of the solid shaft and sleeve type. It is carried on four sets of flexible roller bearings.

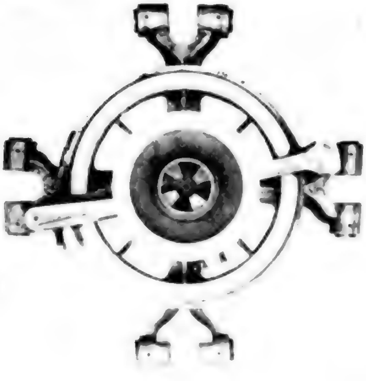
As action and reaction are equal it is obvious that when the power is applied there is just as great a tendency to roll the rear axle housing backward as to drive the wheels forward, and vice versa when the car is being driven backward. If no other provision were made, this reaction would pull upon the springs and spring clips at the outer extremities of the housing. To avoid this a torsion roller is arranged on the upper portion of the right hand side of the differential casing. This roller is carried on a heavy pin passing from the housing to a supporting arm. Directly above is a guide carried on two cross tubes, which are riveted to the frame at their ends. This guide is provided with a deep slot which allows the torsion roller to move up and down according to the spring action. It is seen that any tendency to throw the differential casing out of its normal position is obviated by the confinement of the torsion roller in the slotted support.

The front axle is a single piece I section drop forging.

BRAKES AND CONTROL.

Two entirely separate systems of brakes are provided—one operated by a pedal and the emergency set operated by a side lever. Both brakes are external contracting band brakes placed side by side upon a drum fastened directly to the hubs of the rear wheels. This pressed steel drum is 14 inches in diameter. The band of the foot brake is 1¼ inches wide, while that of the emergency brake is 1½ inches wide. In mechanical design the foot brake and the emergency brake are identical. The brake shoes are in two halves—upper and lower. Each half is supported at either extremity, which makes it impossible for them to drag owing to misalignment. The brakes are also arranged with ample clearance when released. The lining is of Raybestos. The drum is hollow, and so arranged that it may be filled with water, thus giving a water cooled brake. Both the foot brake and emergency brake are arranged with equalizers. Both of these brakes are adjusted by a single turnbuckle having a two way thread. It is located on the rear portion of the brake and is easily accessible.

Two control pedals are placed in comfortable positions for operation. The one on the left operates the clutch, and the other the clutch and brake. Midway between these is placed the accelerator pedal. The steering column, of polished brass tubing, is considerably raked, and is equipped with a steering wheel 18 inches in diameter, 2 inches more than on last year's model. The throttle and spark levers are placed upon a stationary quadrant above the wheel. The



HAYNES CLUTCH

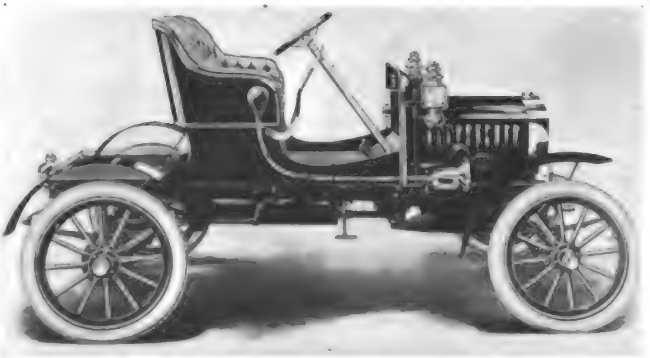
HAYNES IMPROVED TORSION LEVER.

range of sweep of the gear lever is such that at no position is it inconvenient for the operator to reach, and when the high gear is in, the lever is in a position near the driver's seat. When not in use the lever controlling the emergency brake is in a forward position. Thus separating the controlling and brake levers avoids confusion in case of emergency.

The wheels are 36 inches in diameter, instead of 34 as last year, and the wheel base has been increased from 106 to 112 inches. The spring clearance is now 7 inches, while formerly it was only 4.

BODIES.

The body is made of wood throughout and built entirely in the Haynes shops. The front seat is divided; the rear seat is 52 inches wide and of very comfortable depth. There is sufficient room in the tonneau of the car that side seats accommodating two other passengers may be installed if so desired. A runabout body of the conventional type may also be supplied. The seats are placed about 6 inches further back than on the regular touring model, and are quite low and of the individual type. The dash is drawn well back and hooded in. This runabout body can be equipped with either a single rumble seat, two small rumble seats side by side, or full sized seats like the front ones. The Hiker type of car is similar to the runabout, except that it accommodates two passengers only. The bucket seats are set very low, and in order to make them entirely comfortable are placed at a slight angle, being tilted up in front about 1½ inches higher than at the back. Directly back of the seats is placed a large circular gasoline tank, and on the flat deck in the rear is placed a small tourist's trunk. In the toy tonneau type of body the front seats are placed in the same relative position as in the runabout; the tonneau is thus made shorter and the seat is wide enough only to accommodate two passengers.



THE MAXWELL JUNIOR RUNABOUT.

The Maxwell Junior Runabout.

Considerable interest has been taken in the recent announcement of the Maxwell-Briscoe Motor Company, of Tarrytown, N. Y., of the production of a new runabout selling at $500. The specifications of this car, which it is intended to produce to the number of 5,000 during the coming season, have only just been made public. All of the distinctive Maxwell features are retained in this vehicle; in fact the car is very similar to last year's model of the Maxwell runabout, which sold at a considerably higher price.

The motor is of the double cylinder opposed horizontal type, of 4 inches bore and stroke respectively, and is rated at 10 horse power. The crank case and change gear case are cast of aluminum in a single piece to insure continued perfect alignment of all the shaft bearings. The cylinders, pistons and piston rings are made from gray cast iron, the rings and pistons being lapped to secure a high finish. The crank shaft, which has its two throws set at 180 degrees, has its journals ground, and is supported in babbitted bearings. The connecting rods are drop forgings. The cam shafts and cams are enclosed in the cast iron crank case cover, which latter may be removed to allow of inspecting the bearings without disturbing the timing of the valves. Both the inlet and exhaust valves are mechanically operated, and are interchangeable with each other. The engine and change gear unit is supported at three points so as to eliminate stresses due to distortion of the frame. Both the water jacket space and the water connections are of ample size, the thermo-siphon system of circulation being employed, which requires liberal cross sections to minimize the friction and resistance to circulation. A honeycomb radiator is used. The inlet pipe for the two engine cylinders is so arranged as to give an equal charge to both of the cylinders. The motor speed ranges from 150 to 1,500 revolutions per minute.

The carburetor is of Maxwell design, of the float feed type, with automatic compensation for changes in the suction. The air drawn into the carburetor is first drawn through a "hot air" ring surrounding one of the cylinders whereby it is heated. Ignition is by jump spark, with a double coil on the dashboard. Lubrication is effected by a pressure oiler located on the dashboard, from which oil tubes lead to each of the cylinders. The oil enters the cylinders on top, and finds its way around the pistons by gravity. A sheet metal pan extends underneath the motor, protecting it from dust and mud.

The clutch is of the multiple disc type, as has been used on all Maxwell cars since the company was first started. It operates in a bath of oil, thus reducing wear due to slippage to a minimum. The change speed gear is of the planetary type, giving two speeds forward and a reverse. The brake bands for the low speed and reverse gears can be readily adjusted by means of set screws in the side of the enclosing case. The whole change gear runs in an oil bath.

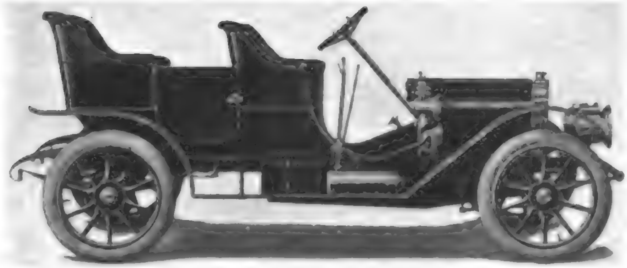
The transmission to the rear axle is by a shaft with two universal joints. The latter are of the Maxwell self oiling type, the crosses being provided with oil chambers, and the bearings automatically lubricated without attention from the driver. The bevel gear drive is provided with a thrust bearing taking up the side thrust always present in bevel gears. By this means it is always possible to take up any back lash that may occur.

The steering gear consists of a pinion and gear segment, with link connection to the steering knuckles. One pair of brakes are provided, and act on brake drums secured to the rear hubs. They are of the external contracting type. Full elliptic springs are used both in front and rear. The frame is of pressed steel, hot riveted. The car has a wheel base of 82 inches, a tread of 56 inches, and is equipped with 28 inch wood artillery wheels fitted with 3 inch standard clincher tires. The gasoline tank holds 10 gallons, the cooling system 2½ gallons, and the oiler one quart, which last named is claimed to be sufficient for 100 miles running. The weight of the car is about 1,100 pounds.

The control devices consist of a single side lever for the change speed gear; two pedals, for the gas throttle and brake respectively, and a spark lever on the steering column. The body is of sheet metal with stamped molding, the seat being divided, and there being a flat rear deck with a railing around. The equipment furnished with the car consists of two oil side lights, one oil tail lamp, one horn with flexible tube, one set of tools and one tire repair kit. The body is ironed for a top. The color is speedster red, and no options are given.

New Kisselkar Models.

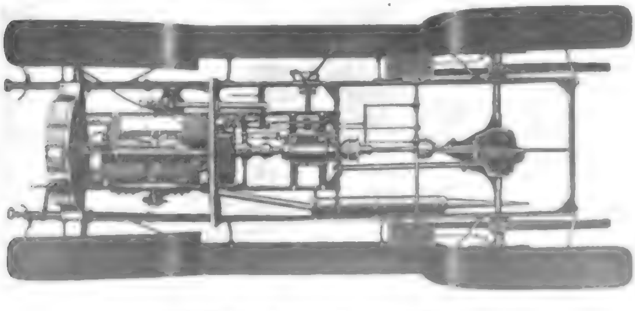
The Kissel Motor Car Company, Hartford, Wis., are bringing out three new models for the coming season, viz., a 30 horse power roadster, a 30 horse power touring car, and a six cylinder, 60 horse



Kissel Four Cylinder 30 Horse Power Touring Car.

power touring car. The new 30 horse power model has a four cylinder engine with 4¼ inch "square" cylinders. The motor is lubricated by a positively driven mechanical oiler. A flat tubular radiator with fan is used. The change speed gear is of the selective type and the drive to the rear axle by a shaft with Spicer universal joints. The pinion shaft on the rear axle is mounted on two Timken roller bearings, instead of one, which is claimed to insure continued perfect alignment. There are two sets of brakes on the rear wheel hubs, internal and external, both double acting. The diameter of the brake drum is 14 inches. The frame is of pressed steel and is supported on semi-elliptic springs in front and three-quarter elliptic springs in the rear. The differential gear is of the spur type. The car has a wheel base of 107 inches; the wheels are 32 inches in diameter and fitted with quick detachable rims. All control levers are drop forged, properly machined and keyed and bolted, instead of being taper pinned, as is often the case on low priced machines. Taper pins are not used at all in the construction of the car. This model is furnished either with a touring, surrey or roadster body, seating five, four and two passengers respectively.

The big six cylinder car has a cylinder bore of 4¾ inches and the same length of stroke. The wheel base is 128 inches, and the wheels are 36 inches in diameter, with 4½ inch rear and 4 inch front tires. The front axle is of I section. Ignition is by an Atwater Kent generator and a Bosch magneto. The rear axle is of the floating type.

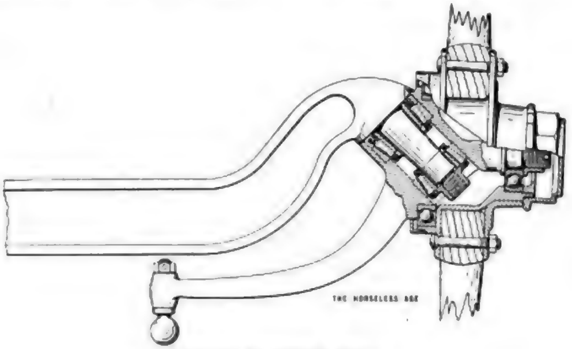


Chassis of Four Cylinder Kissel Car.

The Weaver "Pathfinder" Axle.

George A. Weaver, of Newport, R. I., is the inventor of the novel steering axle herewith illustrated. Instead of the axle end being forked or provided with a vertical socket or hub, it is provided with a spindle extending at an angle of 45 degrees downward and outward. To this spindle is fitted a knuckle turning on the spindle on conical rollers. The spindle extends about half way through the knuckle, and of the two annular ball bearings on the knuckle the one at the inner end is necessarily of quite large diameter. The inventor claims that the wheels return to the straight course more naturally than with the ordinary vertical pivot; but after looking into the design carefully we are at a loss to understand why this should be so. In fact, we would expect the opposite to be the case, for the simple reason that the axle is in its highest position when the wheels are in the straight ahead position and is lowered as the wheels are turned from this position and assume an inclined position toward the ground. The weight of the car would therefore tend to turn the wheels to the limit of their pivotal motion. Of course when in the straight ahead position this action cannot take place, on account of the dead centre effect, but it would occur for any other position of the wheels.

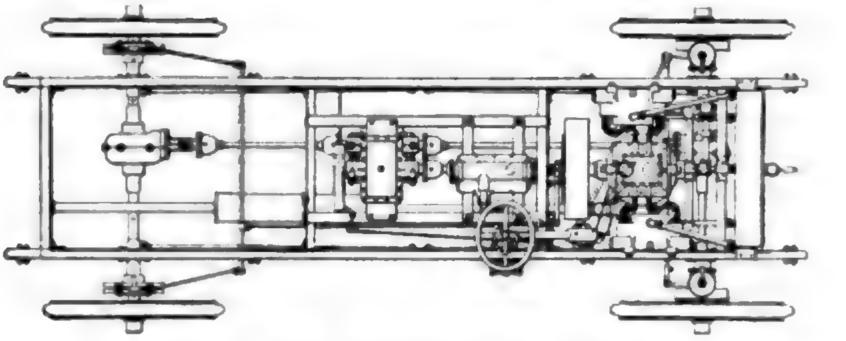
This axle requires a differential linkage, so as to turn the inner wheel, when describing a curve, more than the outer wheel. The inventor also claims that with this axle there is no skidding on corners.



Weaver Pathfinder Axle.

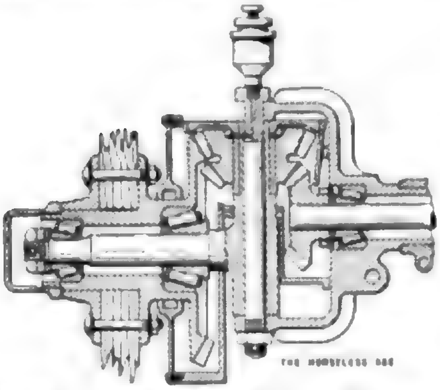
The Kato Four Wheel Drive.

The Four Traction Auto Company, of Mankato, Minn., are manufacturing several models of automobiles of the four wheel drive type for commercial use exclusively. The models include a one, two and three ton truck, and a ten and a twelve passenger sightseeing car. These models have the same constructional features, differing only in detail. The motor is a "Davis" two cylinder opposed, water cooled type, rated at 25 horse power. It is placed crosswise in front under the hood. Cooling is by the thermo siphon system. Ignition is high tension, with a two unit coil, with both dry batteries and storage battery. A force feed lubricator forces oil to all the important parts of the motor. Power is transmitted through a cone clutch to the change gear box, which affords three speeds forward and reverse. From this gear case a short shaft fitted with one universal joint transmits the power to the equalizing gear case, from which it is transmitted to both front and rear axles through Cardan shafts, each fitted with two universal joints. The

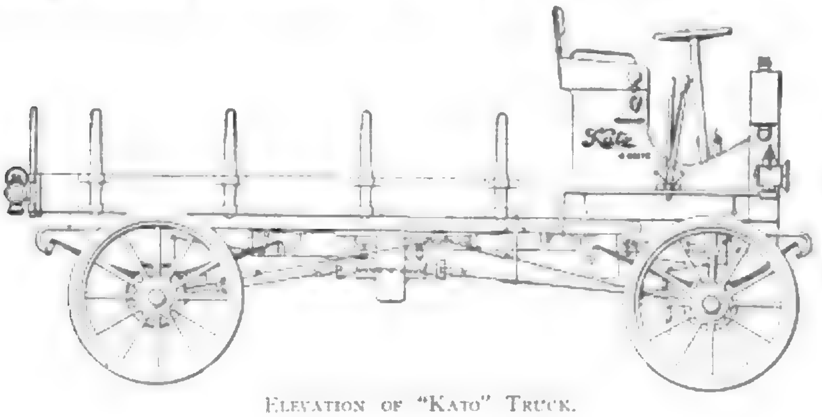


Plan of "Kato" Four Wheel Drive Chassis.

rear axle is a typical tubular, live axle, the drive from the beforementioned Cardan shaft being through bevel gears. The front axle is of the same general construction, except that at the steering knuckles bevel gears are used to permit driving and steering at the same time. The illustration of this transmission—which is patented—is practically self explanatory. As will be seen, the wheels are free to turn in a horizontal plane, while the power is being transmitted to them. Both axles are fitted with roller bearings, and all parts are enclosed and run in oil, thus insuring proper lubrication. The frame is of a steel reinforced wood construction, and is supported on semi-elliptic springs in front and rear. The wheels are wood, of the artillery type, and are fitted with 36x2 inch solid rubber tires front and rear. Two sets of brakes are fitted, one of the compound type acting on the main shaft, and thus breaking through all four wheels, and the other of the external contracting type, acting on the hubs of the rear wheels. Steering is by wheel through a Ross steering gear of the irreversible worm and sector type. Control is by two pedals, for the clutch and transmission brake, respectively; two side levers, for the change gears and the rear hub brakes respectively, and the motor is controlled by spark and throttle levers above the steering wheel. The wheel base is 112 inches, with standard tread. The cars are regularly geared for speeds of from 3 to 20 miles an hour.



"Kato" Combined Driving and Steering Axle.



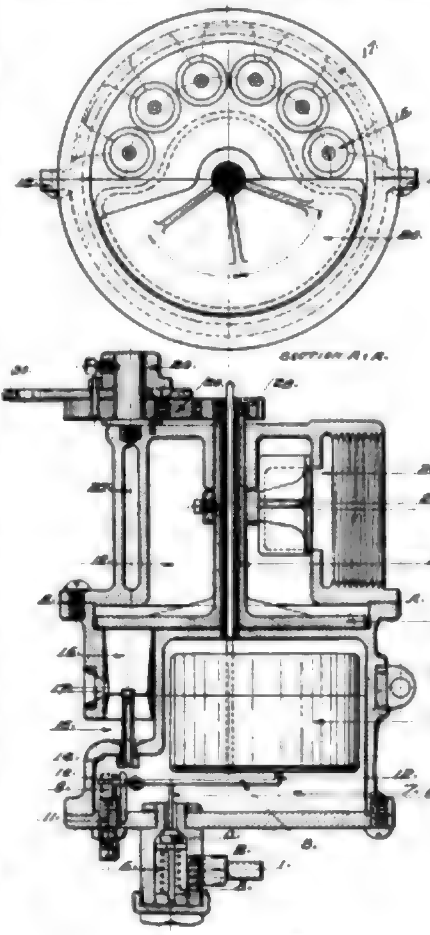
Elevation of "Kato" Truck.

The Krause Carburetor.

The Krause Carburetor Company, of Cleveland, Ohio, manufacture a carburetor with six separate nozzles, of which more or less are active, according to the degree of throttle opening. Referring to the line drawing herewith, the gasoline enters at 1 and passes through openings 2 into valve chamber 3. The valve 4 is closed by spring 5. The pinlike extension 6 on this valve extends into the float chamber 7, and on it rests the lever 8, hinged to the adjustable support 9. In placing the hinge point 10 higher or lower, by means of screw 11, the lever point 12 is lowered or raised, and as the float 13 operates the lever, and by it the gasoline valve, it will be understood that the gasoline level in the float chamber can be adjusted even when the engine is working.

Six nozzles, 14, extend from the float chamber into six separate Venturi tube shaped air ducts, 15, communicating with the atmosphere through the opening 16. These air ducts have each an extra air inlet, 17, placed above the narrowest part of the Venturi tubes, and these openings can be closed more or less by means of the ring valve 18.

As the areas of the narrowest part of the air ducts and the openings in the gasoline nozzles are experimentally ascertained and properly proportioned to each other for different sizes of engine cylinders, it is claimed that an adjustment of the carburetor is needed only for different qualities of fuel and for very different altitudes. These six air ducts, 15, with their supply of gasoline through nozzles 14, constitute six separate carburetors, all of which deliver into the chamber 19. As may be seen in the section, the air ducts are placed around the outer edge of the circular chamber 19, extending over half of its circumference, so as to allow the semi-circular valve 20, when operated, to gradually cover or uncover them. On the valve stem 21 another valve, 22, is provided, which opens or closes the outlet 23 from the valve chamber 19. This valve 22 is the throttle valve proper, and governs the amount of explosive mixture fed to the engine. This valve 22 is operated simultaneously with the valve 20, increasing or decreasing the outlet opening 23 in a certain proportion to the increase or decrease of the outlet area of the carburetors, thereby maintaining, it is claimed, a constant vacuum in the mixing chamber 19 for all throttle positions.



Krause Carburetor.

If a still higher flexibility is desired than can be obtained with six nozzles, a greater number of nozzles may be used, and the company will furnish to order carburetors with any number of nozzles. As heating of the mixture is advisable in the winter time, the mixing chamber 19 is provided with a jacket 27 for connection with the circulating hot water or the exhaust gases, if desired. As the valve 20 has a range of motion of a half turn, it is geared down through the outside gears 28 and 29 in order to allow of practical operation of the valve handle 30. The stop 24 on top of the valve handle allows of limiting the valve motion to any desired point of minimum opening.

The Meyer Two Cycle Engine.

This engine uses crank case compression; it differs from the usual three port type in the timing of its port openings, which is effected by the differential action of a sliding sleeve surrounding the piston. The figures shown herewith are merely diagrammatic and do not represent the actual detail construction.

Referring to Fig. 2, it will be seen that the piston pin is offset from the centre of the piston toward the left. Arm A is an integral part of the connecting rod forging. Its end is forked to receive sliding block B. This block turns upon a pin, which is fast in sleeve D. D is ground inside and outside to fit the piston and cylinder, respectively, and is furnished with the necessary rings to make gastight joints. The piston C is of the usual construction, except for a projection above the head, which makes contact with the sleeve around the exhaust port, and contains a port opening.

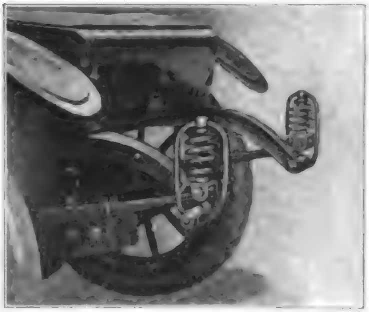
It will be seen that as the crank shaft revolves the piston and sleeve reciprocate together, but the sleeve is given a slight up and down movement with relation to the piston. This movement is different on the up and down strokes and serves to bring the ports shown into line for the passage of the gases. The movement is fastest at the ends of the stroke when it is needed.

In Fig. 2 the exhaust has just closed and the by-pass is wide open. The crank case inlet is shown in Fig. 1, the charge passing from E down a channel in the sleeve and through ports in the bottom of sleeve and piston.

We will consider this latter action first: The inlet opens at 40 degrees past the lower dead centre and remains open until 20 degrees past the upper centre. This gives an opening and suction diagram very similar to that of a four cycle engine.

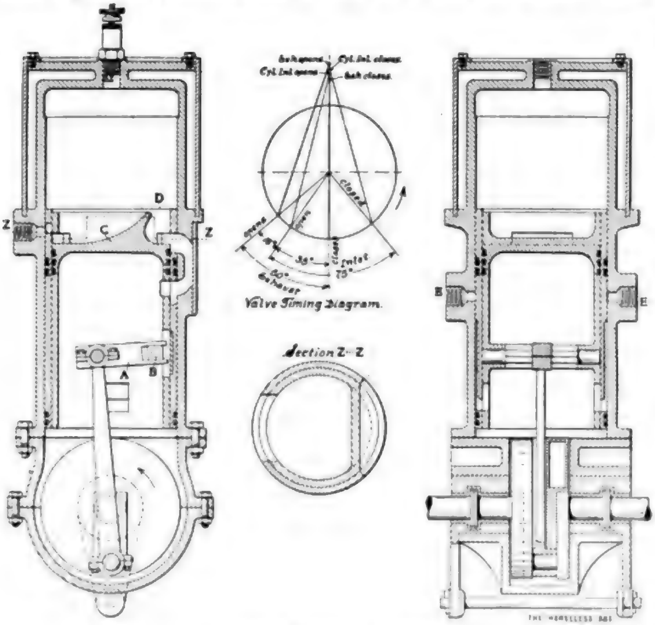
On the down stroke of the piston the mixture is compressed in the crank case until the crank pin is within 35 degrees of the lower centre, at which point the by-pass opens. As the exhaust port has already been open 15 degrees, the mixture rushes into the cylinder, aiding the evacuation of the burned gases. At the lower dead centre the exhaust port closes, but the by-pass remains open for 40 degrees of the up stroke, allowing additional mixture to pass into the cylinder from pressure and inertia of the gas. At the instant the by-pass closes the crank case inlet opens and carburetor action begins.

It will be seen that this sleeve construction offers the advantages of a long time of carburetor opening without the power loss due to crank case suction, of closing the exhaust at the dead centre to prevent the escape of incoming gases, and of allowing considerable packing surface against all gas pressure.



Sager "Easy" Spring

This engine is the invention of J. M. Meyer, of West Chester, Pa. It has been made in both water and air cooled styles, and has been the subject of extensive tests.



Meyer Two Cycle Engine.

The Sager "Easy" Springs.

J. H. Sager Company, Rochester, N. Y., have placed on the market a spiral spring device to improve the action of stiff semi-elliptic springs. These springs are wound in barrel form, and work under compression in carrying the load of the frame and body. The lower end of the spring is secured to a fork hinged to the end of the semi-elliptic spring, and the upper end supports a form of yoke which extends downward, and is provided at its lower end with a hub passing over a stud extending sideways from the end of the spring horn. A particular advantage of this construction is claimed to be that there is no side motion of the vehicle. The device is recommended only for runabouts having stiff semi-elliptic springs.

Charles A. Duerr & Co. Fail.

In the failure of Charles A. Duerr & Co., 2182 Broadway, one of the more or less prominent New York selling agencies went to the wall last week. The firm was New York agent for the Royal Motor Car Company, also in the hands of a receiver, and a portion of its assets consists of deposits with the Royal Company. The petition for the appointment of a receiver was filed by Julius O. Foote as attorney for the following creditors: Firestone Tire and Rubber Company, $401; B. Goodrich Company, $681, and Hartford Rubber Works Company, $251. It is alleged that the corporation is insolvent, on September 15 made preferential payments of $2,000, repaid loans of $500, and on September 18 paid $500 to H. Paskal, the landlord. Judge Holt appointed Lindsay Russell receiver, with a bond of $25,000. It is stated that the nominal assets are $60,000 to $75,000, the actual value of which is estimated at $40,000, consisting of automobiles, parts, supplies, garage equipment, furniture, etc.

A Useful Addition.

By Parry T. Hersey.

In 1905 I bought a small 10 horse power gasoline car for combined business and pleasure use, and being the father of two small children it was "up to me" to devise a way to carry them when I wanted to take the family out for a ride.

My wife had to hold the baby, but our small daughter of four needed a comfortable seat, so the following device was invented. The photograph shows how the seat looks attached to the dashboard of the car, the ends straddling the coil box. The fastenings are loose pin butts, and by removing two pins the seat comes off in ten seconds.

The following diagram shows the parts to the seat, all being made from three-quarter inch pine. The bottom of the seat A has fastened underneath by screws two cleats G. Pieces B, C and D form the top rail. Two pieces, F, running from the top rail to the floor of the runabout are screwed into gains L L in the bottom of the seat. Two of pieces E make the end next the dash, fastening in gains M M. The third piece, E, makes the back, fastening at K. Screws are used in all places for fastenings.

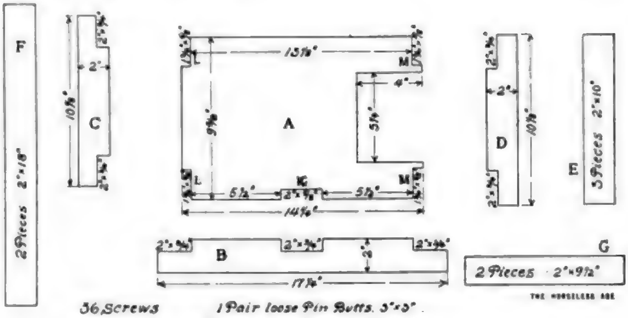
Attached to pieces E and the dashboard of the car is a pair of 3x3 inch loose pin butts, the double part on the dash. By taking out the pins the seat is removed entirely, leaving only the two half hinges on the dash.

The seat is fitted with a cushion and is painted and varnished to match the car.

The child sits in the seat facing the outside of the car, and is secured by a strap across the front of the seat.

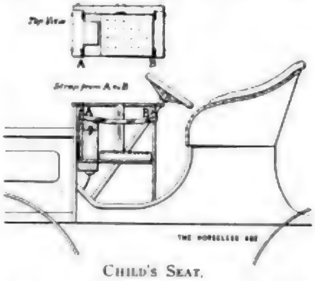
Although the seat appears to crowd the occupant of the regular seat, there is plenty of room for the feet.

Last fall we decided that the baby was large enough to use the seat, and it was a problem for a while what to do with the older child. The folding rear seat that comes with this make of car has no sides or handle, and we were afraid to let the girl ride behind in it unless accompanied by an older person; besides, the cost was more than we wanted to spare at the time. A rumble seat and trunk were more suitable, but still the cost was in the way; but brain triumphed at last, and the rumble seat and trunk shown in the photo (built by myself) cost me only $3 in cash, and solved the problem.

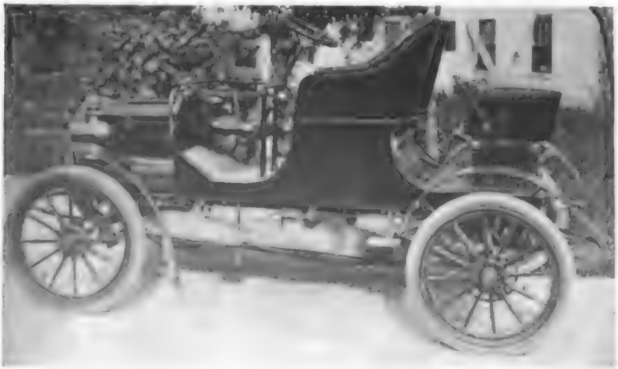


36 Screws 1 Pair loose Pin Butts 3"×3".

Details of Child's Seat.



Child's Seat.



Hersey's Child's Seat.

The Market Situation in Philadelphia.

During the latter part of this summer the automobile situation in Philadelphia was fairly good as far as sales of pleasure vehicles were concerned, the runabout, as usual, selling in greatest numbers. Professional men may be said to have furnished the bulk of custom in this line, the various professions running in the following order: Doctors (first by a great majority), engineers, lawyers, dentists and clergymen. The majority of runabouts sold were of the planetary transmission type, with either two or four cylinders. Quite a number of sliding gear transmission cars were disposed of, and a few single cylindered models. In touring cars, little was done, and the same may be said of commercial vehicles. One of the sightseeing companies remodeled an old car for its service, but this class of business on the whole was not large. The Broad street motor bus lines were well patronized, and actually did the greatest volume of public service business in the city, although the thirty-odd taxicabs in service were not idle. Very little was done in hiring vehicles, but the "Founders' Week" was looked forward to as the real opening of a prosperous winter season.

There were a number of changes along "Gasoline Row," various agencies shifting about, usually moving one or two numbers further on, and in three cases locating in new buildings. The agencies for imported cars either disappeared or took up an American car in addition. The agencies in general are gradually moving nearer to Penn square, those on North Broad street gradually establishing themselves in the row. Several new garages are nearing completion, but these are mostly on other streets, and are intended solely for local trade. West Philadelphia has a number of fine garages, and the suburbs are also being provided for, though a large number of suburbs are very poor fields for garage business, the residents keeping their cars on their own premises. Philadelphia is now nearly as well equipped with garages as New York in proportion to the number of automobile users, but there are as yet no signs of there being too many garages for the custom, as is the case in New York and other large cities. Taking it all in all the situation shows a big improvement over that of last winter.

Commercial Applications.

New Fire Wagon for the Detroit Department.

The Detroit fire department has received a new fire wagon consisting of a Packard "Thirty" touring car chassis with a special body and equipment, making it suitable for carrying a squad of firemen about town with the speed of the fastest touring motor car. The truck is now located at one of the fire stations, but will eventually have a separate house built for it. It has its own organization of fifteen picked men, including captain and lieutenant, forming what is locally called the flying squadron. This comprises Fire Company No. 30, the purpose of which is to reinforce any regular company in the city in time of need. The fire fighting forces of Detroit have been in need of reinforcement for some time. Last winter the Legislature passed an act authorizing the increase of each company from eleven to fifteen men, meaning an additional 180 to 190 men in the entire department, or an annual increased expense of about $190,000, exclusive of the cost of furnishing means for the housing and transportation of these extra men to and from fires. After considerable study of the proposition, the fire commissioners decided to use motor cars and a small number of men, instead of a large number of men employed in the usual way.

The chassis is practically standard, with the exception that it has heavier springs than the touring car, in order to take care of the additional load. The twelve men are carried, two on the front seat, six on the lengthwise seats of the tonneau, two on the rear running board and one on each side of the running board. Special handles are provided for the men on the running boards. Provision is also made for carrying three hand fire extinguishers, there being a three gallon chemical on each side and a six gallon chemical in the rear compartment. The tool box and battery box which in the touring car are carried on the running boards, are under the front part of the rear seat. The running boards are made of open mesh steel so that snow and mud will not easily adhere to them. All of the special railing and handles are of brass and the side rails are equipped with snaps on which twelve helmets may be hung. The space under the rear seats is open storage for boots and coats.

On the dash is a regular fire department bell and the car is also equipped with a large electric siren. The headlights are especially made, being provided with a small pilot burner which is kept constantly burning at night in order that turning on more gas from the Prest-O-Lite tank will instantly light the main burners. The body is of standard Packard construction, that is, sheet aluminum panels over wooden framework, and the whole car is painted in special fire department red.

We are informed that it has practically been decided that this first automobile fire wagon in Detroit will soon be supplemented by four or five others.

Railroad Opens Auto Stage.

Though the Salt Lake Railroad's nearest station to Searchlight, a growing mining camp in southern Nevada, is twenty-three miles distant from the town, while the Santa Fe has a branch directly into Searchlight, the Salt Lake road is a successful competitor with the Santa Fe for the Searchlight passenger business by means of an automobile stage line. The Salt Lake road's station for Searchlight is Nipton; a 40 horse power, four cylinder touring car with a seating capacity of seven meets both the north and south bound trains of the railroad and carries the passengers for Searchlight to their destination within one hour, where formerly the stage drawn by four horses required five hours. B. F. Smith manages the automobile line; the number of passengers for Searchlight is wired him several hours before the arrival of the trains, and if the one automobile is insufficient to transport them all, a second motor car is sent out. Smith also has an automobile stage running daily from Searchlight to Eldorado canyon, thirty miles distant, enabling passengers arriving in the morning to transact their business in Nipton, Searchlight and Eldorado and depart again on the afternoon train. Before the advent of the automobile the journey required two full days.

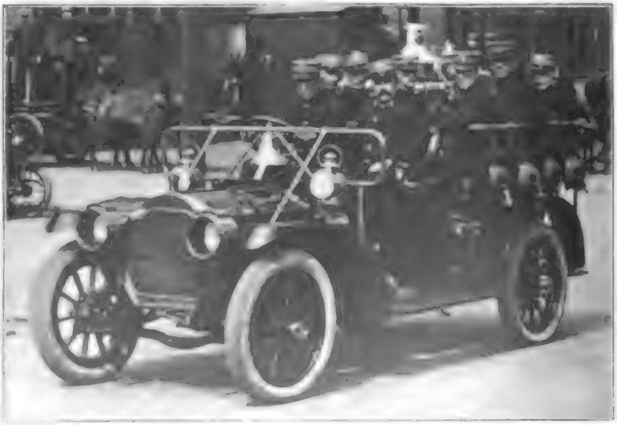
A six cylinder car with a capacity of seven passengers is operating between Leastalk, on the Santa Fe, and the new mining camp of Hart, sixteen miles to the north of the railroad. Gold ore carrying high values was discovered on the desert where Hart stands to-day early in January of this year, and when the news of the strike reached the centres of population, over two hundred miles distant, a free-for-all race between a number of automobiles and the regular trains from Los Angeles and Goldfield to the scene of the discovery began. From Goldfield four large touring cars started out in the effort to beat the train carrying the hordes of prospectors and be first on the ground and first to locate claims close to the original discovery. O. Elliott, of Goldfield, was the first to arrive of the four automobiles, all of which pulled in ahead of the train. Elliott forsook all beaten trails, neglected the water holes and steered across the desert in as nearly a straight line as the intervening ranges of mountains and hills would permit. Even on the circuitous trails the three other automobiles beat the time of the train.

Commercial Notes.

B. A. Griggs, formerly manager of the C. & O. Steamboat Company, has purchased three large touring cars to establish a motor transportation service from Brewster through the Okanogan country in the State of Washington.

The Reading Taxicab Company, Reading, Pa., has been formed by J. L. Shearer, Jr., and Robert W. Daniel, the former being president of the Harrisburg Taxicab Company. Six taxicabs will be placed in service at an early date.

E. S. Youse, a Reading, Pa., automobile dealer, has organized the Reading Taxicab and Baggage Company, and has ordered four cabs, which will be placed in service in a week or two. The cabs are to be stored at Mr. Youse's garage, 122 Madison avenue, while the office will be located at 46 North Fifth street.



Packard Thirty Horse Power Fire Wagon for the Detroit Fire Department.

The Indiana Endurance Run.

A two days' reliability run under the auspices of the Indianapolis Automobile Trade Association was run October 1-2, the route being to French Lick and return. Of the twenty-six cars that entered, fifteen finished with perfect scores, a more creditable showing than was expected because of the road conditions.

The entries were arranged in three classes. Class A, for cars listed above $2,500, included thirteen entries, of which eight finished with perfect scores; Class B, for cars listing from $1,200 to $2,500, had nine entries, six finishing perfect; Class C, for cars listing under $1,200, and which was made to include a ten passenger Rapid bus, had four entries, three being penalized.

On Thursday morning the cars left the parking station and control at University Park at one minute intervals. In addition to the entries there was a press car, a National seven passenger car driven by Frank Moore; an Overland confetti car driven by P. D. Stubbs; a Premier pilot car driven by Joe Moore, and a Studebaker touring car carrying the technical committee and referee. The first day's route was 131.2 miles long, Franklin, Columbus Seymour and Salem being the principal points touched. On the return trip, which was 122.2 miles long, the principal points along the route were Mitchell, Bedford, Bloomington and Martinsville.

For the most part the first day's run included fairly good roads, except that a number of steep hills were found. Out of Indianapolis for the first 10 miles there was a stretch of bad roads, but from Franklin to Seymour the roads were in good condition. The last few miles of the run were the worst, because of water breaks on the hills, which called for the most cautious running and made hill climbing difficult. After the first 15 miles of the second day's run the roads included numerous hills, among the worst in the State. However, all of the cars negotiated them, although some of them had trouble in doing so. There were no controls, except the one at French Lick, where the party spent the night, the cars being parked just north of the hotel on the baseball grounds.

Some of the cars had difficulty in starting Friday morning, and the American roadster, Packard, Overland and Hassler had to be towed for a few minutes, each car being penalized five points.

Owing to the delay of the technical committee in reaching French Lick the return start was not made until 8 a. m. Friday, an hour later than scheduled. The technical committee experienced tire trouble all of the way to French Lick. A Premier test car was sent to Franklin with inner tubes, but this did not end the trouble. One tire was worked on nine times. Late Thursday night the National press car was sent to rescue the committee.

Among the drivers was Miss Elizabeth Love, who drove a Premier touring car through with a perfect score. Miss Katrina Fertig also drove a Premier touring car, but was penalized. Miss Love's performance was little short of remarkable because of the steep hills and sharp turns which required skillful driving. The only commercial car entered was a ten passenger Rapid bus, the occupants being dressed to represent convicts. This car was in charge of T. P. Myers, sales manager of the Rapid Motor Vehicle Company, and Paul Smith, of the Indianapolis Motor Car Company. While the bus had a perfect road score, it developed on arriving at Indianapolis that two lamps were loose, and the car was penalized four points. The car was driven by Frank Grogan, and carried automobile, tire and press men. It was equipped with solid rubber tires, so that no trouble was experienced from that source.

Several of the other contestants had much tire trouble. Several miles of newly placed crushed stone and gravel were encountered, and this proved disastrous to tires. The American roadster was stopped several times because of flat tires, the driver spending about two hours on the return trip repairing tires. Under a ruling of the committee no penalty was assessed for tire work as long as the engine was kept running. However the time lost had to be added to the running time, this being done to prevent any great bursts of speed.

The committee fixed the schedule of Class A at 18 miles an hour, Class B at 16 miles an hour, and Class C at 14 miles an hour. Had this schedule been closely observed on the road few of the cars could have checked in on time. As it was the drivers made all of the time they could when they had good road conditions. Several cars had to wait from thirty to fifty minutes at the control before they could check in.

Only one accident of importance happened during the run. This was on Thursday morning near Seymour, when a Maxwell touring car driven by J. A. Newby ran into an Oakland touring car driven by Harry Hocker. The Maxwell was trying to pass the Oakland when it struck it, forcing Hocker to run his car into the ditch. The Oakland was damaged, but this did not count against it in the final result.

The entrants nominated an observer for each car entered, the committee assigning these observers as they saw fit. Friday the observers were all changed so that abso-

RESULT OF INDIANAPOLIS RELIABILITY RUN.

CLASS A.—CARS LISTED ABOVE $2,500.

No.	Name of Car.	Car Model.	H. P.	Driver.	Penalization.	Final Score.
1.	National	Roadster	50	John Aitken		Perfect
2.	National	N	50	Thos. Kincaid		Perfect
3.	National	N	50	Harry Moore	Two plates in front spring broken	
4.	Studebaker	A	30	F. B. Willis	Left rear fender loose	2
5.	Packard	30	30	Chas. Stultz	Starting crank bent; towing car	11
6.	Marmon	50	50	H. G. Shafer		Perfect
7.	Marmon	..	50	H. Stilman		Perfect
8.	Haynes	U	60	Robert Murden	Foot brakes not working	10
9.	American	Roadster	50	Fred I. Tone	Towing car for starting	5
10.	Premier	30	30	Harry Hammond		Perfect
11.	Premier	30	30	Henry Letsinger		Perfect
12.	Premier	30	30	Miss Elizabeth Love		Perfect
14.	Premier	30	30	Frank Morrison		Perfect
	CLASS B.—CARS LISTING $1,200 TO $2,500.					
17.	Overland	32	30	Henry Barnes	Towing car; foot brake not working	15
18.	Rambler	34	32	Ted Collier		Perfect
19.	Mitchell	G	20	Geo. Gastenau		Perfect
20.	Maxwell	K	24	J. A. Newby		Perfect
21.	Maxwell	H	20	T. L. Marshall		Perfect
22.	Chalmers-Detroit	30	30	J. H. Stickney		Perfect
24.	Oakland	20	20	Harry Hocker		Perfect
25.	Premier	24	24	Miss Katrina Fertig	Adjusting coil and carburetor	11
26.	Cartercar	A	24	C. J. Haines	Nut off front spring shackle bolt	5
	CLASS C.—CARS LISTING UNDER $1,200 AND TRUCK.					
27.	Rapid	132	24	Frank Grogan	Two lamps loose	4
28.	Maxwell	LC		O. J. Gronendyke	Broken seal, adj. carburetor, broken wire.	19
29.	Hassler	MB	10	Robert H. Hassler	Towing car for starting	5
30.	Reo	R	20	E. L. Jacoby		Perfect

lute impartiality was assured. The rules were similar to those used in the recent Glidden tour, and the technical committee drew the line closely in reaching decisions. There was no complaint as a result of their work.

Owing to the prediction that not more than 20 per cent. of the entries would finish with perfect scores, the number of entries was smaller than had been hoped for. Some of the dealers were unwilling to enter cars in such a contest with the chance of their returning with heavy penalties. Other dealers were unable to get cars to enter, having sold their 1908 allotments and not having received the 1909 models.

It was expected that Class A cars would make a good showing, barring accidents, but it was feared that the length of the route and the condition of the roads would be a severe test on the Class B and Class C cars. Probably the most interest centered on the three runabouts in Class C, only one of which finished perfectly. One of the Class C cars was a Hassler high wheeled runabout built and driven by Robert H. Hassler. This car is of 10 horse power and has four cylinders under the hood. The only penalty assessed against the car was for towing at French Lick Friday morning.

Through a misunderstanding as to the cause of his trouble, O. J. Gronendyke, driver of the Maxwell runabout, received a penalty he need not have had. He broke a seal to adjust his carburetor, when the real fault was that a secondary wire had broken. The Cartercar was penalized 5 points because a nut was found to be off of the front spring shackle bolt. Two cotter pins would have enabled the car to finish with a perfect score, as it made a perfect road score. A National touring car driven by Harry Moore reached Indianapolis with two plates in the front spring broken and was penalized 16 points. After making a perfect road score the Packard reached the last control with the left rear fender loose, losing a perfect score by two points.

There was a remarkable absence of mechanical trouble, as evidenced by the fact that only one seal on the twenty-six cars was broken. During the run given by the association last May, when the route was only 140 miles over comparatively good roads, only nineteen out of thirty-seven cars finished with perfect scores, and broken seals were frequent.

The run was the worst test automobiles have ever had over Indiana roads, which makes the result all the more satisfactory. Until the Sunday previous there had been no rain for eight weeks and the dust was several inches thick. The dust made fast driving dangerous.

The committees having charge of the run were as follows: F. I. Willis, A. C. Newby, Frank Moore, G. A. Weidley and F. Fanning, contest committee; G. A. Weidley, Howard Marmon and W. G. Wall, technical committee; L. M. Wainwright, referee, and P. D. Stubbs and Frank Staley, press committee.

Simplex Wins Brighton Beach Twenty-four Hour Race.

George Robertson, driving the 50 horse power Simplex car with Michelin tires, won the twenty-four hour race held at Brighton Beach track on October 2 and 3, covering 1,178 miles. Mulford on a Lozier car was second, with 1,125 miles, and Roberts on a Thomas "6" third, with 1,115 miles. The first three cars succeeded in breaking the record for twenty-four hours of 1,107 miles made last month by the Lozier at Brighton Beach.

Although there were fifteen cars entered in the race, only thirteen lined up for the start. While trying out on the track previous to the race the Garford car collided with the four cylinder Lozier and damaged the latter to such an extent that it was unable to start. The Garford itself had a wheel ripped off, and the start was delayed forty-five minutes to give the crew of this car a chance to make the necessary repairs, but when at 8:46 the car was not yet in position to line up the start was proceeded with. The Simplex took the lead during the first round, and held it till the seventh hour, when it collided with the Stearns, which caused both cars to be taken to the paddock for repairs. The Renault driven by Strang now assumed first place, and continued to hold it until nearly the close of the eighteenth hour, when it broke a connecting rod; suffering also from a sagging frame it was withdrawn, with a total of 888 miles to its credit. When the Simplex returned to the track it was in fourth place, but before the race was half over it had taken the lead, and held it until the end of the race.

The foreign cars suffered accidents necessitating their withdrawal as the race went on. The Renault driven by Bloch overturned, and was partially destroyed by fire during the sixth hour, and the Fiat, driven by De Palma, broke a connecting rod, and withdrew at 3 o'clock on Saturday morning. The Cleveland, driven by Chevrolet, suffered greatly from ignition troubles, but lasted out the race, finishing with 632 miles. The Acme was withdrawn at 7 o'clock on Saturday morning. The Garford, after having been out twelve hours, due to the collision with the Lozier, came on the track and drove for two hours, when it was withdrawn after a total mileage of but 47. The four cylinder Thomas withdrew at 7 a. m. on Saturday.

The six cylinder Thomas car is said to have made seventy-four changes of tires during the race, and it was estimated that three and one-half hours were consumed in tire changing alone. The Züst experienced considerable tire trouble, as well as ignition trouble, and finally went through the fence at 9:26 on Saturday night, spilling the driver and mechanic, who were not seriously injured, however. A special officer, in attempting to cross the track to the paddock at 11 o'clock Friday night, was hit by four cars which were then making the turn, and so badly injured that he died in the hospital on Saturday. Several cars caught fire owing to broken gasoline connections, or to carelessness of a bystander during the filling of the gasoline tank while the car was in the paddock.

Previous to the twenty-four hour race there were two minor events run off. The longest of these, for 50 miles, was won by Oldfield, driving a 60 horse power Stearns, his time being 50:43. Another Stearns, driven by Soule, took second place, and a Mercedes driven by Roux finished third. The other event, a 5 mile race, was run between the Fiat "Cyclone," the six cylinder Stearns, and the Fiat "Tornado." De Palma, driving the "Cyclone," finished first with the other Fiat a close second.

Following is the score for the twenty-four hour race:

Car.	Drivers.	Mileage.
Simplex 4	Robertson and Lescault	1,178
Lozier 6	Mulford, Cobe and Michener	1,125
Thomas 6	Roberts, Winter and Salzmann	1,115
Allen-Kingston 4	Rippingill and Lanwell	907
Cleveland 4	Chevrolet and Miller	632
Stearns 4	Laurent, Marquis and Oldfield	510

Excessive Hack License Fees.

Rogers & Rogers, of Asbury Park, N. J., made attempts to provide a motor stage service between Trenton and the Mercer County Fair during the week the fair lasted, but after they had gathered information regarding the cost of the various licenses necessary they gave their plan up in disgust, and returned with their twenty passenger vehicle alone to Asbury Park. The city officials of Trenton, under an ordinance passed in 1905, demanded a fee of $100 for the hack privilege, and the Hamilton township officials were even more unreasonable, and asked the hackmen to pay $150, which price for the privilege has been fixed in a recent ordinance. The Rogers brothers did not think they could afford to pay $250 for the privilege of running a stage for one week, and gave up the plan.

Now It Is the Motor Car Posse.

The motor car has before now been used by criminals in escaping and by officers in pursuing. Kansas, however, gave what is believed to have been the first instance of that Western institution, pursuit by posses, as adapted to the automobile, recently. Three bandits had held up a railroad station agent near Salina, Kan., an interior jobbing point in the big wheat State, and made away with a large sum taken from the safe of the depot. Salina, however, had a means of pursuit, when the news got in, several hours late. Fourteen motor cars of various kinds and sizes started and pursued the three robbers for more than eleven hours along roads where there were roads and over the open country when roads were not practicable. The men were caught.

Suit Under Maintenance Guarantee.

A somewhat peculiar claim under a maintenance guarantee is being urged in a suit for $1,500 damages brought by John Scheminger, Jr., against the Nock Auto Company, of Providence, R. I. Scheminger alleges that the defendant company agreed to keep the car in repair for one year free of charge. About two months ago, while he was driving the car in the streets of the city, the hub cap of the left rear wheel was lost, the wheel came off, and as a result the car ran into a pole and was badly damaged. Scheminger claims that the accident was due to the failure of the defendant company to keep the car in repair, as they had agreed, and that it cost him $1,000 to have repairs effected. One of the articles of the written guarantee is to the effect that "this does not include any repairs outside of the running of the car, caused by collision or carelessness in operation."

Good Roads Legislation in Missouri.

Missouri will vote this fall on the question whether a tax of 10 cents on every $100 worth of real estate shall be levied as a road fund to be divided among the various counties of the State for road building purposes. Good roads advocates are opposed to the plan for the reason that, they say, the counties will squander the money, build poor roads and accomplish no permanent good. A plan has been suggested by which the money may be retained by the State for the building of trunk lines of roads through the State, the first one to extend from St. Louis across the State to Kansas City, 300 miles away. Later, one is to be built worth and south through the State. T. A. Witten, of Kansas City, is one of the advocates of the latter idea.

A Taxicab Decision.

A London magistrate has decided that a taxicab driver can exact only the proper fare for the shortest route to any point to which he is directed. In the case in question a taxicab was ordered by a woman to her house, and the driver selected a roundabout way, with the result that his meter showed 10 pence when he arrived and a shilling by the time the woman had entered the cab. She indignantly refused to pay the shilling and left the cab. The cab driver brought suit for the amount, but was unsuccessful, the magistrate holding that he was not entitled to the amount.

Ray D. Lillibridge, 170 Broadway, New York city, formerly president of the Rees Garage Company, 42 West Sixty-second street, has filed a petition in bankruptcy, with liabilities aggregating $12,401, and assets consisting of seventy shares preferred and 361 shares common stock of the Rees Company, which is also in bankruptcy. All but 100 shares of the stock is pledged as security for loans.

Driving Rules for City Streets.

The chief of police of Cincinnati has recently called the special attention of all vehicle drivers to the following driving rules embodied in a municipal ordinance:

1. All vehicles will keep to the right.
2. Vehicles meeting will pass on the right.
3. Vehicles moving slowly must keep near the right curb, allowing those of increased speed to occupy the centre of the street.
4. Vehicles turning into another street to the right will keep to the right.

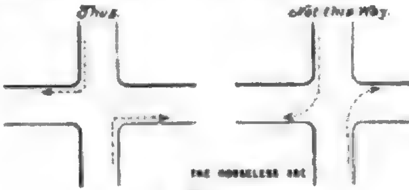


Fig. 1.

When to the left, continue to the opposite side of the lateral street before changing direction to the left.

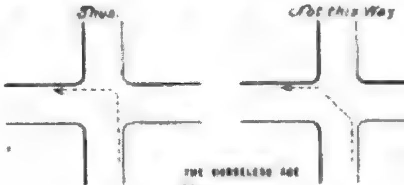


Fig. 2.

5. Vehicles will not be allowed to stop with the left side to the curb, nor on any street crossing. When desiring to stop on the left side of the street make a complete circle, bringing the right side of vehicle to the curb.

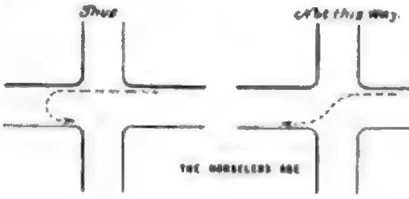


Fig. 3.

Legal Notes.

Thomas Courtney, a former constable, and Philip Bulfer were held to the grand jury at Chicago on October 2 on the charge of having extorted money from automobile owners by promises to settle prosecutions for speeding out of court. The charges were filed by Gerhardt Schwarting, 509 Fulton street, Chicago, who claims to have paid $12.50 to the men.

The city council of Los Angeles, Cal., has passed an ordinance requiring all professional drivers of motor vehicles to obtain a license from the city clerk. On payment of $2 a numbered shield is issued to each applicant, and the number of the shield, together with the address of the driver and the name of his employer, is entered on the books. Owners of automobiles who drive their own machines are exempted from the provisions of the new ordinance.

Ohio Garages Consolidated.

Bennett's Garage, Findlay, Ohio, has moved from Front and Main streets to the west side of Court House square, in a building running through to South Cory street. The storeroom facing the square will be used as a display room, for a stock of supplies and as an office, while that portion of the building facing Cory street will be used for the machine shop. This portion is 75x75 feet, two stories high, and the machine shop will be located on the second floor, an electric elevator being used to carry cars to the shop for repairs. The first floor will be devoted to a battery charging plant and an oil storage room. The machine shop is being equipped with electric motor driven tools. The firm is a consolidation of the old Bennett Garage and the automobile department of the C. F. Jackson Department Store, with F. J. Collingwood, of the Jackson Company, as sales manager, and H. Bennett as superintendent of the mechanical department. The Buick is now being handled, and two or three other gasoline cars and one electric are being sought.

Garage Insurance Rates.

It is reported that Eastern insurance company managers are urging an increase in the insurance rates on garages in the West. The present rate for frame garages in small towns varies between $2.75 and $3.35, and it is claimed that the hazard involved justifies a rate of $4.50. It is held that the rapid increase in the number of automobiles and in the small shops where they are stored and repaired greatly increases the general fire risk. In Chicago the rates on garages have already been increased.

Commercial Notes.

Avery & Roeder started a motor bus service between Dubuque and East Dubuque, Ia., on October 1.

A second taxicab service, with Thomas cabs, is to be started in Chicago in the near future. At the start the headquarters will be at the garage of the Walden W. Shaw Company, local Thomas agents, and the service will be in charge of F. R. Nieman, who is referred to as a veteran taxicab line manager.

A concession in fares has been made by the New York Taxicab Company, which now operates 450 Darracq cabs. When a taxicab is called to any address in Greater New York the meter will not begin to register until it arrives at that address, and no charge will be made for the return of a cab from any point in Greater New York.

The common council of Milwaukee, Wis., has just voted a $3,600 car for use of the police department, which already had a motor police patrol car. There are sixty odd schools in Milwaukee, which must be visited frequently, and the plea of Secretary F. M. Harbach, of the school board, was answered without hesitation by the council by voting $1,500 for a touring car for his use.

Strike of New York Taxicab Chauffeurs.

Five hundred chauffeurs of the New York Taxicab Company went out on strike on Saturday morning, October 3, owing to the refusal of the company to accede to the demands of the chauffeurs for the payment of fixed wages of $2.50 per day. Under the present arrangement the drivers are paid 20 per cent. of their total receipts, but out of this they must pay for the gasoline used by them, as well as a certain amount for their uniform and for polishing the car. The sum of $2.50 was fixed on by a committee of the strikers, and is the same as is now paid by another large company operating taxicabs in New York. When the demand was presented to the company and refused, the strike was ordered.

As the 500 chauffeurs constitute nearly the entire driving force, no cabs left the various garages until Saturday afternoon, when a number of new men were taken on and a few cabs operated. The advent of the cabs was the signal for a series of small riots, some occurring near the garages and others in various parts of the city. A looker-on was shot by a special policeman detailed to guard a strike breaking driver on his trip out with a cab. A number of cars were wrecked or damaged as to the body work, and a cab belonging to one of the officials of the company was burned. The new men were attacked and in some cases badly beaten by patrols of strikers. The special policemen also suffered, in several cases being beaten with their own clubs and having their uniforms torn off. The regular police broke up a number of patrols and acted as guards to the company's garages, but from time to time new men were attacked on side streets or at night when no police were in sight.

H. W. Allen, president of the taxicab company, made the following statement:

> The entire trouble has been fomented by labor union agitators connected with the Liberty Dawn Association and the Teamsters' Union. We gave a banquet to our chauffeurs as recently as last Thursday morning in the Harlem Casino, and it was there made plain to them that, we would be glad to encourage the formation of a beneficial organization among their own number and would co-operate with them in a union of chauffeurs. But we could not see what they could have in common with the teamsters and cab drivers, and we would not consent to have such unions dictating to us in the management of our business.
>
> The labor agitators then forced the fight and our men struck, a committee subsequently formulating a list of so called grievances, of which I had heard nothing until then.

Mr. Allen further said that the police were arresting the new men for speeding, "in most cases without justification," and that an amicable settlement was looked for on October 6, when terms of agreement would be drawn up.

Representatives of the chauffeurs, on the other hand, say that the company has made promises but has not lived up to them. A grievance seemed to be the withholding of the drivers' percentages of the receipts and the application of this money to the repair of cabs injured or said to be injured by the men themselves. This was claimed to be the case by a number of drivers, while others were silent on the subject. The chauffeurs have endeavored to bring about a reconciliation, and have already had three conferences with representatives of the company, but it appears that little progress has been made. They admit having recently become members of the Teamsters' Union and of the Liberty Dawn Association, the latter being the union of the cab drivers of New York city. The company's offer to co-operate with the chauffeurs in forming a union among themselves was refused.

Racing Suspensions Revoked.

The misguided entrants and drivers who participated in the "outlaw" twenty-four hour Brighton Beach track race in September, and against whom suspension was pronounced or at least threatened, have been taken back into the fold by the A. A. A., on the one condition that they must "not do it again." The A. A. A. no doubt took into consideration the fact that there is no superabundance of either race entrants or race drivers, and that it needs the assistance of these "outlaws" to make the Vanderbilt Cup race a success. It has therefore come to the conclusion that when the latter disregarded its threat of disqualification they were under a "misapprehension," which entitles them to forgiveness. The full text of the racing board's ruling is as follows:

> Whereas, Various persons have participated in races coming within the jurisdiction of the American Automobile Association, but for which no sanctions had been granted by that association; and
>
> Whereas, It appears that from the statement of some of such persons that they participated in the said races under a misapprehension, be it
>
> Resolved, That in the cases of such participants as were under the misapprehension referred to, their disqualification, pursuant to the rules of the racing board of the American Automobile Association, be suspended to the extent of enabling them to participate in any race already sanctioned by the racing board, upon such persons filing a statement to the effect that they shall not hereafter participate in any manner or form in any race claimed by the association to be within its sole jurisdiction, and for which no sanction has been granted by the racing board of the American Automobile Association.

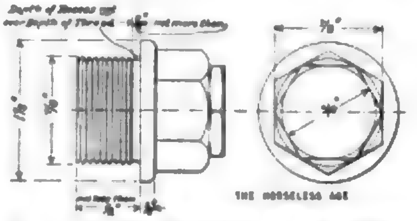
Automobile Accidents and Races.

(New York Times.)

"* * * In each of Sunday's accidents there was a considerable element of carelessness. People seem to have been unwontedly moved to maintain an excessive speed, often over unfamiliar and dangerous roads. Possibly they have been made reckless through unconscious imitation of the racers at Brighton Beach, men who have abandoned all thought of caution and only retain the determination to get ahead at any risk. The effect of such races, so far as it has any on the automobiling fraternity, can hardly be other than a bad one. The only attraction of the contests on flat circular tracks of small circumference is that fatal accidents to the competitors are constantly to be expected. The spectacle they present, therefore, is the reverse of edifying, and their influence is plainly visible in the behavior of automobilists on their way home after watching the dizzy whirl of the racers for a few hours. Road races are bad enough, but these are far worse, and their appeal is directly to the instinct that once drew thousands to gladiatorial combats."

The A. L. A. M. Standard Spark Plug.

Following are the specifications of the standard spark plug adopted by the Mechanical Branch of the A. L. A. M.: The plug body is made from 1⅛ inch round stock, this being the diameter of the flange above the thread. The thread is seven-eighths of an inch in diameter, with eighteen threads to the inch, United States standard. The total length below the flange, including the thread and recess, is to be not less than half an inch, and the width of the recess not more than one-eighth of an inch, the depth of the recess being not greater than the depth of the thread. The thread is cut perfect into the recess. The flange is one-eighth of an inch wide. The head of the plug body is a milled hexagon of seven-eighths of an inch smallest diameter. The packing gland nut head is hexagonal and has a small diameter of three-quarters of an inch. The flange on the body has an annular seat one-eighth of an inch wide, suitable for a McKim type copper-asbestos gasket.



A. L. A. M. Standard Spark Plug.

E-M-F-Northern Consolidation Completed.

The final papers in the consolidation of the E-M-F Company and the Northern Motor Car Company were signed on October 2. It is stated that the Detroit Northern plant will turn out renewal parts for all old Wayne and Northern models, while the Port Huron Northern plant will turn out E-M-F axles. By this arrangement the Everitt-Metzger-Flanders Company secures the Selden license of the Northern Motor Car Company and becomes a member of the A. L. A. M. The company last week started work on an addition to its plant at Detroit. It is an exact duplicate of the one now in use, 400 feet long, 50 feet wide and three stories in height, of modern mill construction.

Will the author of the article "In a Rural Practice," by Blank, M. D., kindly send us his name and address?

MINOR MENTION

The Elkhart Motor Company, of Elkhart, Ind., has increased its capital stock by $8,000, to enable it to push the manufacture of its car

The Columbia Carriage Company, of Hamilton, Ohio, have completed a motor buggy with 12 horse power engine and solid rubber tires

The Streator Motor Car Company, Streator, Ill., has started work on two new concrete block buildings, one 50x150 and the other 36x100 feet.

The Hitchcock Motor Company, of which W. H. Creahan is manager, will engage in the manufacture of automobiles at Warren, Ohio, next spring.

The Sommers Motor Company has started work in the building formerly occupied by the Aurora Bleachery in Aurora, Ill. The company manufactures automobile motors.

The capital stock of the Haynes Automobile Company, Kokomo, Ind., is to be increased to $180,000. The additional stock issued will be taken by Kokomo and Portland, Ind., capitalists.

It is reported that D. C. Durant, of the Buick Motor Company, left Los Angeles, Cal., on September 22 for a motoring trip to New York, accompanied by Ernest Shuter, of New York city.

J. V. Lindsley & Co., manufacturers of the Lindsley motor buggy, Dowagiac, Mich., are negotiating with the Business Association of East Liverpool, Ohio, with a view of locating in that town.

The W-D Spring Cushion Tire Company, who have been organized under Delaware laws with a capitalization of $220,000, are arranging for the manufacture of the springs for these tires with a Bristol, Conn., spring concern. James L. Shellhammer, of Pottsville, Pa., is president of the tire company.

Registration certificates for 5,935 automobiles have been issued by the Secretary of State of Wisconsin, about 3,000 being in Milwaukee. It is thought that there are about 6,000 in Milwaukee alone, which would appear that some 3,000 have not been registered in the State Department as required by law.

The Rumsey Electric Company, of 245 Jefferson avenue, Detroit, have placed on the market a storage battery adapted to use for ignition, and also for power purposes upon pleasure and commercial vehicles. This company also rents ignition batteries. The cost for renting a battery and keeping it recharged is $2 per month.

The New York Automobile Trade Association will hold its annual Fort George hill climb on Saturday, October 17. The event is in charge of a committee consisting of Richard Newton, Charles P. Skinner, C. H. Larsen and Walter R. Lee. In addition to the usual price classification the plan of classifying entries according to rated horse power will be tried.

An attachment was taken out some time ago on the property of the Augusta Motor Company, Augusta, Ga., by R. A. Health, on a claim of $65 due for rent. The constable levied on fourteen automobiles and the whole equipment of the place.

The Harris Tire Company, Drayton and Perry streets, Savannah, Ga., have decided to broaden the scope of their business and carry a complete line of automobile sundries in addition to tires. S. N. Harris, manager of the concern, has just returned from a business trip to New York.

The negotiations between the Duplex Motor Company and the Streator, Ill., Development Association have failed. It appears that the motor company desired local business men to subscribe for $10,000 worth of its stock, of the total issue of which the promoters intended to retain 51 per cent., and as the company intended to employ only eight men the proposition did not meet with favor among local business men.

The Child's Automobile Company has been formed at Newark, N. Y., to manufacture a small single cylinder runabout for children's use, to cost from $150 to $250. S. H. Mora, of the Mora Motor Car Company, is president of the new concern, and it is understood that the two interests are allied. A vacant building on Siegrist street, formerly occupied by the Mora Motor Car Company, is to be used.

The Toledo Electric Vehicle Company has been incorporated at Toledo, Ohio, to manufacture electric cars. The new company takes over the business of the Allen & Clark Company, 2014 Adams street, Toledo, a developing concern organized to perfect a storage battery invented by A. F. Clark. It has leased the Riding Academy building at Hollingwood and Delaware avenues, where it will begin at once the manufacture of electric runabouts.

The Holt Manufacturing Company, Stockton, Cal., have brought out a gasoline tractor of the type which lays its own tracks as it proceeds, an endless "chain" forming the track encircling the two wheels on one side. The tractor has a four cylinder, 40 horse power motor, weighs 7½ tons and is geared to run at 2 to 4 miles per hour. The machine was specially designed for use in the construction of the 240 mile Owens River aqueduct, through which Los Angeles is to be supppled with water.

The engineer of the National Brake and Clutch Company, Boston, Mass., has prepared plans of three clutches of 20-24, 38-35 and 45-50 horse power respectively, embodying the results of three years' experience in designing these clutches, and indicating the angle and width of face, diameter of cone, area of cork surface, weight of spring, etc., required to give the best results. The company are forwarding to automobile manufacturers reduced drawings of these clutches, and will furnish full size drawings to engineers or manufacturers on request, without charge.

The Imperial Motor Car Company, of Williamsport, Pa., has gone into the hands of a receiver.

The Ajax-Grieb Rubber Company, Trenton, N. J., have opened a Philadelphia branch at 316 North Broad street, in charge of J. L. Keir.

Nineteen entries were received for the 1,000 mile reliability contest which is being held by the Chicago Motor Club from Tuesday to Friday of this week.

The Auto Crank Shaft Company, Detroit, Mich., manufacturers of axles and crank shafts, have moved from 793 Gratiot avenue to their new factory at 192 to 196 Piquette street.

The Champion Ignition Company is being organized at Flint, Mich., by Albert Champion and Albert Schmidt, both formerly of Boston, to manufacture spark coils, plugs and other automobile accessories.

The Society of Automobile Engineers will henceforth maintain an information bureau for the mutual benefit of members seeking positions and of manufacturers in need of additions to their technical staffs.

Albert E. Morrison, formerly with the Morrison Automobile Company, of Boston, Mass., and now manager of a taxicab company there, has filed a voluntary petition in bankruptcy. He has liabilities of $3,076 and no assets.

According to a report from Cleveland, a committee of the creditors of the Royal Motor Car Company has agreed to a reorganization plan, and the attorneys for the company have been instructed to proceed at once with the formation of a new company.

Waukesha, Wis., the Saratoga of the West, famous for its mineral water, claims the championship for number of motor cars in proportion to population. Waukesha has one car to every 220 inhabitants. There are thirty-five cars in the city, not counting the scores brought there every summer by Southerners who resort there.

The motorcycle manufacturers of the country have been organized under the name of the Motorcycle Manufacturers' Association, and George Hendee, of Springfield, Mass., is said to be a likely candidate for the office of president. A show committee has been appointed, and held a meeting in New York recently to determine the various shows which the manufacturers will patronize the coming winter.

Charles A. Stickney, of the Stickney Gasoline Engine Works, St. Paul, Minn., is endeavoring to organize a company to manufacture a motor buggy designed by him. The car is equipped with a 10 horse power, two cylinder vertical, air cooled motor in front, and has 40 and 44 inch wheels fitted with solid rubber tires. A sliding gear transmission and a multiple disc clutch are used. The frame is of hickory and the wheels run on roller bearings.

Garage Notes.

H. W. Chubb has opened a garage at 1022 State street, Schenectady, N. Y.

G. P. Cory, of Detroit, has established an agency for Aero cars at Oklahoma City.

The Russell Motor Co. have opened a garage at 310 East Superior street, Duluth, Minn.

William Hausmann and Norman Nelson, Churches Ferry, N. Dak., have entered the automobile business.

The Palo Alto Garage and Machine Shop has been opened at 424 High street, Palo Alto, Cal., by Carah & Ellis.

Henry C. Taylor has moved his garage and repair shop from 323 John street to 435 Harrison avenue, Harrison, N. J.

C. A. Bachelor, northern Indiana agent for the Buick Motor Co., is endeavoring to establish a branch agency in Fort Wayne.

The Hills Motor Car Co., Philadelphia agent for the Royal Tourist, have moved from 130 North Broad street to 604-6 North Broad street.

James A. Cox and Harry Stead have purchased the repair department of the Hamilton Motor Car Co., Hamilton, Ohio, located on North Second and Market streets.

The Southern Automobile Co., Charlotte, N. C., formerly under the management of Ham & Zimmerman, is now under the management of Ham & Ross.

The Acme Motor Car Co. will shortly open a Philadelphia agency at 606-608 North Broad street, in charge of E. F. Theobald, H. B. Childs and M. M. Blake.

The Thayer Auto Garage Co., of Marinette, Wis., has added a 22 horse power, 1,250 pound Rambler truck, designed along special lines, to its equipment.

The Johnson Auto Co. has been incorporated at Vincennes, Ind., with $10,000 capital, to operate a garage and livery business in the vicinity of the Grand Hotel.

The Independent Automobile Co. has been organized at Indianapolis, Ind., to handle the Oakland car, and has secured quarters at 216 East Vermont street.

The Ford Sales Co. has been formed at Utica, N. Y., by Frank E. Henabray and A. P. Howarth. They will handle the Ford in Oneida and Herkimer counties.

The Auto Sales Co. has been formed at Oklahoma City to deal in and rebuild second hand cars from the East. They are located at 15-17 North Hudson street.

The new garage under construction at Merrill, Wis., for Norman Chilsen will be ready for occupancy about November 1. It is two stories high and the largest in Merrill.

The Hastings Brothers' automobile garage, Iola, Kan., was moved into the Woods Building recently. Two pits are provided in the new quarters for convenience in repairs.

Forbes S. Day, who has been connected with the George N. Pierce Co. at their factory in Buffalo for twelve years, has taken the local agency for the company at Kansas City, Mo.

The Sabetha Automobile Co. has been organized by Miller & Mishler, implement dealers, and Frank Ramsay, at Sabetha, Kan. Mr. Ramsay will be manager of the concern. A 30x70 foot two story cement block garage is to be erected.

The Rambler Automobile Co., of Kansas City, has been formed to handle Rambler cars in Kansas and adjoining States. The incorporators of the new company are W. L. Lacy, Estel Scott, George Devol, J. R. Nave and D. G. Anderson. The last named will act as general manager.

The Reliance Iron Works, of Stevens Point, Wis., are building a new machine shop, which will include a large garage. The building is to be [illegible] feet in dimensions, the garage to occupy half of the first floor. The company is in the market for auto repair tools and equipment. F. A. [illegible] is manager.

Louis A. Robertson, Kansas City, Mo., has taken the agency for the Franklin car in that territory, which he will represent exclusively during the coming season. He has secured temporary quarters at [illegible] Troost avenue, and intends to erect a two story, 65x185 foot steel and concrete garage.

The McBride Automobile Co., agents for the White steam car at Walla Walla, Wash., have under construction a two story, 125x60 foot brick garage, which when completed will comprise a fully equipped machine shop, vulcanizing department, battery charging department, paint shop and upholstering department. The building will be occupied on November 1.

While Carl Endebrock, a garage owner of 25 Chancery street, Trenton, N. J., was brazing an axle on September 27, the jet of the gasoline torch used blew off, and gasoline was thrown over the floor and rafters, and immediately caught fire. Endebrock and his assistant at once played the fire extinguishers kept in the garage at the blaze, and they succeeded in subduing the flames after only $75 damage had been done.

The Westcott Garage Co., Utica, N. Y., whose organization we announced in a recent issue, have occupied a garage with 14,000 feet of floor space at the corner of Cooper and Cornelia streets, and will give special attention to the tourist trade. They will also handle a line of cars and accessories. The garage is located between the commercial and residential sections of the city, and easy of access from both sections.

The Bischeld Automobile Co. has been organized at Grand Island, Neb., and will take over the Hart Gun Co. automobile repair shop and garage owned by O. H. Hart and Robert McAllister. About October 10 they will occupy quarters in the R. R. Watson Poultry Building. Oscar R. Kirschke is president of the new firm and Bert E. Watson secretary and treasurer. The company is incorporated for $10,000, and intends to conduct a general agency, garage and repair business.

Henry J. Adams, Fostoria, Ohio, has recently moved into his new garage and salesroom at 122-124 West Tiffin street. It is a one story brick building, 50x150 feet, with truss roof and cement floor, and considered fireproof. Repairing of cars, charging and vulcanizing are made specialties. General supplies and Michelin and Morgan & Wright tires are being handled. Mr. Adams is general agent for northwestern Ohio for Reo and Premier cars, and has sub-agencies in most small towns.

The Electrical Construction and Motor Co., Findlay, Ohio, has been incorporated and is building an extensive garage on South Main street. The building is of brick, 50x125, with cement floor. The company carries the Stoddard-Dayton, Maxwell, Overland and Columbus Electric lines. The garage will be ready by October 15, and a full line of general supplies will be carried. The shop will include a repair, charging and vulcanizing department. H. Kelly and O. Burton will look after the repair end, while Chas. Hoch is business manager. Kelly and Burton until recently conducted a bicycle repair shop.

New Incorporations.

The Evans, Chamberlin, Stanton Co., Los Angeles, Cal.—Capital, $10,000.

Larson Current Motor Co., Seattle, Wash.—Capital, $25,000. Incorporators, John L. Johnson and Charles M. Best.

City Autocab Co., New York, N. Y.—Capital, $250,000. Directors, L. F. Braine, Henry H. Gardiner and Lloyd Milnar.

Des Moines Electric Co., Augusta, Me.—Capital, $5,000,000. President, J. Berry. To deal in machinery, generators, motors, etc.

Eagle Automobile Co., Cincinnati, Ohio.—Capital, $10,000. Incorporators, F. L. Rhan, John Murphy, Fred L. Hoffman and C. O'Hern.

Twin City Automobile Exchange, Minneapolis, Minn.—Capital, $10,000. Incorporators, William Railsbeck, W. S. Railsbeck and F. W. Star.

Northwestern Storage Battery Co., Milwaukee, Wis.—Capital, $25,000. Incorporators, F. E. Scudder, Edgar J. Knapp and Edward [illegible].

Shore Line Garage Co., Pine Orchard, Conn.—Capital, $10,000. Incorporators, John T. Manson, Minotte E. Chatfield and Winthrop G. Bushnell.

Minneapolis Motor Cycle Co., Minneapolis, Minn.—Capital, $30,000. Incorporators, Joseph M. Michaelson, Charles S. Gilmore and Walter E. Michaelson.

Fairbury Automobile Co., Fairbury, Ill.—Capital, $10,000. Incorporators, Henry Foster, W. B. Decker and N. J. Foster. To repair and deal in automobiles.

Toledo Electric Vehicle Co., Toledo, Ohio.—Capital, $50,000. Incorporators, W. E. Allen, A. F. Clark, F. B. Willard, E. J. Hall and J. W. Schaufelberger.

Goshen Motor Works, Goshen, Ind.—Capital, $25,000. Incorporators, Orland D. Ihrig, Guy B. Kessler, Lewis E. Ihrig, Hattie C. Kessler and Lillian G. Ihrig.

Cleveland Automobile Co., Cleveland, Ohio.—Capital, $30 000. Incorporators, Emma Wadsworth, C. B. Stannard, Mary M. Brice, W. A. Coy and S. J. Wallace.

C. Jensen, Inc., New York, N. Y.—Capital, $10,000. Incorporators, Charles Jensen, Edward B. Wilson and Franklin Lockwood. To manufacture automobiles, etc.

The Winnipesaukee Co., Berwick, Me.—Capital, $10,000. Officers: President, Henry D. Yeaton; treasurer, Orren R. Fairfield. To deal in automobiles, boats and carriages.

Johnson Auto Co., Vincennes, Ind.—Capital, $10,000. Incorporators, Marshall T. Johnson, Frank P. Emison and Charles F. Daily. To carry on automobile livery and transfer business.

Alamosa Automobile Co., Alamosa, Col.—Capital, $10,000. Incorporators, G. M. Culver, C. B. West, Roy Campbell, William Ward, E. T. Hyatt, M. D. Blakey, J. E. Clarke and H. E. J. Lawton.

Dan Canary Taxicab Service Co., Chicago, Ill.—Capital, $20,000. Incorporators, William J. McCarthy, Daniel J. Canary and R. A. Cavenaugh. To deal in motor vehicles and conduct a garage.

Trade Personals.

Gustave Reinberg, 115 Broadway, New York city, has been appointed United States agent for De Dion-Bouton cars.

W. M. Paige, of Travers City, Mich., has accepted a traveling position with the Maxwell-Briscoe Motor Co., with headquarters at Detroit, Mich.

E. Leroy Pelletier, advertising manager for the Everitt-Metzger-Flanders Co., has also taken charge of the advertising of the Studebaker Automobile Co.

George M. Davis, who some time ago was advertising manager for the E. R. Thomas Co., has accepted a similar position with the George N. Pierce Co.

H. J. Newman, formerly designer for the Pennsylvania Motor Car Co., has accepted a similar position with the Coates-Goshen Automobile Co., Goshen, N. Y.

T. R. Roberts has been appointed manager of the Rambler branch in Philadelphia, to succeed William S. Smith, whose resignation was announced last week.

Edward Wilke has been appointed manager of the Buick Philadelphia branch, located at 235-237 North Broad street. The territory of the branch includes the whole of Pennsylvania.

Arthur J. Paige, of Terre Haute, Ind., has succeeded George von Rotweiler as superintendent and general manager of the Fort Pitt Motor Manufacturing Co., building the "Pittsburgh Six."

The board of directors of the Cleveland Motor Car Co. at a meeting in New York city on September 26 elected James B. Strawbridge general manager and treasurer, to succeed Walter A. Woods.

Chas. B. Warren, sales manager of the Haynes Automobile Co., of Kokomo, has resigned his position to enter the employ of the F. B. Stearns Co., of Cleveland, and will ultimately take charge of the California branch of the F. B. Stearns Co.

A. C. Wheelock, who for some time was the representative in Oakland of the Pioneer Automobile Co., will be the agent of the company in Fresno. The Pioneer Co. expects the Chalmers-Detroit to have a large sale in the country districts of California.

The Horseless Age

First Automobile Journal in the English Language

VOLUME XXII NEW YORK, OCTOBER 14, 1908 NUMBER 16

The Probable Amount of Distortion in "Block" Cylinders.

By F. E. Watts.

It will hardly be denied, even by those who are most strongly attached to the old style of construction, that the degree of success attending the casting of all four cylinders in a single unit is a subject of interest. Among the numerous objections, theoretical and practical, which have been raised by the opponents of this construcion, one of the most important relates to the distortion of the casting as the engine heats. It has been claimed that this effect is great enough to force the cylinders sufficiently far apart at the top to seriously throw the parts out of alignment, and thus increase the friction of the engine.

Any four cylinder block casting which I have seen is a pretty complicated piece of foundry work, and to attempt to discuss all the effects of expansion would be an intricate and well nigh hopeless task. So all that we will consider here will be a few of the principal points relating to the two common types.

The distinguishing features of these types are shown in Figs. 2 and 3, and relate to the portion of the walls between the cylinder barrels. In some instances these walls are single, as in Fig. 2, while other makers leave a water space between adjacent cylinders. All carefully made cylinders are pickled, "aged," and sometimes heat-treated during the process of finishing, so we are pretty safe in saying that whatever distortion occurs after the engine is assembled is produced by the action of heat caused by the combustion of gas inside. This being true it is important to know the distribution of the heat in the cylinder wall to predict the distortion.

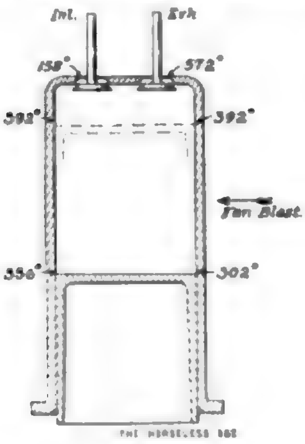


Fig. 1.

Unfortunately, no tests have been made upon this point which are exactly applicable under the conditions we are considering. So the best we can do is to determine limits within which these temperatures must lie from such tests as have been made.

For air cooled cylinders some very valuable experiments were carried on in England by Professor Callender some years ago. The results of these tests were given in The Horseless Age on page 537 of Volume 13. For our present purpose it is sufficient to say that the engine had a 2.4 inch bore and a 2.8 inch stroke, and was cooled by the usual circumferential ribs, aided by the blast from a fan impinging on the exhaust side of the cylinder near the head.

While the temperatures varied a rough average is represented by the diagram, Fig. 1. These temperatures are in degrees Fahrenheit, and are for the interior of the metal. The well known scientific ability of the experimenter is a guarantee of the accuracy of these figures.

A water cooled cylinder is, of course, cooler than this, but how much cooler is a question. Tests made in Germany upon a single acting 400 horse power Körting engine, with a cylinder wall 1.59 inches thick, showed that the temperatures of the metal near the middle of the wall were as follows: Near the combustion chamber, 201 degrees; just below half stroke, 145 degrees; in the bridge of the exhaust port, 338 degrees. The temperature of the inlet water was 68 degrees, and that of the outgoing water 100 degrees (all by the Fahrenheit scale).

Of course the temperature in a cylinder wall must depend somewhat upon the thickness, and it naturally decreases from the inside to the outside, following an unknown law, but the most important factor determining the median heat of the metal is the mean temperature of the cooling substance.

In this case the mean temperature was 80° Fahr. In automobile motors it is common to keep the water in the neighborhood of 150° Fahr.; it seldom exceeds 180°, and is, of course, always below 212, unless the system is kept under pressure, which so far as I know is never done commercially.

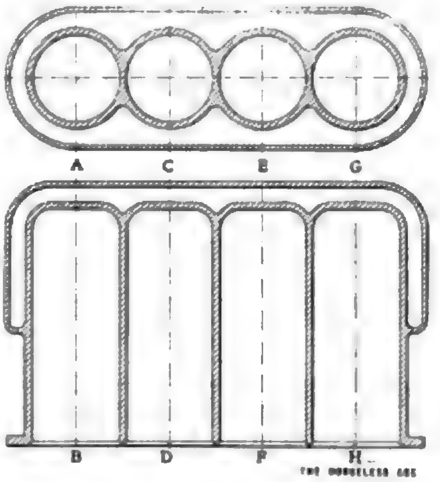


Fig. 2.

Neglecting the effects of wall thickness, the mean temperature of the wall of an automobile cylinder should be approximately given by the following proportion:

$$460 + 80 : 460 + 180 = 201 : \psi,$$

where ψ = temperature of the wall of an automobile engine cylinder at the upper end of the piston travel,

$$\psi = 238° \text{ Fahr.},$$

so I think that we are pretty safe in saying that the temperature does not exceed 250 degrees. This is the temperature at the middle of the wall, and is what determines the amount of expansion at that point. The largest block cylinder in automobile work with which I am familiar has a 5 inch bore. So, to consider the extreme case, we will say that the cylinders shown have 5 inch bore, one-quarter inch walls, and that Fig. 2 has a three-eighthhs inch water space.

The linear coefficient of expansion of cast iron varies somewhat with its composition, but we may take the mean value as .000,006, for each degree Fahrenheit increase in temperature. Using that value, and considering the normal temperature at 70°, we get the following table:

Temperature Degrees Fahr.	Expansion Per Inch Diameter.	Expansion on 5¼ Inch Diameter.
100	.00018	.0009
150	.00048	.0025
180	.00066	.0035
200	.00078	.0041
250	.00108	.0057
300	.00138	.0072
400	.00198	.0104
500	.00258	.0136

Convection by the piston is an important factor in the distribution of heat in the cylinder walls, as is shown by the fact that the drop in wall temperature is only 36° from top to bottom of the stroke at the right hand of Fig. 1. Even below this point the piston is conveying heat to the cylinder, so I think that I am well within bounds in assuming that the temperature of the bottom of the cylinders is over 100°. Calling this temperature 100° and the temperature at the top 250°, the distances AC, CE, EG, will exceed BD, DF, FH, respectively, by:

.0057 — 0009 = .0048 inch,

which is the amount adjacent cylinders will be thrown out of parallel. AG will exceed BH by .0048 × 3 = .0144 inch.

These values show a distortion great enough to interfere with the action of the engine or to appreciably increase its friction, and they are in all probability larger than the actual distortions.

With cylinders of the type shown in Fig. 2 the distortion will be determined by the difference between the temperature at the bottom and at the lower wall of the water jacket, provided that this jacket wall is sufficiently stiff to force the cylinders out of line. It is probably fair to assume a drop in temperature of 50° from the upper end of the piston stroke to the lower end of the jacket wall. This would give the temperature at that point as 200°. The deflection, not considering the minute expansion of the jacket wall, would become .0041 — .0009 = .0032 inch between adjacent cylinders. And the total deflection between fore and aft cylinders would be .0032 × 3 = .0096 inch.

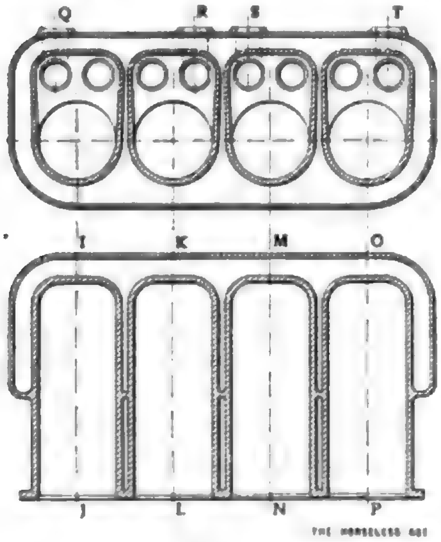


Fig. 3.

While this is less than the first amount, it must be borne in mind that the deflection takes place only about half way up the cylinder, and that although the cylinders are free to expand above this point, they have been pushed apart so that their bores stand at an angle. So the upper parts probably expand symmetrically around these diverging axes, and the upper ends are out of line more than in the first case.

In the actual castings the presence of bosses connecting the cylinder barrels with the jackets may influence the conditions considerably. Where the inlet or exhaust manifolds, or both, are cast with the cylinders they further complicate the problem.

It has been common practice for some time past to cast cylinders in pairs, and there has never been any trouble from their warping. While the four cylinder casting multiplies the deflection between axes of the pair casting by three, it has been shown above that the total resulting deflection is still so small as to offer no practical objections to the method.

So far as I have observed the exhaust manifold is the only place where allowance for the heating effect has been made in practice. In a few of the larger and more highly specialized engines expansion joints have been placed in the manifold between the cylinder pairs.

Turning again to Fig. 3, we find the exhaust outlets represented by Q, R, S, T. The distance between Q and T is 19½ inches. If we make the extreme supposition, very seldom if ever realized in practice, that the exhaust pipe gets red hot, its temperature will be about 970° Fahr. The temperature rise will be 970 — 70 = 900°, and the total expansion .000,006 × 900 × 19½ = 1055 inches.

The expansion would usually be from half to two-thirds of this amount. It is easy to see that with a large engine having the cylinders cast singly or in pairs, where the pipe is considerably longer than this, if the exhaust manifold is to be kept tight allowance must be made for this effect, either by making the branches of the pipe of considerable length, so that they can bend, or by putting a sliding joint in the middle.

In conclusion it may be said that there is only one form of cylinder which will maintain its shape perfectly when heated; that is an individual casting with its valves in the head, or preferably with only a single valve in the centre of the head, water cooled, with its jacket carried well down and the entering water distributed by a deflecting plate. How much is detracted from the performance of an engine by departing from this ideal can be only a matter of opinion until exhaustive tests are made; but I think most practical men will unite in the opinion that the loss does not become important until quite large sizes are reached.

Some Views on Runabout Design.

By Warren Noble.

Europe has paid more attention than the United States to the actual manufacture of runabouts, and is conducting a revival even now. Most prominent in runabout construction—probably by reason of a more sober prosperity among purchasers—has been England, though the survivors among the adventurous ones are not too numerous.

To my mind the most famous of the runabouts of the past was the 6 horse power De Dion. This model, which succeeded the converted 3½ horse power water cooled model by the same firm with the engine in the rear, combined a (for those days) most excellent grace, smooth running, good control qualities and reasonably good springing, with a selling price within the reach of the "man of moderate means," with the result that its success was insured and lasts with a modified model to the present day, still with a single cylinder engine.

This model had many copyists, Belgium in particular turning out great numbers of runabouts on somewhat similar lines with genuine De Dion engines, light three speed change gear boxes and conventionally poor live axles. How bad those axles were for a while only the makers and sundry repairers know. Then the runabout idea in those same cars was lost and they bloomed again as light touring cars, worse than ever, in some ways. But the De Dion progressed uniformly from year to year. Small details only marked the parting lines in succeeding models, while many of its one time competitors progressed from single to double and from double to quadruple cylinder motors in their search for a ready market, and so lost their classification in the runabout section.

Before going further it may be as well to have a clear understanding as to what a runabout is. In general conversation the term "runabout" means to an automobile man simply a car with a two seated body; the chassis may be powered anywhere from 6 horse power to 160 horse power, but so long as it is equipped with a two seated body the runabout definition applies in a classifying definition. I would say that "a runabout is a motor vehicle whose total capacity is such that two passengers may be comfortably and conveniently carried at an average speed equal to the legal rate upon normal road surfaces." A runabout as set forth in this definition would have a two seated body mounted upon a chassis of approximately 95 inches wheel base with 54 to 56 inches tread, having an engine whose output would represent from 6 to 10 horse power at the road wheels at normal speeds. The weight of such a machine should not exceed 1,600 pounds. It should be geared sufficiently low to permit of a good range of speed on the high gear, and should be capable of not more than 30 miles per hour under the best conditions. These specifications conform closely to the most successful runabouts of the present day. It seems almost a heresy to come right out nowadays and say that a single cylinder car is a good job, and that it is a pity some do not realize it, but that is my actual belief. I am not trying to decry multicylinder machines, because no one believes more firmly in multicylinder engines than I, even to an extension of the present six; but, having had lots of experience in both directions, I firmly hold that a good single cylinder is better than a less meritorious two cylinder, or an indifferent four or six cylinder.

It seems like going back four or five years to bring up this question of one, two, three or four cylinders again. As an instance of the capacity of the single cylinder runabout, I would refer to the results of the small car trials held in France and mark the accomplishments of the Sizaire & Naudin machines.

In the design of the runabout first and foremost comes the question of the engine. I have defined above the power requirements of a serviceable runabout as 6 to 10 horse power at the road wheels. Such an output demands, with reasonably good transmission appliances, an engine capable of delivering to the transmission not less than 16 horse power at normal revolutions. This power may reasonably be expected from a quadruple 3½ inch "square" motor, with a probable surplus to take care of the inevitable "not at its best" habit that most motors have, or a double 4¾ "square." Now, as regards cost of manufacture, I think there is little doubt that the "double" has the advantage over the "quad" type, although the difference in dollars and cents may be but little, and possibly may be offset in the balance of the chassis work. However, fashion being prevalent in these matters, the "quad" is the type of most general interest, and consequently I will deal with it here.

Inasmuch as fewness of parts is the most desirable feature from a production point of view, the block type of construction recommends itself, since by its adoption all piping may be avoided. Besides, the T head is not likely to find favor, since it implies the use of two cam shafts where one may be made to efficiently do the work, with a reduction in the cost and the number of parts.

Thermo-siphon circulation is also desirable from the point of view of simplicity; it is not inefficient, though a larger radiator is demanded. I think, however, that the extra cost in the radiator is duly offset and th. total cost of the power installation reduced by abandoning the pump and its attachments. Suspension by underframe is not likely to find favor for such small work, since not only does the frame cost overshadow its economics, but its abandonment tends toward neatness.

Provided a block system of design is adopted its qualities may as well be carried to their limit. Thus there is little reason in making simply a block of cylinders and not extending the block idea to the upper half of the complete crank case. Neither does there seem to be reason to ignore the manufacturing advantages presented by the use of a two bearing crank shaft. Much doubt as to its efficiency was expressed some months ago when the dual bearing type of shaft was first commercially employed. Time and continued service have demonstrated its qualities, and the experience is favorable to its continued use. Splash lubrication continues to be perfectly satisfactory. External cam shafts are cheap, and, to my mind, entirely satisfactory (vide the English Daimler, the Matheson and some other prominent successful machines). Simplicity being the aim, the flywheel, if sufficiently large in diameter, makes an excellent fan, and so dispenses with additional parts. Correct design is necessary for the flywheel blades in order to insure satisfaction, but is not difficult to arrive at. A tight hood and a tight under pan are, however, necessary.

Parts assemblies being desirable from the manufacturing standpoint, the grouping of the transmission about the rear axle is a probable arrangement, an alternative plan being the grouping of the engine and gear together as a unit. As a manufacturing proposition I would prefer the former arrangement; as regards efficiency of design I am entirely on the fence between the two systems. For the frame, pressed steel, though by no means a sine qua non for light jobs, is probably the best material to use. The steering gear need not be irreversible; indeed some simpler and direct coupled system is more desirable, even on many larger cars. Irreversibility is never a true necessity, and often a detriment to a good steering gear. The selective change gear is as cheap in the shops as the progressive, if a slide gear is used. Body work on the straight line principle and sheet iron construction ar ethe best I know of, and far the cheapest.

And now we come to some limiting features, among which I would class clearance and wheel sizes most prominently. In endeavoring to provide a liberal clearance three courses only are open. One may (1) create an abomination without straight line transmission; (2) incline the whole system and incur the expense of a special lubrication system for the motor, or (3) abandon live axle transmission altogether.

To locate the engine high, to provide the necessary 10 inches (less is suicidal and more is to be desired), and to transfer the power to the rear axle centre by an angled shaft is very bad practice, yet it is the only way out if the engine has a splash oiling system. To incline the engine means drilling out the crank shaft (in a four cylinder job), and providing a force speed non-splash installation which, while representing the highest practice and the best of all solutions, is undoubtedly expensive. The third solution is to substitute side chain drive for the live axle and place the engine high and horizontal. There is yet another way out, consisting in the use of worm drive, but in America many people are fearful to try this, despite its innumerable advantages.

Let us consider for a moment the second limitation, the wheel diameter. Large wheels are most desirable for road work; a car with 36 inch wheels is safe with a smaller clearance than one with 34 inch wheels and with very much smaller clearance than one with 32 inch wheels. Now to fit 36 inch tires to a runabout is commercially impracticable, unless the manufacturer raises his selling price beyond that of his competitor fitting 32 inch wheels. Yet the riding qualites, the tire life and the clearance are all considerably improved by so doing.

A runabout frame cannot well be more than 25 inches above the road surface, if the runabout is to retain lines of grace, lowness and its consequent stability, but the use of a dropped front axle and a picked frame permit of the use of large wheels. There is no doubt in my mind that if a manufacturer could be persuaded to fit the large wheel the extra price of the machine would be cheerfully paid by customers who understand the matter. But runabouts are sold largely to people who do not realize these things.

One other great difficulty in connection with the runabout proposition is that the car will eventually be overloaded. A firm makes a two seated runabout in accordance with the standard definition. They are soon forced to fit, first, a rumble, then two extra seats, and finally someone fits privately a baby tonneau, and there is trouble right away. The remedy from the manufacturer's point of view is to make the wheel base short, to preclude any such "monkeying," but in that event the hardest of all problems in runabout work—springing for comfort—becomes very difficult indeed.

And so it goes until the following model becomes more powerful, longer and heavier —a light five passenger car. The truth of the matter is that the runabout should be treated as an entirely different proposition from the automobile for more than two passengers. Were I to make a runabout to suit myself I would locate the engine, if a vertical four, between driver and passenger, or a double opposed engine back of them, and use an inclined driving shaft and a worm drive and tiller steering, the tiller lying under the right arm; or I would use conventional lines, a four cylinder block engine, a coil clutch, a four speed gear box with direct drive on the second and third, and single conversion only for the first and fourth gear. I would also use side chain drive, using pressed steel chain cases as radius rods, and rack and pinion wheel steering. I once laid out such a car with 88 inches from dash to rear frame members and 112 inches wheel base, in sufficient detail to permit of approximating the cost as compared with the car having the same power plant, but a live axle and transmission unit. I found—and the result was checked by one of the best production men it has ever been my good fotune to meet—that it was possible to beat the latter arrangement by not less than 15 per cent.

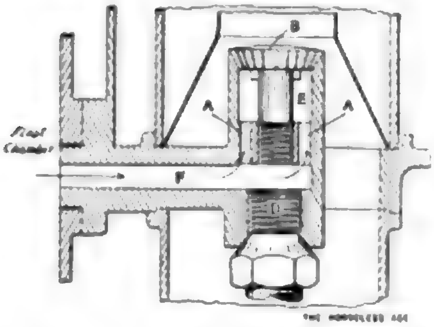
Trial of Tricar for Fire Service.

A trial was recently made with a specially built tricar for first aid service at fires at Beckenham, England. The car has a 6 to 8 horse power, air cooled twin engine, a two speed gear, a large fan for cooling and belt drive, and resembles the regular model of tricar turned out by the German firm. It carries two automatic chemical fire extinguishers, hose, ladders, lines and everything required to subdue a fire in the earlier stages. It is now installed in the Beckenham fire stables, jacked up in readiness for an alarm. The driver is an ex-marine engineer, and the car is to carry also a fireman. The machine is fitted with 26x2½ inch tires all around, and has magneto ignition, electric side lamps and a special horn.

Maintenance and Repairs

A Case of Carburetor Trouble and Its Remedy.

A case of carburetor trouble was experienced recently by a dentist who uses a runabout for pleasure purposes, the symptoms taking the form of gradual loss of power. Upon locating the cause of trouble to be in the carburetor, the union nut on the fuel line connecting with the float chamber being removed, small particles of some sort of dust were found, which were evidently metallic. Upon testing in the flame of a blowpipe they showed the characteristic green color of copper. Upon examination of the carburetor itself the channel leading from the float chamber to the spray casing (Longuemare carburetor) was found to have a fine layer of the copper throughout its length. The entry ports A, A (see figure) allow the passage of the gasoline into the chamber E when suction occurs, and the copper particles were carried with it. During the cessation of the suction the particles settled to the bottom of this chamber or dropped into the channel F, and were again sucked upward on the next admission stroke, filling up the channels in the spray head B, and causing the gradual falling off of power. It was noticed that after the motor was stopped and again cranked to start it, it ran finely, this being done before the carburetor was taken down for examination, as stated above. It is supposed that with the cessation of suction the particles sank into the gasoline and rested on the bottom of chamber E and in channel F. A thorough cleaning out fixed the trouble, but the question was, where did the copper come from and how could it be prevented from causing the same trouble again? There were two possible sources of the copper particles, the tank and the fuel lead. If the particles came from either of these the gauze could not prevent them from entering the carburetor, as the particles varied from a fine dust to such a size as would pass through a millimetre mesh gauze. The fuel lead was disconnected and a stream of water at 30 pounds pressure forced through it, but only a few particles came out. The lead was straightened and a flexible bristle brush, used on a gallery rifle, was run through it, but the lead was evidently not responsible for the copper particles. The tank was opened after being drained and a stick was scraped around on the bottom of the interior, bringing up a coating of copper particles on its end when removed from the tank. The conclusion was that owing to the action of moisture or water that gets into the tank in the course of usage a scale was formed, and this dropped off in particles, which were carried from the bottom of the tank to the carburetor by way of the lead. Two methods of preventing a recurrence of the trouble suggested themselves, viz., to plate the interior of the tank or to replace it with another of non-corrosive material. The former course was adopted, the tank being removed from the car for the operation.



The tank being filled with the cyanide solution, a wooden bar fitted with plates of tin was suspended therein and the plating battery connected up, the plates being the anode and the tank the cathode. In this manner the interior of the tank was tinned and further scaling prevented.

The Light Runabout in Colorado and Adjoining States.

Colorado and the Western States in general afford an ideal territory for the use of the runabout or light automobile for business purposes. In Denver, Salt Lake City, and in fact in most of the larger towns of the inter-mountain territory the light runabout has almost universally replaced the horse rig for the use of physicians. The light machine is also being generally adopted by ranchmen, by stock growers, by fruit and beet sugar growers, and in fact by all classes of people who until within a few years were dependent to a greater or less extent upon horse drawn vehicles. One result of the substitution of gasoline for horse propulsion has been an extension of the activities of the class of people affected, who have been able to cover far more territory in a much more regular and dependable manner, and also in the consequent development and increase in comfort of rural living conditions.

In Colorado, New Mexico and Arizona especially the dependable weather conditions, making possible the use of the automobile practically the year around, have greatly increased the possibilities and the popularity of the motor car. In the prairie country the light automobile is at its best, for here the single track roads stretch away for hundreds of miles with little or no climbing and few bad spots. These prairie roads are simply two tracks made by the traffic. With consistently good weather conditions these tracks usually afford smoooth going. Over this class of roads, and over the occasionally improved highways, the way of the light runabout is comparatively easy. In the mountain regions the small car is at a disadvantage, often lacking the power necessary for the steep grades, the clearance required on jagged roadbeds and the wheel base to make pleasurable going.

The urban roads in Colorado are generally good, and well suited for the light runabout for business purposes. For this work horse power varying from 10 to 20 is amply sufficient, and the average daily mileage depends entirely upon the energy and business demands upon the user. Although the garage owners do a large and profitable business in Denver and other sizable Western cities, there is a growing tendency on the part of the man using a light business runabout to have his own garage in connection with his house.

The advantages of the light car over the horse in the town as well as in the countray are the absence of expense when not in use, the superior speed and the ability of maintaining such speed indefinitely while in use, greater cleanliness and less expense in maintaining and cleaning the asphalt city streets. Incidentally it is becoming a matter of pride with the city physician of today to own his automobile, and only the old fashioned practitioners still cling to the horse and carriage. In Denver and Salt Lake business and professional men are using the electric runabout to a great extent, and in such cases generally have a touring car for more extended trips.

Strange as it may seem the city owner of an automobile is far more helpless when it comes to a case of making necessary repairs himself than is his country brother. For the rancher in these modern times is familiar with the use and operation of gasoline motors in farm work, and has a pretty fair idea of mechanics. This is in fact a necessity, as the city man can 'phone the garage, and have his machine hauled in and repaired while the countryman is obliged to use his ingenuity, or be at considerable expense and loss of time as a result.

The adoption of the lighter type of cars in any community is generally the signal for many other sales. Incidentally the man who uses a light runabout in his business for a couple of years soon becomes enough of an enthusiast to invest a little more money and purchase a light touring car as his second venture.

The cost of operating and repairing cars in the West is apparently a trifle higher than East, and this is mostly due to shipping charges on supplies and extra parts. Facilities for supplying of extra parts, by the way, are constantly improving, and whereas in past years it was sometimes almost impossible to repair or substitute a new for a broken part short of sending to the factory, it is now generally possible to secure the necessary accommodations promptly.

For rural mail delivery service the light runabout has not yet been generally adopted in the inter-mountain region. The horse rig still holds its sway in and around the towns, and the big car is generally put in use where the stage coach is supplanted

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The Opportunity of the Buyer.

Until recently the idea was very prevalent that automobiles were being sold at fancy prices, and the expression "I'll wait till they get cheaper" was heard quite frequently. There was, no doubt, some justification for this attitude on the part of those who have to "count their dollars," as the automobile value offered for a given sum has increased from year to year. Those who have so far deferred purchase for economic reasons will probably for the most part eventually buy light runabouts or family cars, and the sweeping reductions in these lines which have been made recently ought to decide all those who have been waiting for automobiles to get cheaper that now is the proper time to buy. It is not likely that a really serviceable runabout can ever be bought new at much less than $500, a figure which seems now to have been fixed upon by the manufacturers as the limit for a really serviceable machine.

It is now evident that there are to be reductions in runabout prices this season all along the line. Licensed and unlicensed makers alike will revise their price lists. What is perhaps of the greatest moment to the intending purchaser who has been awaiting this drop in prices is that he can now get a runabout at a price which ought to suit from any of the well known, long established firms in this branch of the industry, and is not obliged to go to a newcomer whose low price may simply reflect his inexperience.

We do not believe it is the intention of the important makers who have announced new low priced models to sacrifice anything in the way of material and workmanship, as compared with former models. Both labor and material are somewhat cheaper now than they were a year ago; tires especially have come down in price considerably, and all these manufacturers are calculating on a greatly increased demand for their cars at the lower prices, which will enable them to produce more economically.

The day of the practical, economical business runabout seems indeed to be at hand, and there is every reason to believe that during the next few years the horse will be discarded by the majority of drivers whose time is of considerable value. We also believe that the new order of things in the runabout market will revive the interest of corporations having large numbers of men on the road either soliciting orders or delivering light goods. Previous attempts by such firms to provide their traveling men with runabouts have not proved entirely successful; but with the progress in manufacture made in recent years and the present reductions in price, the prospects would seem to have materially improved.

Causes of the Taxicab Strike.

The present strike of taxicab drivers in New York city is the direct outcome of the rapid changes in the taxicab business and of the system of paying the drivers which has been in use by the operating company affected. Similar results have followed similar causes in Paris and other cities. The very involved and difficult problem of the most suitable system of payment to taxicab drivers is at the bottom of the whole situation.

The present system of paying the drivers a percentage of their total receipts, out of which, however, they are obliged to pay for their gasoline, uniforms and for polishing their car, was perfectly satisfactory to them as long as the cabs were practically always engaged. As long as the men made more per day than they had been accustomed to, or than do other men in similar lines of employment (horse cab drivers), they had no reason to find fault with the system. Dissatisfaction broke out, however, as soon as the daily receipts fell materially from the rapid increase in the number of cabs in use, and perhaps also from a slackening of interest in the new conveyance as the novelty wore off. Then, too, the grave defect of the system of payment in its encouragement of speeding became very manifest. Owing to the high speeds maintained more or less serious accidents became frequent, and the company, it is understood, often sought to hold the men responsible for damage suffered by their cars, and withheld their share of the receipts. This is one of the grievances which led to the present strike.

It appears to us that under the present system of payment the earnings of the drivers are too much dependent upon the state of traffic. In fact, as there are some fixed charges to be met by them out of their daily share of the receipts, such as for their uniforms and for polishing the car, their net earnings vary even more than the total receipts. That is to say, if the daily receipts are cut in half, for instance, the earnings of the drivers are reduced by more than one-half. It can thus be seen that any drop in the patronage of the individual cab is felt heavily by the drivers.

Another thing which may have been one of the causes leading to the strike is the recent change in rules regarding the ordering of cabs to any place in the city. Formerly it was the rule for the drivers when ordered from the station to any address to turn down the flag and start the meter as soon as a certain distance (one-quarter of a mile) from the station had been covered, while now no charge is made for calls to any point in Manhattan. Of course, the company must have expected that this would increase the daily receipts, but so far as the men are concerned it means that they will get less for the same total mileage or for the same amount of work, and pay relatively more for gasoline, and it is not likely that the change was popular with them, although we have not heard it specially mentioned among their grievances.

There is evidently justification for a system of payment which encourages the drivers to diligence and to economy in the use of fuel, and we believe that with an ideal system of payment the driver's earnings will rise and fall with his daily mileage; but the fluctuations of the earnings should not be so great as they are likely to be under the present plan, and there should be an underlying fixed wage of perhaps one-half of what the driver is expected to earn, and only the other fraction made dependent upon the receipts, because it must be remembered that the receipts do not depend wholly on the driver's diligence and personal qualifications, but also upon a large number of factors beyond his control.

It is to be expected, however, that in view of the newness of the taxicab business and the rapid changes taking place in it, it will be some time before settled conditions with respect to drivers' pay will be arrived at.

A Change in the Physical Qualities of Cylinder Oil.

The very marked change which has recently taken place in the superficial physical characteristics of the lubricating oil used upon automobile motors can hardly have escaped the attention of even the most careless motorist. A few years ago the accepted grades of oil used for cylinder and motor bearing lubrication possessed a very high viscosity and very marked "body" at ordinary temperatures, and were of a deep brownish red color when viewed by transmitted light and a full fluorescent green when seen by reflected light. Today the greater part of the oil used for this purpose is quite fluid rather than viscous, pours quite readily and is comparatively translucent, of a pale reddish amber color or hardly colored at all when light is passed through it, and possessed of a slight bluish fluorescence.

Modern gas engine cylinder oil is much more quickly handled, owing to its fluidity through a wide temperature range, than was the oil formerly used. It is much more cleanly to deal with and less dirty in appearance and in fact. When used for general lubrication purposes from a squirt can it flows readily and spreads itself much more promptly and effectually over the bearing surface.

Until recently the impression existed that an oil of great viscosity at ordinary temperatures was necessary to furnish a reliable film upon the hot surface of the piston, but a better acquaintance with the facts shows that this criterion possesses little value.

Very little of a reliable and definite nature is given out regarding the essential qualities of commercial cylinder oils, despite the vital importance of the subject. It would be of decided interest to know in just what ways this very noticeable change of physical characteristics of motor oils has been brought about, and how the modern thin, clear oils compare in effectiveness with the thick oils lately used. If an improvement in lubricating quality, a better showing under the cold test and a reduction of the tendency toward carbonization characterize these recent grades, their introduction is certainly to be approved, as they are so much more convenient and pleasant to handle.

A Mechanical Fallacy.

> A fallacy that is beginning to be recognized as such by racing men is that of believing the bolted-on type of tire to be slower because it is heavier. A prominent engineer recently tried out a racing car fitted with removable rims and tires, and he expressed himself astonished to find that the extra weight at the periphery of the wheels was acting like a flywheel and increasing his momentum. It is a recognized fact, also, that the question of weight aside, the bolted-on type of tire, because of its shape, holds 10 per cent. more air than the clincher type, and this, of course, makes it fast.

The above is from one of the publicity sheets which regularly reach our office. It is the second effort of this particular writer to impress the idea that an increase in weight at the rim of the road wheels increases speed. It seems rather queer to us that any "prominent engineer" should be astonished to find that the extra weight at the periphery of the wheels acts like a flywheel and increases his momentum. Every wheel acts like a flywheel, and engineering students are generally taught early in their courses that the momentum of a moving body is equal to the product of its weight by its speed, so any increase in weight necessarily entails an increase in momentum, other things remaining equal. If the said prominent engineer did not learn of this fact until he drove a racing car we can only conclude that his technical education was cut short at an early stage.

The inference in the above item is that weight in the rims of the wheel does not require for its propulsion any of the power furnished by the motor. How such a proposition can be maintained by any intelligent man is rather hard to grasp. A flywheel draws power from an outside source as long as it revolves at a constant or increasing rate, and when the supply of power is shut off it soon comes to rest. A hoop rolling on the ground must be given a constant succession of impulses if it is to be kept in motion. Similarly, an automobile wheel with its tire constantly absorbs power when running in a horizontal plane at constant or increasing speed, and the heavier the wheel the greater the power absorbed, other things being equal. In fact, a certain amount of weight in the rim of the wheel requires more power for its propulsion at a certain rate of speed over a given surface than an equal weight in the chassis, for the reason that the wheel is not spring supported, and, therefore, vibrates more strongly and causes more energetic hammering of the wheel against the road surface than the weight in the chassis.

We do not dispute the assertion that the bolted on tire is as fast as or faster than the clincher tire, but if this assertion be true it is not because weight in the wheel rim is self impelling, as it is not.

The Coming Shows.

In recent years it has been repeatedly observed that the so called national shows had a tendency to become trade shows, as contrasted with popular shows, and the advancing of the show dates for the two New York shows last year to October and November respectively was in line with this idea. This winter these shows will both be held during January, and they can hardly be expected to serve much of a purpose as trade shows, as all the more important concerns in the field have even now completed their agency arrangements for the coming year. As popular shows the dates will undoubtedly still be found too early, except possibly by the several concerns whose products and prices for the season have struck the public fancy, and who are therefore requiring long delivery terms. Some gratification has been expressed at the apparent disappearance of "seasons" in the automobile business, which was inferred from the fact that manufacturers announced their 1909 models about the middle of 1908, but we rather fear that it is premature, and that we must bear up with slack and busy seasons in the automobile business for a while yet. The prospects are therefore that the retail sales at the shows will be largely confined to those particular makers who are known to require long delivery terms owing to large sales previous to the show. This prospect, however, does not seem to have had the slightest effect in reducing the eagerness of possible exhibitors, and the applications for space are reported to have been more numerous this year than ever before. One thing in favor of this winter's show dates is that the exhibitors will have had abundant time to get their show cars ready, and it may therefore reasonably be expected that the models shown will be exact duplicates of the product to be turned out, and not subject to numerous changes.

The Automobile for Japan.

By A. W. Babbitt.

The Russo-Japanese war opened the eyes of the world to the fact that Japan was prepared to consider herself, and to take her place as. one of the great powers. Though the disappointment at the unproductive result of the war (as concerns indemnity) was intense, the country quickly recovered and entered into a period of post-bellum activity, culminating in the most remarkable boom ever experienced in Japan. The shares of the many strongly established companies rose rapidly, while those of new enterprises, contemplated for every line of business, were eagerly bid for before issue and at a high premium. Immense orders for machinery were placed abroad, and it seemed as though Japan were about to enter the class of industrial rather than agricultural countries, manufacturing not alone for her own needs but for export; a country that would call for all that was new, where the modern method of transportation, the automobile, would play an important part.

SLUMP FOLLOWS BOOM.

The highest period of inflation was reached about the middle of January, 1907, when the inevitable reaction occurred, and the subsequent decline of values was even more remarkable than the rise. The shares of the principal stock exchange, for example, dropped from yens 745, on January 19, 1907, to yens 99.95 in December of the same year; and now, in July, 1908, are held at but little more than yens 110. This example, an extreme to be sure, is given to show the panic that followed the post-bellum boom. Naturally the weaker concerns, the bubble companies, promoted with little regard for the future, together with many of the smaller banks, went under. Nor has there been the recovery from this depression that was expected when the bottom of the market was apparently reached. The great fire loss at Hakodate, heavily involving the insurance companies, as well as the uninsured, the floods of last year, the business depression in the United States, cutting down the exports to that country, Japan's best purchaser; the absence of tourists, the fall of silver, and now the Chinese boycott, have all tended to further the financial depression. Added to this the enormous expenditures of the Government for army and navy expansion, and the immense burden of debt left as a reminder of the late war, all to be paid for by the people in one way or another, it will be readily seen that the Japanese are not in a position to indulge in many luxuries.

This preamble is given to show how little opportunity there is at the present time to place automobiles of any class in Japan. If, however, the Japanese can be induced to look upon the automobile not as a luxury but a necessity, or at least an improvement over certain present methods of transportation, the motor car will come to take its place among the innovations which Japan is adopting in every direction. That the automobile will become a feature of certain parts of Japan is reasonably sure, but at the present time the country does not seem ready for it.

OBSTACLES TO BUSINESS.

But one American concern has so far made any particular effort to introduce its cars into Japan by means of an expert agent from home and an establishment where the goods could be seen and purchased from stock. Partly because they were too early and the cars rather crude, as cars a few years back now seem compared with those of 1908, the venture did not prove profitable. The method, however, is the only one that could succeed in building up a trade. The Japanese want to be "shown," and catalogues alone, without a demonstration, are but of little use. How many buyers in the United States, entirely unacquainted, as are the Japanese, with the motor car, would make a purchase from the mere catalogue? Many of the foreign importers of machinery and general lines, when approached on the subject, have stated that they might find purchasers if they had the cars to show, but they would not order on the terms the American manufacturers demand, and assume the expense of freight and duty. With a customs tariff of 50 per cent. ad valorem (which covers also tires, parts and accessories), the initial expense is too great for the average importer, particularly at the present time when Japanese and foreigners alike are watching carefully each individual dollar.

ROADS AND TRAFFIC.

The only foreign retailer and renter of bicycles in Yokohama who has a touring car for hire states that he would gladly take an agency for cars on consignment, or to be sold from the catalogue, using his present car to demonstrate. He cannot, however, from lack of the necessary capital, undertake to carry even the customs and landing charges. His present car, a Ford, suits him and his business, and there are times when he could use three or four to satisfy the requirements of tourist parties, who are glad enough to be able to secure for yens 25 ($12.50) per day a comfortable four passenger automobile to take them up to Tokio, off to Kamakura or Miyanoshita, or to the many other places of interest and beauty within easy distance. In the immediate vicinity of Tokio and in the city itself the roads are generally wide and excellent. The Tokio tram cars serve the city adequately, and the fare of 4 sen (of which 1 sen is a war tax which will probably never be removed) takes the foreigner who can read Japanese, or the native, practically anywhere and any distance he may desire to go. But while the Japanese has suitable transportation enough, the tourist can hardly avail himself of the generally crowded cars, if he would desire to, and there remains for him the expensive carriage or the uncomfortable, unsociable jinrikisha, to which so many visitors object because of the "human horse." A garage, with automobiles on hire by the hour or day, with competent chauffeurs reasonably efficient in English, to act also as guides, would undoubtedly be a success in Tokio. When a tourist party of four, seeing the sights of the city, extending over the area it does, figures up the day's expenses for jinrikishas, including one for the absolutely necessary guide, it would find the automobile cheaper, far more comfortable, and capable of taking them over far more territory, with no thought of easing up out of pity for the little man between the shafts. This is only one of the opportunities which seem to be awaiting the automobile in Tokio.

BUS COMPANY'S FIELD LIMITED.

The Bus Company, which was to unload 300 big double-decked cars on the city, and which failed, as did so many of the bubble companies conceived after the war, failed mainly because the police regulations forbid the running of regular lines of buses on streets already occupied by the trams, or on roads of less than 36 feet in width, thus limiting the operation to the extent that there would have been no profit, particularly as the venture would be in competition with an established efficient service ample for the needs of the Japanese. But a system of four to seven passenger cars, traveling independently, to be found at or near the Shimbashi Railway station in Tokio, or with an agent there, would cater to the foreign visitor and not to the Japanese, who, except for the wealthy class, not numerous, could not be expected to indulge. There is no great likelihood, however, of any such enterprise starting in the near future, but if the Japanese fail to see the possibilities of this business for the year of the great exposition, in 1917, they will lose a golden opportunity. Nor can there be any better time to demonstrate to the Japanese the advantages of all sorts and descriptions of motor vehicles than this coming exposition. Japan is both gratified and astonished at the action of the United States Government in devoting a sum of yens 3,000,000 to participating. It is understood that free transportation for exhibits can be had by U. S. army transports, and American manufacturers should not fail to take advantage of the offer. True, this is looking ahead, but it is more than likely that there will be no great demand for automobiles before the time of the exposition, unless the manufacturers exhibit a real desire to show and sell their goods on the ground.

CHANCE FOR STAGE LINES.

There are also many places where the Japanese themselves could be better served by motor cars than by their present methods of conveyance. For example, there is a line of the native carriages, called "bashas," running between a point in Yokohama and the village of Sugita, well around on Mississippi Bay, a distance of perhaps six miles. There are no electric cars in this direction, the road is practically level, amply wide and fairly good, and a number of cheaply constructed cars of not great power could give this line service far superior to that at present provided. The patrons of this route are largely of the farming and fishing class, and the construction of the car body could be of the cheapest. A type similar to that now used quite extensively in Osaka would be useful on many such routes, for the basha is a common vehicle on all fairly level roads throughout the empire. Even Nagasaki, with its limited field (because of the extremely hilly locality), possesses a bus service. It would be useless, of course, to consider such lines operated by foreigners; their only part would be the supplying of the cars.

SMALL RUNABOUTS MOST SUITABLE.

Away from the larger cities the big touring car is decidedly out of place, though it is always possible to operate them, as was demonstrated by the "New York to Paris" racers, which passed through to Tsuruga, and by one or two venturesome tourists who chose this ideal way of travel. The country roads are too narrow, bridges often too weak, turns too abrupt, grades too steep and native children, vehicles and pedestrians too numerous to allow much pleasure to the occupants of a large car. A straight road of any great length does not appear to exist in the country, while even in the cities they are sometimes laid out in serpentine twists, to conform to the lay of the land. For example, the Bluff Road, along the shore of Yokohama Bay, at no point along which it is possible to see one's way clear for a hundred yards in either direction.

The car that can go practically anywhere in Japan that any wheeled vehicle now goes would be a narrow runabout of not too great a wheel base but with plenty of power. Japan is a country of hills and mountains, and the roads seem to take to the hills from choice—at least, level roads are the exception. Good hill climbers are therefore very essential, and plenty of power is desirable, though not for speed, there being little opportunity to let out one's car. The narrow width is advisable because of the narrow roads. The short wheel base is also advisable because of the very abrupt turns, which in the country villages are often difficult to negotiate, particularly as there are seldom any sidewalks and the buildings are brought to the very edge of the road. When it becomes necessary to turn about, too, in these 10 foot or less highways, a short wheel base and perfect control are a blessing, especially if there be a rice swamp on either hand. The average country road was laid out to accommodate the jinrikisha and the narrow native cart for man or horse, and is ample for the purpose, but given an ordinary touring car on one side and one of the generally vicious and unruly native horses with his load and a scared driver on the other, the passing is a mater of careful manœuvre and often a serious problem.

MOTOR TRICYCLES IN USE.

There have been several motor tricycles in Yokohama, of English make, the third wheel being in the rear. They have the advantage of being compact, but are of ancient model and anything but beautiful in appearance, nor are they particularly useful or comfortable. A young foreign engineer of Yokohama has recently built a car on the tricycle type. His idea was to build on the principle of the jinrikisha, of exactly the same width, to travel over the same roads that a jinrikisha could go. While his car is much longer, and cannot turn in its own length as can the two wheeled vehicle, it is light enough to be easily lifted around; indeed, the construction seems too light for the roads it is likely to meet. This car is fitted to carry a passenger forward of the wheel, and the builder believes that it will steer and run better when this is done. The wheels are 24 inches, and the rear wheel —it being a tricycle—is to be changed to a double affair, two wheels set closely together, to steady the car. The two cylinder engine is located under the rear seat, with the tank forward. This car, which cost some yens 900 ($450) to build, can properly be classed with the freaks, and could hardly be popular in Japan or elsewhere, being too low and hardly an improvement over the motorcycle. The latter is becoming somewhat popular here, having the advantages of comparative cheapness and ability to get to places where even a jinrikisha could not easily go. The bicycle has long held an important place, and is still imported in considerable quantity despite the local manufacture of a very fair grade.

The manufacture of motorcycles has not yet been attempted, but surely will be if there arises sufficient demand, gas engines being now made in Osaka.

SOME SUGGESTIONS.

One of the important points in relation to automobiles in Japan is the matter of tires. They cannot be made here, nor properly repaired, so that with a 50 per cent. duty it is advisable that they be made to last as long as practicable. It is strongly recommended by owners who have had experience with the country roads that a studded leather outer tire be used. Grades are so steep and turns so abrupt that the brake is in almost constant use, while it is often dangerous to allow skidding on some of the hill roads. To lose control of one's car on the average Japanese hill would be almost sure to result fatally. A double set of powerful brakes is essential. Indeed, one car here has been fitted with a third safeguard to hold on hills in case power and brakes give out.

Another feature of importance is the steering gear, which should be a wheel operated device and irreversible, so the car will not be thrown about by the small stones and ruts which are a prominent feature of the country roads. A minor feature is recommended because of the winding roads, viz., that a pivot searchlight be a part of the equipment of a car destined for Japan, if it is to be used at all at night. The advantages of such a light can be seen in a five minutes' trip along the Bluff Road of Yokohama's foreign residence section, where the twists are really remarkable. Its usefulness would have been more than demonstrated to one auto party had the fishermen who built barricades across the road in their village of Negishi taken a curve for the scene of their operations instead of the straight course. What motive these men had in building obstructions cannot be learned, there being no one in sight to question. One obstruction was simply a heap of rice straw, but others were of oars, timbers, etc., and of a more serious nature.

FOR THE FOREIGN POPULATION.

As to the opportunities for the small runabout, there are, for example, some seventeen doctors to attend to the ill of the foreign population of Yokohama. Of these one possesses a motor launch, but none is so up to date as to be the owner of an auto to make his calls. A small one seated, two cylinder runabout, with ample hill climbing power, would serve such needs admirably.

The Government owned telephone, lacking stimulating competition, gives poor service, and instruments, being fewer than the demand, are at a premium in Yokohama. In consequence the banker, the broker and the business man are always about the streets in their jinrikishas, with two men pulling, tandem, and often one pushing besides. Here again the small and cheap runabout would be useful. As has been pointed out before, if the Japanese business men can be brought to see it, there are places where the light delivery car can be used to much greater advantage than the present methods of man or horse transportation. But the time does not seem right, labor being still too cheap and the initial cost of automobiles too high; then, too, the Japanese must be "shown." It may not be until the exposition of 1917 that American manufacturers can take the trouble, if they will then, to demonstrate to the Japanese the usefulness and desirability of the automobile. In the meantime, while catalogues are practically useless as sales agents, they occasionally do good if kept on file at the various chambers of commerce or in the hands of commission merchants, in keeping in the notice of the public. One leading European manufacturer has his advertisement in the daily foreign press, and one or two others have agents who occasionally advertise, though what they have done, can do, or expect to do, without a car to show, is problematical.

A good car and a satisfied owner are the best advertisement. One American car in Yokohama has thus been the means of an order for another within a few months of its arrival.

Owing to the competition of the Standard Oil Company in Amsterdam, Holland, the Royal Petroleum Company has reduced its gasoline price to 10 cents per litre.

How to Increase the Power of Gasoline Motors.

Such a degree of perfection has now been reached in internal combustion motors that there is little hope of sensational improvements, and it is interesting to consider a simple and comparatively cheap method of increasing the specific power by as much as 20 per cent., or to reduce the fuel, by reducing the dilution of the explosive mixture with spent gases. Reference is had to the process of scavenging the cylinder of the burnt gases which remain in the combustion chamber, and their replacement by fresh gas. One of the interesting consequences of the adoption of the process will be to make practical the use of denatured alcohol for automobile motors. To understand this scavenging process it is necessary to briefly refer to stationary motor practice.

Theoretically each phase of the four cycle motor begins and ends when the crank is in dead centre. In practice, however, the inertia of gaseous fluids must be reckoned with, and these periods will be more or less shortened or lengthened, and begin therefore either before or after dead centre is passed. The profile of the cams ordinarily used to open or close the valves represents a considerable time in relation to the 180 degrees which constitutes each stroke of the cycle. The areas of the passages through which the gases are admitted or exhausted are quite small, owing to the necessity of having to open and close the valves at the beginning and end of the proper periods. To open a sufficiently large passage to the gases it is necessary to commence to open the valves earlier and to close them later.

The utility of advancing the exhaust was thus discovered while building the first gas motors. This is explained by the necessity of exhausting a large volume of gas, expanded by the heat of the explosion. When the inlet valves were mechanically operated it was found necessary to retard their closing. The practice of advancing the point of ignition, when effected electrically, was severely criticised by a number of makers when it was first advocated and experimented with, these makers alleging that the insufficient heat and volume of the spark were the only reasons for the necessity of advancing the point of ignition, which they thought was harmful. Today we know that the heat of the electric spark is the only means by which we can obtain an almost instantaneous explosion, as required in the operation of motors at high speeds, and for the rapid combustion of large volumes of gas.

Referring to the accompanying Fig. 1, which is a diagram of the cycle of a four cycle motor with mechanically operated valves, we see that suction commences at *a*, a little after the closing of the preceding exhaust, and finishes at *b*. The compression then lasts from *b* to the dead centre *d*, and the ignition is produced at *c*, lasting until the opening of the exhaust at *f*, which itself closes at *g*.

In addition to the reasons given above there are a number of others, and all vary in importance as the speed of the motor increases or decreases. Experiments and the analysis of these reasons have enabled builders to construct stationary gas engines of 1,000 horse power, and to reduce the cost per horse power hour to a figure considerably less than that of the best steam engines.

The aim of the builder of stationary motors is to obtain economy in fuel, with little or no regard to weight. Nor does bulk enter to any extent into the question, save where the motor and its generator have to be placed in a certain restricted space. On the other hand the builder of the automobile motor aims to obtain the maximum specific power for the motor, generator fuel and accessories included. Subsidiary to this is the question of flexibility and absence of vibration, which lead to the construction of motors with one or more cylinders.

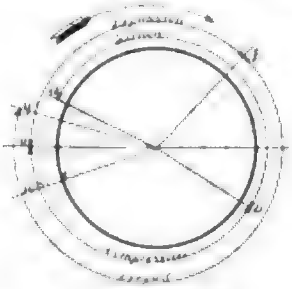

THE HORSELESS AGE

FIG. 1—VALVE TIMING DIAGRAM.

For a long time makers of stationary gas motors, particularly in England, have striven to dispose of the spent gases that remain in the combustion chamber after the closing of the exhaust valve. The disadvantages of the presence of these gases are many, and are common to all internal combustion motors.

1. These gases are very hot, and, transferring their heat to the fresh gases, cause expansion of the latter. Consequently if the aspirated volume remains the same, the quantity introduced is considerably diminished in weight. Let us take a motor having a useful cylinder volume of one litre, and a compression when cold of 5 kg. The volume of the combustion chamber will be 250-1000 litre in this case, and we can assume without risk of exaggeration that the temperature of the spent gases remaining in the cylinder after the closing of the exhaust valve is 400° C. Supposing that the fresh gas entering the cylinder has a temperatore of 0° C., a condition generally met with in automobile motors, where vaporization of the gasoline is carried on at very low temperatures. Where the cylinders are not scavenged the mean temperature of the mixture of spent and fresh gases will be 80°.

Suppose, however, that a vigorous scavenging occurs, expelling all the spent gases and replacing them with fresh air. Now in combining this volume of air with the litre of combustible mixture representing the cylinder volume, the temperature of the mixture will be in the neighborhood of 0°. One litre of air at a pressure of 760 mm. of mercury, and a temperature of 0°, weighs 1.293 grams, while a litre of air at 80° does not weigh one gram. We will then have admitted to the cylinder, owing to scavenging, an explosive charge possessing 29 per cent. more energy, and a motor giving 10 horse power without scavenging will give about 12½ horse power with scavenging.

2. The more the initial temperature of the total mixture before compression is lowered, the more can the compression be raised before pre-ignition occurs. Lowering the temperature 80° allows of raising the compression 1 kg. (13.2 lbs. per square inch). The power of the motor is nearly proportional to the compression, hence in raising the compression from 5 to 6 kg. we obtain an increase of one-fifth of the power, and our 10 horse power motor is now nearly 15 horse power.

3. It is well known that when the proportion of burnt gases remaining in the cylinder is 55 per cent. of the total, the mixture is no longer ignitible, and a mixture containing nearly this proportion of burnt gases can only be ignited if originally it was rich in fuel. Ignition in 1 litre cylinder stops if it receives less than 205-1000 litre of active mixture. A number of deductions have been made from this fact:

(a) Regulation of the speed by throttling of the charge is the worst from an economic viewpoint, a fact which has been known for some time.

(b) A very rapid loss of power considerably reduces the flexibility of the motor.

(c) Raising the compression diminishes the volume of the combustion chamber, and the flexibility of the motor is increased thereby.

(d) In a motor where the inlet valve is located in the same chamber with the sparking device, and this chamber is distinct from the combustion chamber, the flexibility of the motor is greater than where the inlet valve opens directly into the combustion chamber. In the first instance, the fresh gas fills the entire inlet valve chamber, preventing the burnt gases from re-entering and producing there a more easily ignited mixture. In the second case the fresh gas mixes with the burnt gas, and the explosion is not so powerful and not so quickly propagated.

(e) In cylinders where the valves open directly into a hemispherical combustion chamber, scavenging results in greater flexibility, in addition to the increase in output, while the fouling of spark plugs consequent upon incomplete combustion is diminished if not eliminated altogether.

Having explained the advantages of scavenging, we will now see how it is to be ef-

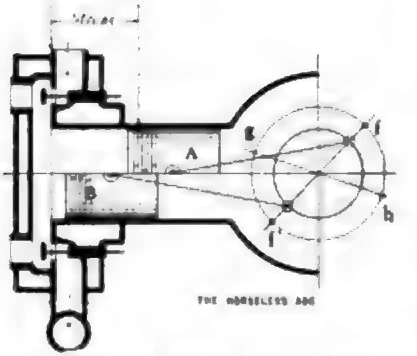


FIG. 2—SHOWING OVERLAPPING OF EXHAUST PERIODS IN FOUR CYCLE ENGINES.

fected. In a stationary motor with "hit and miss" governing, the governor acts to prevent the admission of gas, but allows fresh air to fill the cylinder. This is followed by the usual periods of compression, expansion and exhaustion. The air leaves as it entered, and the increase in its volume due to the heat absorbed by contact with the cylinder walls is quite inconsiderable in comparison with the volume of the exhaust gases after an explosion stroke.

By studying the diagrams produced in these two different cases it is seen that during expansion and before the end of the exhaust stroke the pressure in the cylinder is slightly lower than the pressure of expulsion of compressed pure air, afterward expanded. The exhaust gases rush through their conduits with a velocity proportional to their pressure, and in virtue of this velocity and the direction in which they are projected, they leave a relative vacuum behind them. Now, supposing that the air admission valve be situated opposite the exhaust valve, with relation to the combustion chamber, it is readily understood that if at this moment the fresh air valve starts to open the inertia of the exhaust gases escaping in the opposite direction causes a strong flow of air into the combustion chamber which completely fills it and sweeps the remainder of the burnt gases before it. This effect is analagous to another inertia phenomenon, viz., that the fresh gas drawn in by the piston nearly fills the cylinder volume, although the inlet valve is closed after the dead centre.

Returning to the motor of 1 litre cylinder volume, in which we have reduced the volume of the combustion chamber to 2/10 litre, to carry a compression of 6 kg., and in which we effect scavenging with combustible mixture and not fresh air, we obtain an explosion whose power is increased one-quarter, and our 15 horse power motor gives nearly 18 horse power.

If we analyze what occurs in a motor we will see how the exhaust cut-out effects an increase in the power. The diagram in Fig. 2 represents portions of two pistons of a four cylinder motor whose cranks are 180 degrees apart. It will be noticed that when the crank of A is at *f*, at the instant of the opening of the corresponding exhaust valve, the crank of the other piston B will be at *f*₁, performing the stroke preceding that of A by a half revolution. From *f* to *h* the cylinder A exhausts rapidly, while in the corresponding period *f*₁-*g*, B is at the end of the exhaust stroke.

Now, as with stationary motors, we know that at this instant the temperature of the exhaust gases in B has been materially lowered by the expansion and that their inertia, combined with a suitable exhaust piping, lowers the pressure in the combustion chamber to less than atmospheric pressure, the point where scavenging can begin. In an automobile motor, on the other hand, the resistance of the muffler tends to hold the spent gases from A in the manifold or mufflers, and these gases, in seeking an outlet, enter the cylinder B by way of the exhaust valve, which is open at this period, and subject the piston during the remainder of its upward motion to a back pressure which causes a loss of power. Again, when the exhaust valve is closed it keeps the spent gases coming from A in the combustion chamber. These gases are very hot and are above atmospheric pressure, and before creating a vacuum sufficient for sucking in a fresh charge these gases will first be expanded in B and their temperature will be communicated to the fresh charge, diminishing its density. A loss of power occurs, due to the fact that an incomplete or small charge is taken in.

To overcome this we close the exhaust valve a trifle after dead centre, so that a throttling of the exhaust gases occurs at the valve, which increases their velocity and also produces a negative action on the piston. This velocity of the gases opposes the entrance of gases from A, and the final result is not so harmful.

M. Mathot, an engineer of Brussels, has made a number of interesting experiments with two stationary motors regarding the losses caused by the muffler. Fig. 3 shows the arrangement, the motors being of 24 and 70 horse power respectively, each motor having its own muffler. The exits from the mufflers were brought to a common chamber, which was provided with a chimney or outlet pipe leading to the atmosphere. The combustion chamber of each motor was then actually protected from the exhaust of the other motor by three chambers in series with free exhaust from the second of each series. The chambers and chimney were made much larger than in ordinary practice.

M. Mathot found that when the two motors ran simultaneously the maximum explosion pressure in the 70 horse power motor was 3 kg. per sq. cm. (40 pounds per square inch) less then when it ran alone (27 kg. instead of 30 kg.). The pressure remaining constant in the gas conduit supplying the two motors, and the delivery not being affected by their being simultaneously supplied with fuel, there was no necessity of experiment in that direction. The power produced by the 70 horse power motor was constant, and as the number of idle strokes due to the action of the "hit or miss" governor were registered on a continuous diagram it was found that the explosions increased in number in the same proportion as they decreased in energy. After such a convincing test it is permitted to ask what would have been left of the 70 horse power and also the 24 horse power if the two motors had exhausted, like our automobile motors, into a common manifold, several inches one from the other, and with a *noiseless* muffler at the end of the exhaust pipe?

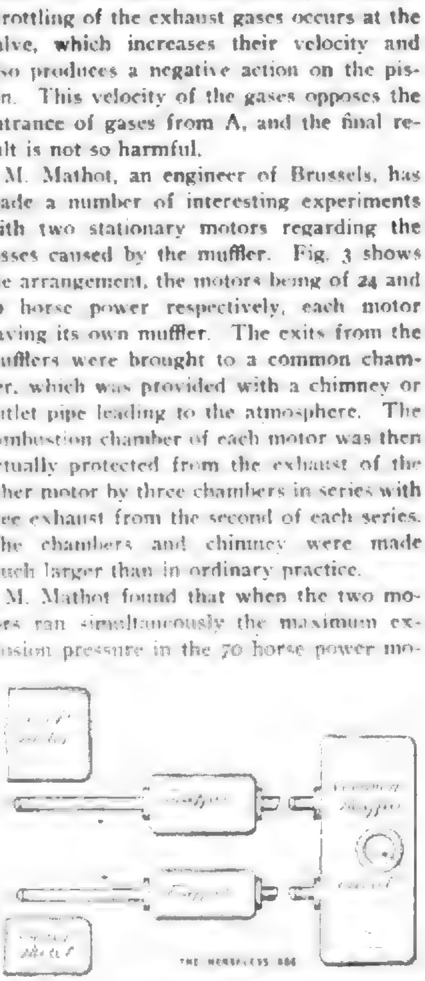


FIG. 3—MUFFLER CONNECTION.

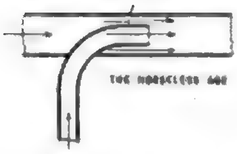


FIG. 4—ILLUSTRATING INJECTOR EFFECT.

We noticed, moreover, that on the victorious Mercedes in the Grand Prix the exhaust manifold was conspicuous by its absence. The reason is that there it would not do to reduce the power the least bit, and between a question of appearance and a gain in power the Untertürkheim designers did not hesitate for a moment. The exhaust from each cylinder was carried by a separate tube passing through the lateral wall of the bonnet and downward to an expansion chamber located outside of and at the height of the frame.

In the arrangement of the exhaust manifold we utilize the principle of the injector, as shown in Fig. 4. If we have two concentric tubes, each carrying a current of air or gas, flowing in the directions indicated by the arrows, but at different velocities, the current which moves the faster will have an injector action upon the other, tending to cause the slower one to flow with the same velocity as itself. This is true whether the gas with the greater velocity passes through the inner or the outer tube. An example of this in practice is seen in an ordinary carburetor, where the gasoline enters from a jet placed in or near the centre of the mixing chamber, and the air sucked in by the piston passes over the jet and "entrains" the gasoline, a fluid whose density is much greater than that of the air. Also, in a Bunsen blowpipe the same action occurs, except that the gas arriving through the centre of the tube draws in sufficient air to make a mixture of 1 volume of gas to 6 of air, a proportion necessary to give the characteristic blue flame of perfect combustion.

Applying the arrangement in Fig. 4 to the four cylinder motor, we allow the spent gases from cylinder A to pass through the exterior tube, and those from B through

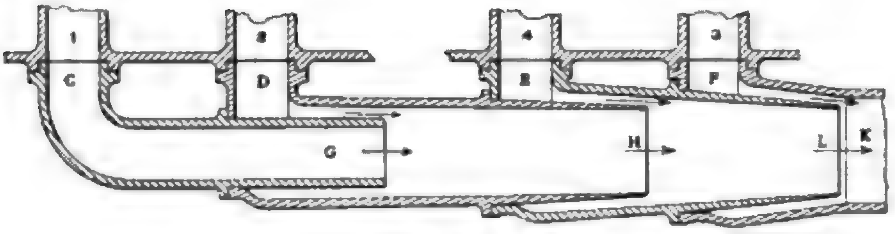


FIG. 5.—SUGGESTED EXHAUST MANIFOLD.

the interior tube. The gases from A now "draw out" those from B, instead of opposing their free exit. In the motor under consideration the desired result would be to have the gases from B always endowed with a certain velocity when the exhaust from A ceases, and these gases should possess a maximum velocity of not less than 100 metres per second during the period *f, h*. Contrary to the conditions in the blowpipe, the volume of gas from B "entrained" by those from A is much less than the volume from A. Consequently, the fact that the exhausts from A and B occur simultaneously does not cause a loss of power and output where this arrangement is used, but, on the contrary, it aids the expulsion of spent gases until the pressure in the cylinder drops below atmospheric. Furthermore, this method of scavenging is sufficiently certain and effective to have rendered it satisfactory for stationary motors, in default of something better.

The manifold shown in Fig. 4 permits scavenging in each of the four cylinders. Suppose that the exhausts occur in the order 1, 2, 3, 4, it will be seen that the gases from 1 are "entrained" by those from 2, which gases in turn are entrained by those from 3, and these latter by the gases from 4. The gases from 4 are entrained in their turn by the gases from 1. The injector or entraining action in 1 and 2 is produced at the periphery, while in 3 and 4 it is produced at the centre.

The manifold so constructed is but little more complicated than an ordinary manifold, it consisting of four bent tubes C, D, E, F, assembled one within the other and each being prolonged into the interior of the next in order, by coned extensions G, H, L, K, respectively. There are other arrangements besides this one, but after a number of tests this one gave the best results on the brake.

In automobile motors which have no separate air valves distinct from the gas or inlet valves it is not possible to secure scavengeng by fresh air; but in motors with valves on opposite sides, as in Fig. 1, it is easy to open the inlet valve a trifle after the point f_1, so that the exhaust from A can entrain the spent gases from B. If the exhaust of B is closed 15 to 20 degrees after the dead centre *d*, the inlet and exhaust valve periods of opening overlap, and this permits a quantity of fresh gas to be admitted to replace a large portion of the spent gas.

In practice a loss of fresh gas through the exhaust valve, on account of late closing of the latter, is not to be feared, as at the time this loss occurs the displacement of the piston rapidly creates a vacuum which draws in fresh charge. As it is evident that the muffler would prevent a very energetic aspiration of fresh gas into the cylinders, it is to be presumed that a motor with such an arrangement of valves would produce a scavenging action only when the exhaust cut-out was operated. The driver will have a motor which is normally more flexible, more powerful, of higher efficiency and less likely to heat than before. Then, if it is necessary a powerful scavenging action may be produced by the use of the exhaust cut-out, resulting in a large increase in power due to the additional charge admitted to the cylinders.—*G. Malliary, in Omnia.*

Some Spot Removing Preparations and Processes.

A writer in our French contemporary *Omnia* discusses various methods for removing the spots which frequently gather on the clothing of motorists. Most frequent among the various kinds of spots are those due to oil or grease. Materials in delicate colors require a special treatment so their shade will not be altered. If a grease spot is to be removed, the main portion of the grease is first carefully scraped off by means of a knife blade. Then a plaster of fuller's earth, prepared by diluting the earth with a little water, is applied to the surface affected. This plaster remains in place for several minutes, and is then scraped off. Ordinarily the spot will have disappeared. Any particles of fuller's earth remaining can be washed off with water. By lightly ironing out the affected portion of the garment will be completely renovated.

In no case should a solvent (benzene or gasoline) be used for removing spots from materials dyed in light shades, as there is danger that the dye will be dissolved with the grease, etc.

Cotton and linen garments, whether white or dyed, can be restored by local treatment with soap. Non-dyed materials and broadcloth can be easily cleaned by means of benzol, gasoline or alcohol-benzol mixtures, the latter being the best solvent.

If the material is of light weight it is stretched between the hands and the solvent is poured on it drop by drop until the cloth is penetrated. The degreasing process is completed by pressing the moist portion between two pieces of clean linen. If the material is heavy—and this applies to broadcloth—the spot is rubbed repeatedly with a rag of linen soaked with one of the solvents mentioned above; sufficient of the solvent must be used so that the material will be moistened all through, and care must be taken to renew the rag as soon as it becomes dirty.

Kerosene spots, which are easily formed, should first be treated with a slight coating of vegetable oil (lubricating oil; or, better, olive oil), so as to absorb the kerosene, and then treated with the fuller's earth plaster, which absorbs the whole quite rapidly.

There are a number of liquid compositions which are recommended for removing grease spots from cloths which are not delicate. One of the simplest of these consists of

Wood alcohol	2 parts
Alcoholic essence of soap	2 parts
Ammonia	4 parts
Turpentine	4 parts

The alcoholic essence of soap is prepared by dissolving some white Marseilles soap in sixteen times the amount of 90° alcohol, and adding ten parts of water. The white Marseilles soap is probably substantially the same as Ivory soap. Any druggist will undertake to prepare this essence. It is sufficient to apply it moderately with a linen rag.

Finally, on a road only recently tarred the motorist's clothes may be bespattered with tar, or the vehicle body may be covered with spots of tar. Tar spots on the varnished portions of the body may be removed by rubbing with a rag covered with grease, or, preferably, with vaseline, until all traces of the tar have disappeared. The varnish is then restored by means of a soft rag soaked in linseed oil.

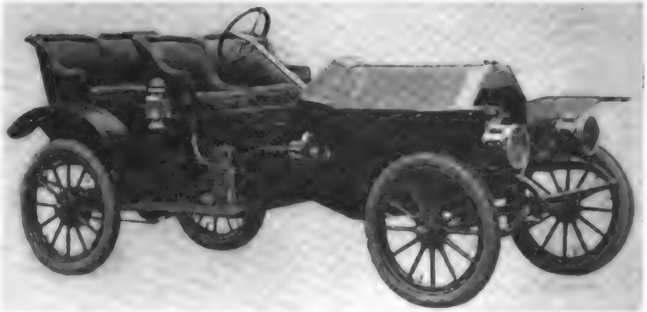
As to tar spots on clothing, their treatment is a rather delicate matter. If launderable garments or fast color materials are concerned, one may, after having removed the major portion of the tar by scraping, pour either benzol or gasoline drop by drop on the back side of the material, so that the solvent will run through the spotted part. If the material is light colored it may be nearly completely cleaned by using a rag soaked in gasoline, and taking care to touch only the spot. This latter treatment calls for considerable dexterity, but with patience one may succeed.

Timken Heavy Truck Axle—Correction.

In a description of a new truck axle brought out by the Timken Roller Bearing Axle Company, in our issue of August 12 last, the last sentence was somewhat ambiguous, and we take occasion here to make the point involved clear. A feature of this axle is that the distance between spring centres can be varied considerably. The springs rest on spring seats which can be moved along spring pads forged integral with the axle to suit the width of the frame, these spring pads extending the whole distance from the steering fork to where the central downward curve of the axle commences.

NEW VEHICLES AND PARTS

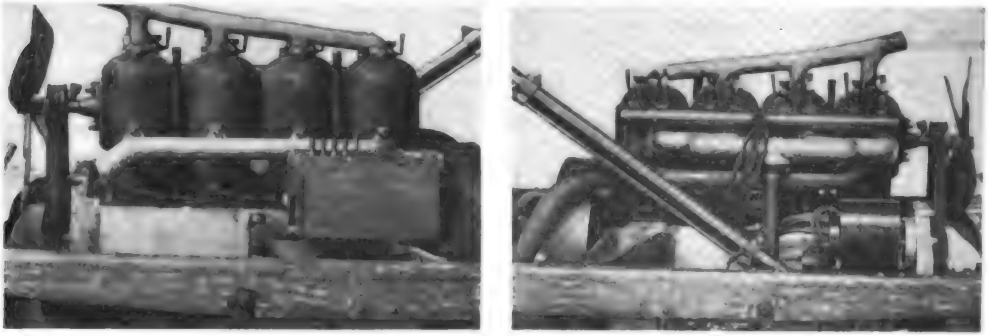
Overland 1909 Models.



Overland Model 30 Double Bucket Roadster.

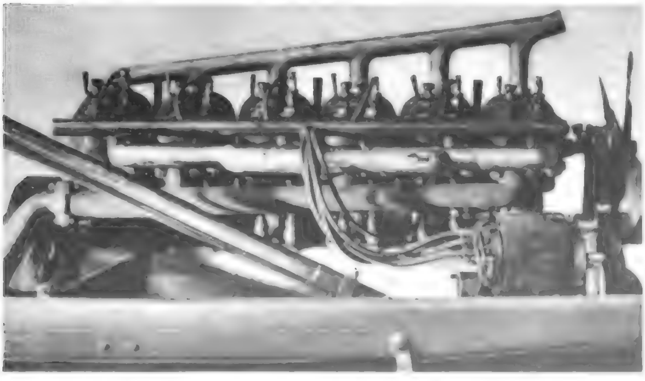
The Overland Automobile Company, of Indianapolis, are building three distinct chasses for the 1909 market, all of which they will mount with roadster bodies equipped with either single or double rumble seats, making three or four passenger cars.

The Model 30 chassis follows the same lines as the Model 24 used last year, except that the dimensions have been considerably increased. The four cylinder motor with cylinders cast singly is used, and a 4 inch bore and a 4½ inch stroke are employed. Both exhaust and inlet valves are on the right hand side of the motor and are operated by push rods from a one piece cam shaft. The cylinders are cast by the manufacturers of the Rutenber engine, but are machined at the Overland factory, as also are the pistons. Four eccentric rings are used. The fitting is very carefully done, and the compression test is unusually severe.



Off Side. Overland Four Cylinder Motor. Valve Side.

The connecting rods are of drop forged steel with a liberal sized, die cast, white bronze bearing with shims to take up any wear. The crank shaft is drop forged, and the bearings, of which there are five, are hand scraped. The cam shaft is machined from solid bar stock, ground and hardened, and has five bearings, the same as the crank shaft.



Valve Side of Overland Six Cylinder Motor.

The crank case is an aluminum casting with a partition in the middle which prevents the oil from getting away from the forward to the rear bearings when on grades. This crank case is so constructed that it is possible to remove the bottom half without disturbing the crank shaft bearings.

The motor is assembled at the Overland factory, and extensive use is made of jigs and special tools. The flywheel, which is placed in the rear of the motor, is of cast iron with the rim indexed for timing, and has fan spokes. This flywheel is bolted and keyed to a flange on the crank shaft, and while it is easily removed, it is claimed that it cannot possibly work loose.

Ignition on all models is by high tension Remy magnetos and batteries. When one set of spark plugs is used separate wires are necessary for both magneto and battery. The wiring is run through conduits and thoroughly protected. The thermo-siphon system of water circulation is employed, and for a motor of this size an unusually large cooler surface is provided.

A planetary transmission of the same design as that used in the Model 24 is again employed, the only difference being that this transmission is made somewhat larger in order to take care of the increased motor power. The entire transmission is encased in an oil tight aluminum case which is bolted to a flange on the differential case on the rear axle. Special stress is laid by the manufacturers on the fact that this transmission is almost noiseless on both the first speed and the reverse—a very unusual thing for planetary gears—and this is achieved by the unusually large pinion gear bearings which are employed.

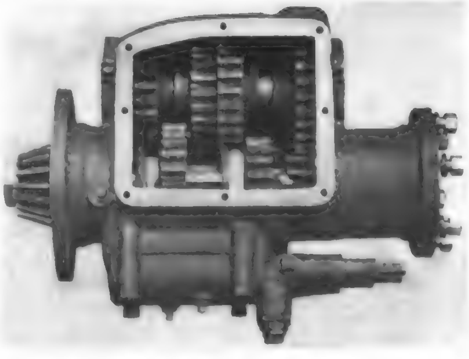
The drive on the high speed is, of course, direct, and the clutch used is of the standard metal to metal cone type. The speed change gears are operated by two pedals, the right hand pedal operating the slow speed and reverse, and also disengaging the high speed. The high speed locks in position and is very easily thrown out by pushing forward the low speed pedal, which returns to neutral automatically. The drive is by a shaft with universal joints at both ends, and with a full complement of passengers this drive is absolutely in a straight line.

The rear axle is of the semi-floating type, and the differential gears are of unusually large construction and are noiseless in operation. The front axle is of I-beam construction with forged steering knuckles, and annular ball bearings are used on all models.

A force feed oiler driven by an eccentric is used on all models, the eccentric being carried on the rear end of the cam shaft, and the oiler itself carried under the hood.

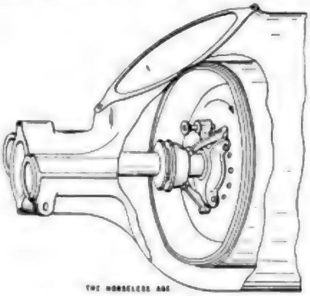
The cars are geared either 3½ to 1 or 4 to 1, at the customer's option, this plan having been adopted to allow for varying conditions in different parts of the country.

The frame is of pressed steel, cross braced and trussed. The spring equipment consists of half elliptics in front and full elliptics in the rear. All the springs are 40 inches long. The steering gear is a Warner worm and sector type irreversible, and spark and throttle control levers are located on top of the steering pillar on the conventional quadrant. The roadster bodies are made of metal, with metal fenders of liberal size, and also metal dust guards between the running boards and body.



Overland Selective Transmission.

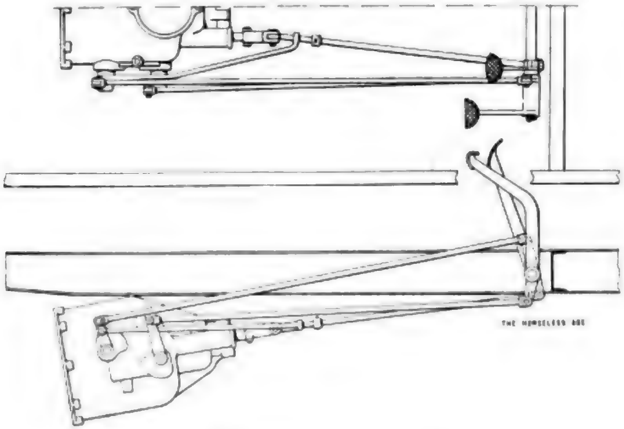
The specifications on the Model 32 are identical with the Model 30 as far as the motor is concerned, but a three speed selective transmission is used, controlled by side levers in the conventional way. This transmission is bolted on to the differential housing, and practically forms one unit. The Model 32 also has a 110 inch wheel base against the 105 inch used on the Model 30, and 34x3½ inch wheels in place of the 32x3½ inch used on the smaller car. The Model 34 has a wheel base of 116 inches and is equipped with a six cylinder motor with a 3½ inch bore and 4½ inch stroke, developing 35 horse power. This motor follows the same lines as that of the four cylinder, and the transmission is the same as that used in the Model 32.



THE HORSELESS AGE

Adjustment of High Speed Clutch.

Pin is pulled out and collar turned in direction of arrow until pin settles back in one of holes.



THE HORSELESS AGE

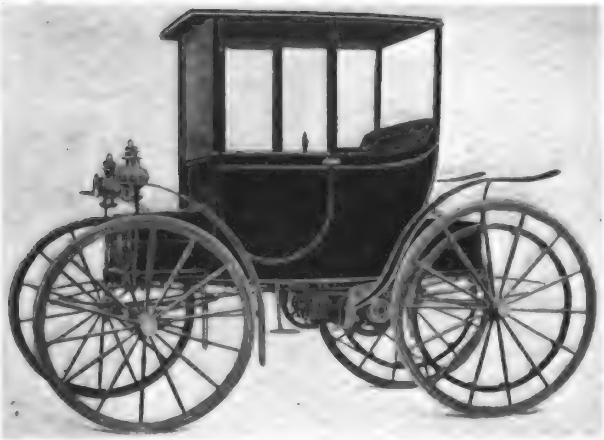
Overland Transmission Control.

The New Holsman "Gentlemen's" Automobile.

The Holsman Automobile Company, Monadnock Block, Chicago, who are generally credited with being the originators of the present day high wheeled motor buggy, have brought out a new type of car with an engine differing radically from all current designs. Unfortunately we have not yet had a chance to see the new vehicle, and our information is derived from a pamphlet which is rather meagre in detail information.

The motor is of the four cylinder, air cooled type, and operates on the four stroke cycle. It is rated at 26 horse power by formula, which means that it has a bore of 4 inches. The stroke seems to be less than this. The cylinders are arranged horizontally in opposite pairs. As will be seen from the cut of the pistons, connecting rods have been entirely done away with in this engine, the opposite pistons being connected together by rigid pieces, one-half of which is cast integral with each piston. Owing to the fact that each piston does not have to act singly as a cross head, the pistons are very short, just long enough to accommodate the three piston rings. How the pistons act upon the crank shaft is not stated in the pamphlet, but we presume that eccentrics are used for this purpose, the throw of the crank being made equal to one-half the stroke of the pistons and the eccentricity of the eccentrics equal to the throw of the crank. The part connecting opposite pistons is fitted with a roller bearing, which is shown in place in the cut of the pistons. The crank shaft, which is made from a solid slab, as shown in the accompanying photograph, is mounted on three annular ball bearings. The shaft extends all the way across the frame, and at its outer ends is mounted in Hyatt flexible roller bearings.

The inlet valves are of the automatic or



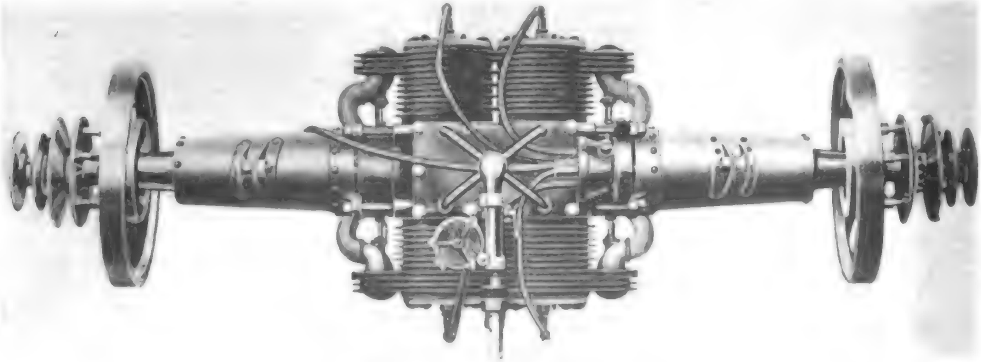
THE NEW HOLSMAN "GENTLEMAN'S" AUTOMOBILE.

suction-operated type, and are located in the centre of the piston heads. Instead of being closed by coiled springs, as in the usual construction, they are closed by what are usually known as shear springs. The exhaust valves are located in valve pockets at the sides of the cylinders, and are said to be operated directly from the crank shaft without the intervention of toothed gearing. What sort of mechanism is used for demultiplying the motion of the crank shaft is not stated, but presumably it is a modification of the Peugeot looped groove arrangement. The valve chambers are of rather peculiar form, designed to avoid sharp bends in the exhaust passages. The two valves on each side of the motor are connected to a separate muffler. It will be noticed that there are two flywheels.

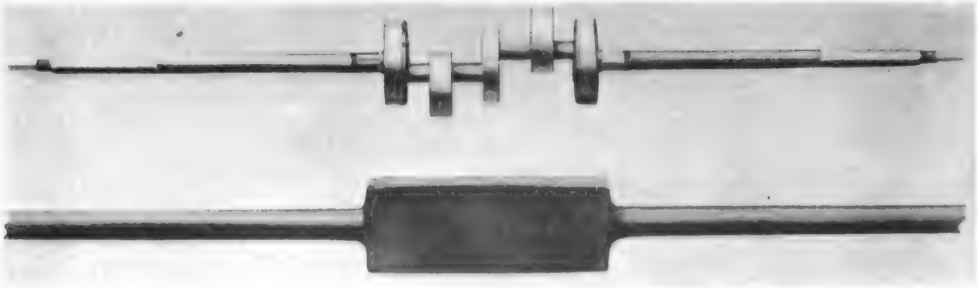
The carburetor is located on top of the motor, and is connected to the crank case through a pipe with four branches. The lubrication of the motor is greatly simplified by dissolving the oil in the gasoline and feeding it with the latter to the crank chamber. In this manner both the cylinders and the motor bearings are said to be perfectly lubricated, and no oil cups or grease cups are required for the whole engine. There is said to be absolutely no chance of failure of the lubrication, and there is never any necessity of adjusting the oil feed. The ignition is by jump spark from a non-vibrating coil. The two mufflers are assembled with the engine, as are also the carburetor, timer and change gear device, and the whole power plant forms a unit which can be readily removed from the vehicle for cleaning or repair, and can be readily replaced by another unit.

The transmission to the rear wheels is by the Holsman patented steel friction chain. Two forward speeds are provided, as well as one reverse. The various speeds are controlled by means of a lever through the intermediary of a rack and pinion device. The steel chains run on grooved sheaves on the ends of the motor shaft. For engaging the low speed the sheaves are forced apart by the pressure exerted on the gear lever and the driving chain engages with sprockets at the bottom of the sheaves. When the necessity for using the low gear ends and the pressure on the gear lever is released, the sheaves are automatically forced together again, and the car is driven again on the high gear. The reverse motion is obtained by forcing the grooved pulleys on the ends of the motor shaft into contact with the channels or rims of the road wheels, this motion being accomplished by the same lever by means of which the forward high and low gear are obtained. The driving chains are completely disengaged whenever the tension on them is relieved, when the brake is set or the reverse is in action. It will thus be seen that the transmission of power from the motor shaft to the rear wheels is direct for both forward speeds and also for the reverse. The transmission chains are made from nickel chrome steel, and are claimed to be as durable as the usual type of block and roller chains running on sprockets. They run in deep sheaves and enter the rear sheaves on the lower side 15 inches above the ground, so that there is no danger of their being thrown off in deep ruts, snow, mud, etc. The chains are claimed to run absolutely noiselessly on the high gear, and on low gear to make only the same sprocket engaging noise as all roller chains. When in driving engagement both branches of the chain are under tension.

The car is steered by means of a lever, which can be swung to either side of the car, so as to permit of entering the vehicle from either side. All control levers are mounted on the steering post, which is placed in the middle of the body and about 8 inches in front of the seat. The car can



HOLSMAN FOUR CYLINDER POWER UNIT.



Crank Shaft, with Ball and Roller Bearings and Forging from Which It Is Made.

be steered and controlled from either side, with the same convenience, it is claimed. The spark switch, ignition and carburetor adjustments are brought out to the front of the seat at the middle, and the carburetor can be adjusted from the seat. All steering connections are of the Holsman Company's patented anti-rattle type. The motor can be started with the crank from either side, and when the crank is pushed into position for starting the ignition is automatically retarded, so that there is no danger of back kicks.

The car is fitted with a coupé body, with the seats and cushions upholstered with whipcord or leather and the sides and ceiling with cloth. German plate glass is used in the front and doors. The front glass may be fastened out of the way, and the door glass stored away in suitable pockets. The sides and rear are specially constructed, covered inside with cloth and outside with suitable grained patent leather, so that they can be easily removed and rolled up, making an open carriage for use in pleasant weather. A weather tight trunklike box, 18x29x14 inches, is provided in front. The cover of this box is hinged on piano hinges and provided with a trunk lock. At the rear of the body there is another compartment for luggage.

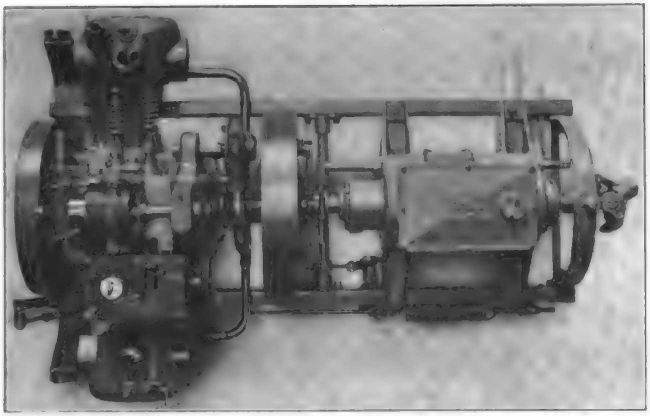
The front fenders are fitted close to the rear side of the wheels, where they serve their purpose best, and are out of the way of persons entering the car. These fenders turn with the wheels, and are thus effective whether the steering wheels are in the straight ahead or in any other position. The same device by which the fenders are turned also carries the headlights, so that in turning a corner the beams of light are always thrown in the direction of travel. The weight of the car is given as 1,100 pounds.

The Type XVIII Autocar.

The Autocar Company, of Ardmore, Pa., are entering the commercial automobile field with their Type XVIII chassis, which they will feature for 1909, and of which several illustrations are here given. The chassis is distinctive in having the motor under the driver's seat, the fuel tank placed immediately in the rear of this seat, an armored wood frame, cast iron gear and crank cases, and a combination of bevel and spur driven rear axle.

From the top view of the chassis it will be seen that the power plant consists of a two cylinder opposed motor with its two flywheels, the clutch and change speed gear all mounted on a sub-frame, and the rear construction consisting of the rear axle, bevel drive and spur reduction gears. Two flywheels are provided, the forward one having fan blades and performing the functions of a circulating fan and the rear flywheel serving to support the clutch, which is of the regular floating ring type. The motor has a bore of 4¾ inches and a stroke of 4½ inches, and is rated at 18 horse power, according to the A. L. A. M. formula. The crank shaft runs in two annular ball bearings of the silent type, and is a one piece drop forging. In machining the crank shaft the skin is left on, except on the crank pins, the surfaces for the ball bearings, and the coned ends for the flywheels. The crank shaft is then heat treated and ground, the crank pins being afterward drilled to afford oil feed to the bearings. The connecting rods are of the I section type, drop forged of special steel and heat treated. The bushings are of plastic bronze, the big ends only being adjustable, by loosening the bolts of the connecting rod caps. The cylinders, pistons, piston pins and rings are all ground to size. Generous dimensions in all parts are a noteworthy feature of this car. The pistons are of gray iron, and are fitted with three rings above the pin and a series of oil grooves on the lower part. The piston pin is made from the solid bar and is held in place by means of a spring pressed pin in a hole in the piston pin itself. These piston pins pass through a hole in one of the piston bosses and are supported in a sort of step bearing on the opposite side of the piston, the hole on this side not going all the way through the wall. This ar-

Double Piston Construction with Ball Bearings.



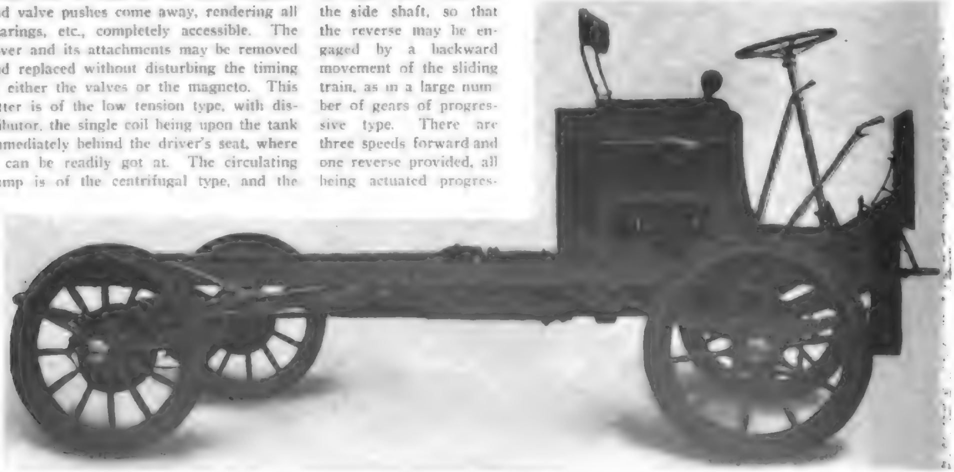
Autocar Commercial Vehicle Power Unit.

rangement has been used exclusively by the Autocar Company for some years. The valves are located on top of the cylinders in common valve chambers, and are all of the same size, both inlets and exhausts being mechanically operated from a single cam shaft located in the crank case. The motor is an enlarged Type XV motor, such as was used on the runabouts, save that the inlet valves are mechanically operated. The cover of the crank case carries the Splitdorf magneto, multiple feed oiler, and gear for driving the circulating pump, located immediately in the rear of the crank case. A shaft for driving the magneto is fitted with a gear having bearings in the cover and meshing with the cam shaft gear, and a pulley upon this shaft drives the oiler by means of a coiled wire belt. When the crank case is removed the oiler, magneto and valve pushes come away, rendering all bearings, etc., completely accessible. The cover and its attachments may be removed and replaced without disturbing the timing of either the valves or the magneto. This latter is of the low tension type, with distributor, the single coil being upon the tank immediately behind the driver's seat, where it can be readily got at. The circulating pump is of the centrifugal type, and the flanged tube radiator is hung from the forward part of the chassis. The carburetor is of the company's own make, and is fitted with both air and fuel adjustments. The motor exhausts into individual breech pipes, which unite at the rear of the power plant and lead to a muffler placed longitudinally at the left side under the frame.

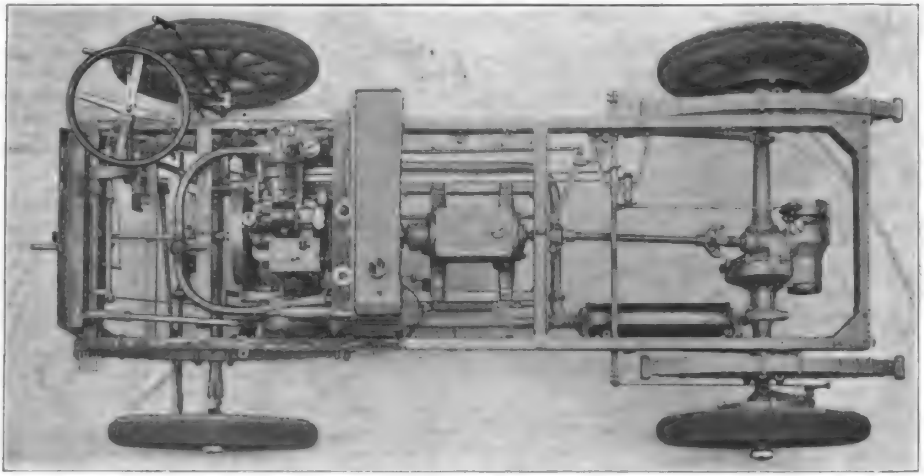
The clutch is of the floating ring type, such as is used on all Autocars, and is put in operation by means of a series of links actuated by a closed fork or yoke. The clutch shaft is a prolongation of the line shaft of the change speed gear, and this shaft is fitted with two ribs upon which the gear train slides. The side shaft is placed underneath the line shaft and carries the gears for giving the various speeds. The reverse pinion runs in mesh with a gear on the side shaft, so that the reverse may be engaged by a backward movement of the sliding train, as in a large number of gears of progressive type. There are three speeds forward and one reverse provided, all being actuated progressively by a single lever. The gears are of high carbon steel and are hardened. All shafts run on roller bearings and can be readily withdrawn by loosening the bearing caps. The gear box, like the crank case, is of cast iron and is fitted with two large hand holes, one of which forms the cover and enables any part of the box to be reached from the top. The other is placed on the side and enables adjustments to be made to the shifting fork on the shifter rod, as well as to clean out the stale oil from the box. The gears run in a bath of semi-fluid oil, which provides the necessary lubrication.

The whole power plant is bolted to a pressed steel channel section cradle, the motor by four bolts going through small feet resting on the upper web, and the gear box by bolts through each of the four feet projecting from the box. The cradle itself has two arms rising from its forward part and bolting to the main frame, and a steel arc bolted to its rear portion, this arc in its turn being bolted to one of the cross members of the main frame. A three point suspension is thus obtained. A propellor shaft fitted with universal joints at both ends connects the line shaft to the bevel pinion shaft on the floating rear axle.

The rear axle housing is entirely of malleable iron, there being neither brazing nor riveting at any point in the structure. It is fitted with a large casing at its centre which contains the large spur gear and the Hedgeland equalizer, which is used in place of the ordinary differential. In addition the casing forms the support for the bevel pinion shaft, bevel pinion and roller bearings which pass above the axle itself. A lateral casing, also of malleable iron, is placed behind the axle and contains the bevel gear fitted to a short horizontal shaft, upon the other end of



Elevation of Autocar Commercial Chassis.



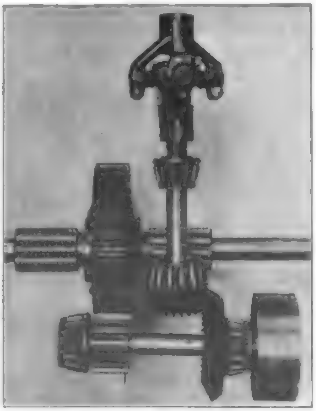
Plan View of Autocar Commercial Chassis.

which is a spur pinion meshing with the large spur gear on the axle. A reduction of about 3 to 1 is obtained by this method, eliminating the use of the enormous bevel gear which would be necessary in ordinary practice to get the desired reduction of 5 to 5½ to 1. Timken roller bearings are used on the bevel pinion shaft and on the lateral shaft, taking both thrust and radial loads. A brake drum is fitted to the extension of the lateral bevel gear shaft, a contracting band operating thereon. The axle casing has the spring seats fixed in place by shrinking on and carries at its outer ends the supports for the contracting bands for the hub brake drums. The half axles are squared at both ends, and run in standard roller bearings. The drums for theh hub brakes are fastened to the wheels, which latter are fitted to the ends of the half axles with square joints. A nut retains the wheel in place. The Hedgland equalizer has square holes into which the ends of the half axles fit. The construction enables the wheels and half axles to be readily withdrawn from the axle casing, and the bevel gear shaft, bevel gear and spur pinion may be withdrawn by unscrewing the covers of the casing in which they are located. A top view of the bevel and reduction gearing is shown in one of the accompanying illustrations.

The front axle is of the tubular type, with Elliott steering knuckles. The drag link connecting the pivots is placed in front of the axle and the operating arm is attached to the left pivot arm and attaches at its other end directly to the end thrust arm of the worm steering gear. The frame is of armored wood, the filler being of hickory within cold pressed steel members of channel section. Gussets of flat stock are provided at the corners for reinforcing the frame at these points. The cross members are also of channel section of the same specifications as the longitudinals.

Semi-elliptic springs are fitted in front and full elliptics in the rear, the number of leaves, the "cup," etc., being regulated by the load to be carried and the weight of the body. The front springs are purposely made less active than the rear springs, so that road shocks may be transmitted equally to both axles. Thirty-two inch hickory wheels of the artillery type are fitted, and either 3 inch solid or 4 inch pneumatic tires may be used.

As previously stated, the driver sits on a seat placed above the motor, and behind this seat is the 12 gallon fuel tank and the single coil. The whole seat structure may be thrown backward, exposing the motor and clutch, which can be easily reached when standing alongside the car, as well as from the footboards. Two side levers are fitted, one actuating the emergency brake, which acts on the drum on the bevel gear shaft at the rear of the rear axle, and the other shifting the gears. A pedal on the footboard at the left of the steering post acts through links which connect with not only the clutch yoke but with the clutch spring placed on the cradle supporting the power plant and actuates the yoke and extends the spring at the same time. Another pedal at the right sets the hub brakes, an equalizer being fitted to insure equal application of both bands. The steering post is slightly inclined and on top of the large wood rimmed steering wheel short levers for spark and throttle are fitted. A straight wooden dash is placed across the front and is well braced to the gunstocks. The starting crank is fitted at the front, its shaft projecting through a bushing in the radiator and its rear end engaging with a pin on the crank shaft extension.

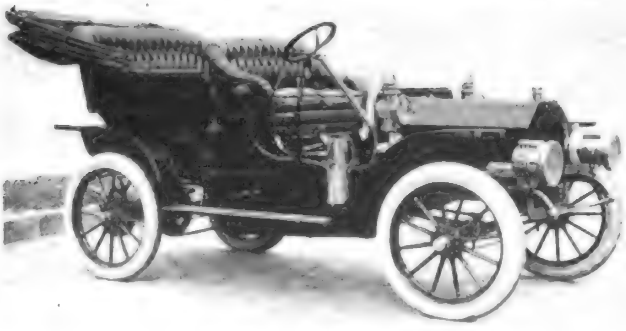


Double Reduction Gear on Rear Axle.

The principal dimensions of the chassis are as follows: A wheel base of 85 inches, giving a platform body of from 68 to 90 inches, or a wheel base of 97 inches, giving a platform body of from 80 to 100 inches. The tread is 56 inches and the frame width 48 inches. Various types of body can be fitted, the stock types being open truck, express, landaulet and omnibus. The net load is 2,000 pounds, but an overload of 500 pounds may occasionally be carried. The bodies are attached by wing nutted bolts holding in lugs on the under side of the body longitudinals, enabling ready removal of the bodies and their replacement by others if desired. Speeds of from 2 to 25 miles per hour are guaranteed.

The 1909 Model Reo Cars.

The Reo Motor Company, of Lansing, Mich., announce the following changes over the 1908 product in their 1909 models. The 20 horse power touring car model has had the wheel base increased from 94 to 96 inches, thus insuring more leg room in both front and rear seats. The wooden



1909 Reo Two Cylinder Touring Car.

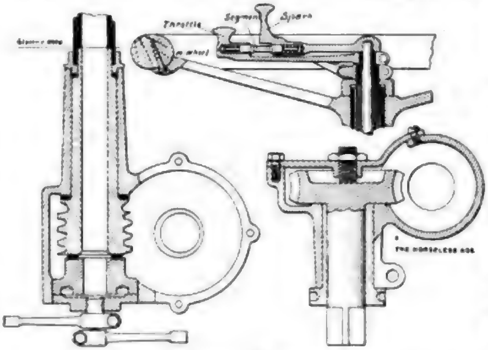
dash is highly polished, with a mahogany finish, and is brass bound, an aluminum support for the hood being provided in front. The hood itself is reinforced at the corners with filler tubes extending through the top. The body is of the side entrance type and is of sheet metal finished with an aluminum coat. Grease cups are provided on all outside oil holes on the spring shackles, steering spindles and reach rods. The lever grips are of solid brass instead of the former black finish. The front axle is of the I beam type with ball bearing spindles fitted with five-eighths of an inch balls. The steering post is given a greater rake so that the car may be more comfortably handled, and its supports are materially strengthened. The fenders are provided with aprons which are fastened to the side frames, preventing splashing of the body.

The roadster is identical with the touring car except that it is fitted with a trunk box and emergency seat with protecting rail. The side panels of the body are swept downward and backward so as to form a "piano box," in which baggage may be carried, the sides of the "box" preventing them from slipping out. The single cylinder runabout is the same as the 1908 model, and it likewise is provided with grease cups on the outside bearings, steering spindles, etc. A valve motion similar to that of the two cylinder model is fitted to this car.

The Bultman Model R Steering Gear.

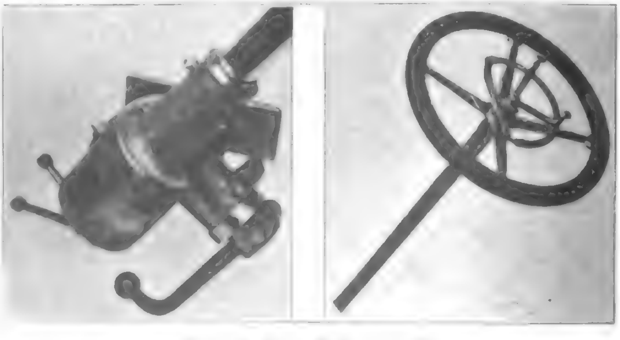
The F H. Bultman Company, 2108 Superior Viaduct, Cleveland, Ohio, are bringing out a steering gear for light touring cars, runabouts and motor buggies up to 1,600 pounds weight. Photographs of the gear, as well as several sectional drawings thereof, are shown herewith. It is of the worm and worm gear type, a full gear being used instead of a sector, and both worm and gear are of hardened steel with ground bearings. The standard ratio of worm to gear is seven to one, which, in ordinary practice, gives one and one-half turns of the wheel for a full throw in both directions. This latter ratio can be varied by the use of different length levers. Different gear ratios can also be furnished.

The worm and gear are adjustable for lost motion, and, besides, if one portion of the gear should wear out the lever can be removed from the square shaft end and replaced after the gear has been given a quarter turn, bringing into use an entirely new section of the worm gear. The worm shaft is electrically welded to a 1 inch diameter column tube. The worm gear is in one piece with the shaft, running in a bronze eccentric bushing. The worm and gear are contained in an enclosed malleable iron case, which is cast with a plate for attaching to the inside of the side frame. This tilts the column at an angle of 55 degrees with the frame and brings the ball lever in the right place for crosswise steering.



Bultman Model "R" Steering Gear.

The steering column is enclosed by a stationary 1⅜ inch polished brass tube. The wheel is made up of a 14 inch oval wood rim finished as desired and mounted on a japanned spider. The spark and throttle control levers and quadrant are of polished yellow brass and located on top of the wheel. The quadrant is stationary. The lower ends of the control tubes are fitted with 2½ inch clamp hub levers. A Billings & Spencer dropped forge steering lever, 5¾ inches long with 1 inch ball, is furnished with each gear.

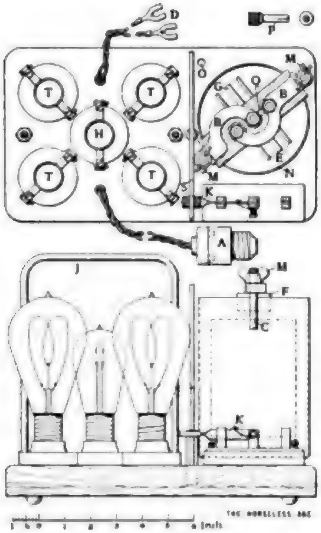


Bultman Model R Steering Gear

The Wico Storage Battery Charger.

The Witherbee Igniter Company, of 1876 Broadway, New York, are bringing out the Wico battery charger for use with either direct or alternating current. The apparatus consists of a bank of lamps, a rectifier, a spring switch and the necessary cables, etc., all mounted on a wooden base and contained within a pressed steel box when not in use. The box is designed to be fixed to the running board of a motor car when on the road, thus enabling the motorist to charge his storage battery at any time.

The rectifier N (see accompanying figure) consists of two aluminum plates E, between which is a lead plate G, the whole being suspended from a wooden frame that rests on the cylindrical iron jar, the plates projecting within the latter. The plates are



THE WICO RECTIFIER AND BATTERY CHARGER.

held to this frame by means of threaded ends passing through holes in the frame and secured therein by nuts. The two aluminum plates are electrically connected by means of an aluminum bridge B, provided with a hook at its outer end, and the lead plate is provided with a similar bridge B. Vertical copper rods C rise from the base upon which the apparatus rests and the hooks on the bridge pieces fit over these rods and are fastened securely by wing nuts M M. The rods, in addition to retaining the frame in place on the jar, serve as conductors.

When a battery is to be charged the rectifier jar is first filled with a solution furnished with the apparatus and the porcelain plug A is screwed into the socket from which the charging current is to be obtained. This plug is made in two parts, snapping together, which may be placed in either of two positions with relation to each other. The object of this arrangement is to furnish a convenient means for determining whether the circuit is direct or alternating, and also for determining its polarity, if it is direct current. On joining the two parts of the plug the four 32 candle power lamps T T T T are lighted. Now if the plug be pulled apart and fitted together the reverse way the lamps will again burn, and if the lamps burn with the same brilliancy as they did with the plug in the former position the circuit carries alternating current. If, on the other hand, the lamps burn brighter in one position than in the other the circuit is a direct current one. The same test serves to determine the polarity of the direct current, and the plug is left in the position for which the lamps burn brightest. If the current be alternating the rectifier is left in circuit, the flat terminals D on another cable are connected to the poles of the battery to be charged and the operation of charging begins automatically. If the current is direct, however, the rectifier is cut out of service by inserting a plug P (ordinarily seated in a hole O in the base of the apparatus) into a hole Q in the wooden frame F, thus connecting the bridges of the aluminum and lead plates. The flat terminals are now connected and the charging commences.

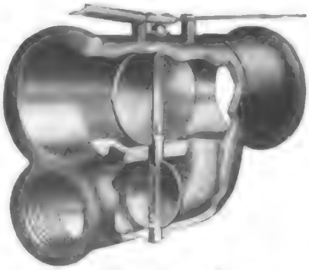
The spring switch K fitted to the base is normally held in position so that the charging current passes through the battery. If it is desired to determine whether the battery is charged, the switch is turned through an arc of 180 degrees, thus cutting off the charging current and sending current from the battery through a small lamp H, which will burn brilliantly if the battery is fully charged. This lamp is an 8 candle power lamp, and is located in the centre of the bank of 32 candle power lamps on the base of the apparatus. Should the charge not be complete the lamp burns dully, and upon releasing the switch the spring returns it to its normal position and the charging continues. When the charge by direct current is completed the plug P is withdrawn from Q and returned to the hole O in the base of the apparatus, and the battery is disconnected from the charger. With alternating current the battery is merely disconnected.

The apparatus comes complete with connecting plug, cables, etc., and space is provided in the box for the chemicals used in the rectifier, several packages of which are included in the outfit. The apparatus is made for use with any current up to 250 volts and weighs about 18 pounds complete.

Improvements in Gabriel Horn Products for 1909.

The Gabriel Horn Manufacturing Company, of Cleveland, Ohio, have devised a new valve for their musical horn, which is guaranteed not to stick under any conditions. As will be seen from the cut, it is a disc valve, and the instant the operating lever is moved the disc in the main channel begins to close, and the disc in the branch channel, at an angle of 90 degrees, begins to open. Consequently the horn will respond to the slightest touch of the valve lever, and there is no chance for back pressure to build up. By removing the circular disc in the main channel of the valve this same device will serve as an exhaust cutout. The passage for the escape of the gases is 1¼ inches in diameter. When the valve is closed there is no leakage of the exhaust gases around it and no noise from this source, it is claimed. These valves are made to fit all standard sizes of iron pipe and steel tubing from 1 inch to 2½ inches outside diameter.

GABRIEL HORN.



GABRIEL HORN CUTOUT VALVE

There has been no change made in the outside appearance of the Gabriel horn, but the new model is claimed to be superior in tone. It will produce a sweet musical tone for city use, but the three notes can be caused to rise in unison, to give a penetrating warning sound for country riding. The company will continue to furnish the single tube three note horn in four sizes to fit any size of motor.

GABRIEL SHOCK ABSORBER.

The 1909 model of shock absorber made by this company has a greater bearing surface where it is attached to the angle plate on the spring, and the stud is now fastened to the friction pad by a ½x¾x2¼ inch case hardened block. This gives a five-eighths of an inch bearing on the stud, which allows it to turn, thereby taking care of the end motion in the same manner as the side links on the spring. It is claimed that these two features eliminate all noise and rattle, and the use of a new friction material makes the device more effective and durable. Severe tests are said to have proven that this friction material will withstand wear for from 12,000 to 15,000 miles.

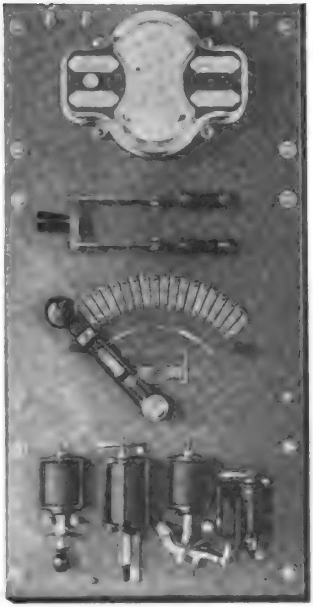
The Cutler-Hammer Battery Charging Rheostat.

The Cutler-Hammer Manufacturing Company, of Milwaukee, have placed on the market the battery charging panel here illustrated, which is notable on account of its automatic protective features. This battery charging rheostat consists of a slate front mounted on an angle iron frame containing the resistance, the whole being designed for attachment to a wall or switchboard.

The panel, which carries all of the operating mechanism, consists of three separate pieces of slate. On the face of the uppermost slate are mounted the terminals or binding posts, and a Western voltammeter. The middle slate carries a double pole knife switch and fuses (National Electrical Code Standard), and below these the contact segments and operating lever, by means of which the charging current is regulated. On the slate at the bottom of the panel are mounted the following automatic protective devices: (1) A low current cut-out which automatically opens the circuit if the current drops to a predetermined minimum. This prevents the battery from discharging into the line should the line voltage drop below that of the battery. (2) A maximum voltage cut-out. This automatically opens the circuit when the battery voltage reaches the point at which the cut-out is set to operate. (3) A solenoid switch, the opening or closing of which "breaks" or "makes" the main line charging circuit. (4) An overload circuit breaker which automatically opens the circuit if the charging current rises to the point at which the breaker is set to operate. This insures the battery against being charged at an excessive rate.

This charging rheostat is operated as follows: After the battery and line connections have been made the operator first closes the knife switch and then moves the operating lever forward to the third contact segment, at the same time raising the plunger on the low current cut-out 1, thus energizing the solenoid switch 3, which closes and permits the charging current to flow to the battery through the resistance. If at the beginning of the charge the operating lever is not in the starting position (that is to say, resting against the rubber stop post at the left), it must first be brought to the starting position and then moved to the third contact segment, as described above. It may then be moved further and further to the right, cutting out one step of resistance after another and increasing the amount of current until the desired amperage (as indicated by the ammeter) is obtained.

Should the current fail, or reverse, the low current cut-out 1 will release its plunger, thus de-energizing the solenoid switch 3, which will in turn open the main circuit. Should the charging current reach the point at which the overload circuit breaker 4 is set to operate, this will open the main circuit. Finally, when the charge is continued until the battery reaches the voltage at which the maximum voltage cut out 2 is set to operate, this will automatically open the circuit, thus insuring the battery against an overcharge.



1 2 3 4

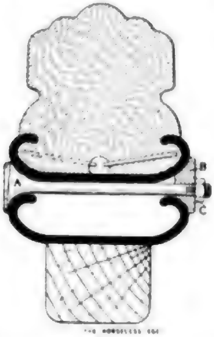
Cutler-Hammer Charging Board.

It will be evident from the above description that the use of this panel protects the battery under all charging conditions, as it not only guards against an excessive charging current, but also prevents the battery discharging back into the line should the line voltage fall below the voltage of the battery. It possesses, moreover, the advantage of requiring no attention after the charge is once begun, since the maximum voltage cut-out 2 will cut off the current of itself when the battery is fully charged.

As an additional protection the operating lever is provided with an electrical interlock which prevents the operator from closing the circuit to the battery except when the lever is in the "off" position, that is to say, with all resistance in circuit.

These battery charging rheostats are made at the New York works of the Cutler-Hammer Manufacturing Company, 130th street and Park avenue, New York city.

Swinehart Rim Attachment.



Swinehart Tire Attachment.

This attachment permits of equipping an automobile with the Swinehart cushion tires without in the least disturbing the original rim equipment or changing the road clearance of the car. Pneumatic tires can be replaced by these cushion tires in less than five minutes, it is claimed. Formerly it was necessary to remove the wheels from the car, and either ship to an applying station or use more or less inconvenient tools to apply cushion tires. With this attachment one or more cushion tires can be used in connection with pneumatics on the same car, as the outside diameter of the wheels is not altered, cushion tires being necessarily somewhat less in height than pneumatics.

The Swinehart cushion tires are fitted on light clincher rims at the factory, and are then shipped to auto owners, together with bolts for attaching. Eight bolts are ordinarily required for each wheel. The nuts on these bolts need not be removed, simply loosened. The bolts are all placed on top of the rim on the wheel, and the tire and rim thrown into position. The bolts are then easily slipped around to their proper position, and tightened with a wrench, which securely clamps the rim and tire to the wheel. The only extra weight involved is the light clincher rim and the small bolts used.

One of the greatest advantages claimed for this attachment is its utilization as a spare wheel in case of injury to one or more pneumatics. A pnuematic tire can be replaced with this spare rim and tire in less than five minutes. Moreover, with this spare wheel, the strain comes directly over the bearings of the wheel.

The Stewart Speedometer 1909 Line.

The Stewart & Clark Manufacturing Company, Chicago, announce a line of four different models for 1909, selling at $50, $40, $25 and $15 respectively. The latter two are entirely new models, while the former two are modifications of last year's models. The two more expensive models are fitted with a trip recorder of three dials, indicating in tenths of miles, and an automatic resetting device of novel design. These models are equipped with a maximum speed hand. The trip and maximum hand mechanism does not comprise any springs.

A feature of the $25 instrument is that the indicating hand is pivoted in the centre of the dial, and the scale is therefore about three times as long as usual. This model is equipped with the new trip recorder and resetting device of the firm. It has a scale reading up to 60 miles per hour. The $15 model is 3 inches in diameter, reads up to 50 miles per hour, and is fitted with a 10,000 mile odometer. All the models are fitted with the Stewart flexible shaft and swivel joint, and are guaranteed for five years.

A frequent cause of leaks in radiators is said to be that the vents in the filling caps become choked with sediment or dust, with the consequence that steam accumulates in the radiator, and the pressure seeking an outlet, forces an opening at the weakest point.

Automobiles at the Carriage Dealers' Exposition.

The exposition held by the National Carriage Dealers' Protective Association in the Grand Central Palace, on Lexington avenue, New York, came to a close on Saturday, October 10, after a satisfactory run of one week. The carriage trade was well represented, and in addition a number of automobile dealers and manufacturers exhibited their products, following the example set by the Ford and Reo companies in preceding years. The following is a brief report on the exhibits of automobiles and parts seen at the exposition:

The Autocar Company, of Ardmore, Pa., showed their Type XVIII commercial chassis, fitted with delivery truck and landaulet bodies, and adapted to carry loads up to 2 tons. The power plant of the car was shown on a special stand actually as it rests in the car.

The Anderson Carriage Company, of Anderson, Ind., exhibited two of their standard motor buggies, one with 36 inch solid tired wheels, and the other with 30 inch pneumatic tired wheels. The Anderson product, which has only recently been put on the market, is fitted with a 12 horse power opposed motor, planetary change gear and drive by side chains.

The Brush Runabout Company, of Detroit, Mich., exhibited two models of pleasure cars and a package cart, the latter being identical in power plant, drive, etc., with the runabouts, but having a different arrangement of control and a closed delivery body.

The Chase Motor Truck Company, of Syracuse, N. Y., showed a 2 ton truck fitted with a three cylinder air cooled, two cycle motor, planetary change gear and side chain drive. The Chase truck is also a newcomer in the commercial field.

The Reliable Dayton Motor Car Company, of Chicago, Ill., exhibited a stripped chassis, a buggy, and a light delivery wagon known as Type J, the three chasses being identical. For 1909 two brakes are fitted to drums on the rear wheels, one set being internal expanding and the other external contracting.

The Ford Motor Company, of Detroit, Mich., showed the new Model T, which was recently described in THE HORSELESS AGE, as well as four cylinder and six cylinder runabouts.

Geo. J. Scott Motor Company, of 1720 Broadway, New York, exhibited Glide touring cars.

The Holsman Automobile Company, of Chicago, Ill., exhibited their new Model H-15 four cylinder car described elsewhere in this issue. The buggy and surrey types were also shown.

J. M. Quinby & Sons, of Newark, N. J., showed a 50 horse power Pennsylvania chassis, in addition to some fine bodies for carriages and automobiles.

Nordyke & Marmon Company, of Indianapolis, Ind., showed 24 and 50 horse power models of the Marmon car, with side entrance bodies.

Thos. B. Jeffery & Co., of Kenosha, Wis., showed several models of the Rambler cars, fitted with both side entrance and runabout bodies. A spare wheel of a new type was shown on one car, this wheel being removable by taking off six one-half inch nuts.

The Schacht Manufacturing Company, of Cincinnati, Ohio, exhibited several of their line of motor buggies.

The Lewis Spring and Axle Company, of Jackson, Mich., showed a motor buggy chassis, with frame members of pressed steel, two cylinder opposed motor, planetary transmission and worm drive, in addition to a line of springs, change gear levers, etc.

The Sheldon Axle Company, of Wilkes-Barre, Pa., exhibited a line of carriage and automobile springs, axles, hubs, etc.

The carriage trade in general seem to be divided upon the subject of the automobile, some firms having decided to build machines of the motor buggy type, while others would have nothing to do with automobiles. Dealers visiting the show seemed desirous, as a rule, to handle a motor buggy as a side line, and quite a number of orders were given to the representatives of the motor buggy manufacturers. A number of manufacturers were interviewed, and while most of them were non-committal, several voiced their opinions readily.

J. W. Allways, of the Lull Carriage Company, of Kalamazoo, Mich., one of the largest of the Western buggy manufacturers, said that he would be very glad if all the other wagon and carriage builders would go into the motor buggy business, as that would enable him to make more sales. Speaking for the Lull Company, he said that they had no intention whatsoever of abandoning their buggy business, nor of going into automobile manufacture or accessory lines. He believed that the horse buggy had sufficient field as it was, and as the company had been building buggies and carriages for the last three years, and had recently made additions to their present factory buildings, they declined to attempt a doubtful experiment when they already had a good market for their product.

J. R. Brown, of the Auburn Wagon Company, of Martinsburg, W. Va., said that the company had been experimenting with motor vehicles off and on for the past two years, but as yet had not found a vehicle which was satisfactory from the standpoint of long life. The wagons turned out by the company are guaranteed for a number of years, and Mr. Brown said that it would be necessary to find a motor buggy that would uphold the standard of the company before any attempt was made to put it upon the market. Otherwise he thought the motor buggy an excellent vehicle, and it certainly was the coming vehicle for the roads in his neighborhood and through the South in general.

Mr. Martin, president of the Martin Carriage Works, York, Pa., stated that the advent of the automobile has seriously injured their passenger or pleasure vehicle business, and that at present most of their business was in commercial wagons. In this line they had not as yet felt any influence of the commercial motor vehicle, but he admitted that in the future this type might also become a serious factor. He was not prepared at present to say whether his company would meet this competition by entering the motor vehicle field.

The Eastern manager of the Troy Wagon Works, Troy, Ohio (manufacturers of a dumping wagon for the use of contractors and others in the removal of material from excavations, etc.), does not consider that the motor vehicle will ever be a serious competitor in his line. A vehicle of the type which they manufacture is subject to extremely rough usage, and for this reason he does not think a motor car would be practical. They do, however, equip their regular wagons with a front and rear attachment to be used in making up trains hauled by a tractor.

John J. McNulty, of Carmel, N. Y., said that as far as the dealers were concerned they themselves were for the most part ignorant of the principles and operation of motor buggies or other automobiles, and looked more toward the carriage parts than they did to the driving mechanism, motor, etc. A thorough education for carriage dealers was needed, he thought, before any of them could act as agents for motor buggies. The deposit of from 10 to 33⅓ per cent. required by automobile manufacturers seemed to the carriage dealers as unwarranted, and, in fact, beyond the means of a number of them, carriages and wagons being purchased at from three months to a year. Mr. McNulty said that he hal experimented for several years with automobiles and had built two for his own use, but did not consider the results sufficiently satisfactory to justify him in entering the manufacture of such vehicles.

Book Review.

Road Preservation and Dust Prevention. By William Pierson Judson. Published by the Engineering News Publishing Company, New York.

This work consists largely of a record of the results which have been attained so far with various dust preventives in different parts of the world. The various materials or preparations and the processes of their application are briefly described, and figures of cost are given wherever possible. We observe that the various oiling and tarring methods date back much further than the advent of the automobile, but the rapid multiplication of automobiles has given a new interest to these road treating methods. The author is evidently a road specialist, and the subject is treated in a strictly practical manner. The little book should prove of much interest, particularly to public officials having the maintenance or construction of highways in charge.

COMMUNICATIONS

The Engine Lubrication Problem.

Editor Horseless Age:

The recent stringent measures taken by the police in New York city against the drivers of machines emitting smoke from their exhaust, and the probability of equally stringent action on the part of local governments in other districts, render it necessary for manufacturers either to limit the efficiency of their cars or to revise the systems of lubrication which they have adopted. Since in the great majority of cases the only sign of sufficient lubrication for the engine has been the emission of a slight blue smoke from the exhaust, makers, in many cases, advise customers to make sure that their exhaust is smoking continuously. Realizing the hardships that such regulations impose upon makers of such cars, it is not out of place to consider the various general efficiencies of the lubricating systems in vogue.

The most usually employed is the splash system, in which the connecting rod ends whip the surface of oil in the crank base, so throwing it to the cylinder walls and other moving parts. In the crudest form—the most common, by the way—of this system, the oil is fed directly to the crank bases, and only about 5 per cent. of it is effective for lubrication. If the oil level is too high the engine will foul and the exhaust smoke—if too low the engine gets no oil, with disastrous results. Smokelessness depends entirely upon the accident of the driver accurately gauging the feed to the crank case to supply oil as used, and the rate of use varies with the immediate mechanical quality of the car and also with different oils.

In an approved form the oil, in considerable quantity, is carried in a lower chamber or sump, whence it is automatically pumped to the crank bases, being kept therein at a constant level by means of a simple overflow device. This system is infinitely better than that previously mentioned, since about 60 per cent. of the oil carried may be used before trouble will occur; but the question of a smoky exhaust depends upon a very accurate gauging of the capacity of the overflow from each and every one of the crank bases. Moreover, there is in this, as in every splash system, the serious disadvantage that the copiousness of the lubrication bears but little relation to the work imposed on the engine.

Attached force feed lubricators entail a complication of tubes likely to clog or leak, and again depend upon accurate setting, which necessarily varies with different engine speeds, and for which a happy average only can be struck, a state of affairs not in accordance with the high efficiency necessary with the modern automobile built for a critical purchaser.

By far the best system in every way is that in which a force pump draws oil from a sump, forcing it by means of suitable ducts in the main bearings through passages in the crank shaft to the crank pins, thence to the piston pins, whence it escapes back to the oil reservoir, the cylinders being lubricated by the oil thrown by centrifugal force from the crank webs. Since the force pump is driven from the engine, the pressure in the oil system is directly proportional to the speed of the engine—the flow equally so, as is also the amount thrown from the crank webs to the cylinders. It is this system—to some makers a new idea—which we developed on the Marmon car some six years ago and which we have always used. It is this system also that has rendered possible—as records show—the extraordinary speeds for extended periods which have been made upon the Brooklands track in England. With it not only is perfect lubrication of every engine part absolutely insured, but the whole quantity of oil in the system may be used up before lubrication fails. Provided the by-pass is correctly set, it is impossible to make the engine smoke. The whole system is integral with the engine without exposed pipes to leak or, indeed, any to clog. Once tested and the by-pass set, the driver may forget this lubrication system once and for all, except for a very occasional replenishing, and may be happy in immunity from arrest for an offence which is primarily due to the maker neglecting to use the best available system for that most important of all the functions in the operation of automobile mechanism—lubrication.

I write this since, with many low priced and attractive cars before the public for the coming season, it is necessary for a buyer to examine such matters closely, both to comply with a soon to be universal regulation and for the sake of his machine's general efficiency and freedom from repair.

Herbert H. Rice.

A Plea for the "Cylindrical Inch" in Engine Measurements.

Editor Horseless Age:

In all the hill climbing contests which have come under my notice the engine ratings have been based on the piston displacement, and invariably the volume is expressed in cubic inches. This is one of the mathematical absurdities that have descended through generations and have produced mental habits hard to break.

We always think of volumes as being bounded by plane surfaces, and we must convert all forms, however regular and common they may be, to the cubic form before we can compare them.

So, also, we think of surfaces and sections as squares, hence our units of area are always square, and we go on converting circles and cylinders and spheres into terms of squares and cubes for each equation, requiring the use of a long decimal multiplier or divider, wearing out gray matter, better devoted to more useful purposes.

When we get away from this worship of the rectangular god we are free to set up a new and more convenient rule for comparing volumes and areas, viz.: When volumes or areas of like form are to be compared with each other the unit of measurement should be of the same form. The electrical people have adopted the "circular mil" as the unit of sectional area for wire, etc., which is much more convenient than a square mil, for it requires only that the diameter in thousandths of an inch be multiplied by itself to give the sectional area, and the diameter in thousandths of an inch of a wire of any desired area expressed in circular mils is the square root of the area. d^2 = area is a much handier equation than either $d^2 .7854$ = area or πR^2 = area, and for purposes of comparison a much better one.

Why should not the engine builders and users adopt the cylindrical inch as the unit of piston displacement and cylinder capacity? Then the equation for displacement would be $d^2 l$ = volume, and the proportion would remain the same as if reduced to cubic inches. Thus the displacement of a cylinder of 4 inches diameter with 6 inch stroke = 96 cylindrical inches, or 75.3984 cubic inches. The displacement of a 6 inch cylinder with 4 inch stroke = 144 cylindrical inches, or 113.0976 cubic inches.

$$96 : 144 :: 75.3984 : 113.0976.$$

It is as easy to convert the volume of irregular cavities, such as the compression space, into cylindrical units as cubic units, the ratio between them being of course 1 to .7854.

The sectional area and volume of intake and exhaust pipes, the area of any circular opening such as valve ports could best be expressed in circular and cylindrical inches. Simple and easily understood methods of comparing one engine with another would be a boon to the automobile user, who is not always an engineer, neither has he a slide rule with him all the time, but he could readily multiply the diameter by itself and the product by the length of the stroke. The calculation usually involves whole numbers or simple fractions, and could be done mentally.

There should also be a standard of speed at which an engine is rated, or, rather, there should be two points at which a variable speed engine, such as used in an automobile, should be rated.

Various compressions and valve timing may give an engine a high power at high speed at the sacrifice of power at low speed, and vice versa, so it is hardly fair to compare two engines of the same bore and stroke at only one speed. Hence a rating should be given at a point between 400 and 600 r. p. m. (the normal running speed), and between 1,200 and 1,600 r. p. m. (the point of greatest output).

The power curve in most engines rated at from 30 to 50 horse power is a rising one up to from 1,200 to 1,600 r. p. m. At some point in this range the gas inertia and other losses which are rapidly increasing balance the increase in power due to speed, the curve flattens out and shortly begins to drop.

Why not establish these extreme points in some engineers' convention as a standard of speed for power rating, publish it widely, and thus "put a crimp" in the practice of trading in ambiguities and fairy tales?

Frederick Purdy.

Queries.

Editor Horseless Age:

Will you kindly inform me on the following points relating to a touring car having: Wheel base, 122 inches; rear tires, 36x4½ inches; front tires, 36x4 inches; gauge, 56½ inches; frame width between front wheels, 32 inches; centre of steering knuckle to gauge line, 3 inches; shaft drive with differential of usual type.

First—Smallest radius in which car can be turned.

Second—Would the use of a differential having the characteristics of the Hedgland type change your answer to the first question by reason of any difference in advance of the rear wheels, tangential to that of front wheels, occasioned by the greater tractive effort of outside wheel over inside wheel?

Third—Is the use of a differential having the characteristics of the Hedgland to be recommended over the usual spur or bevel type for touring car service?

Fourth—Gasoline being delivered to a Schebler carburetor under air pressure, what is the highest pressure allowable which will not affect the position of the needle valve or float?

Fifth—What objection, if any, is there to delivering gasoline under air pressure to the carburetor, the limit of pressure being determined by a spring loaded air relief valve between the engine driven air pump and the fuel tank, which would be hung below the top of the frame?

Sixth—In preference to both the foot brake and the so called emergency brake being hooked up on the equalizing principle, would not the better arrangement be to have one brake, say the foot brake, equalized, and the hand lever brake made positive in action on both sides.

Also, would not best practice tend to the use of the larger brake drum in connection with the foot brake?

Edwin H. Ludeman.

[We have laid the running gear out to scale and find that if the steering gear is turned to its limit to one side so that the inner wheel touches the frame, the car will turn in a circle of 35½ feet. We are here disregarding the fact that the frame is slightly higher than the centre of the wheel (how much we do not know) and we are also assuming that the steering linkage is so worked out that the centre line of the outer wheel prolonged always cuts the centre line of the rear axle prolonged at substantially the same point as the centre line of the inner wheel prolonged, as it should.

We have had no personal experience with the Hedgland axle, and are therefore unable to advise you regarding its qualities. Theoretically we should expect a car fitted with this axle to turn in exactly the same circle as a car fitted with a differential gear, other things being equal. The Hedgland axle has been subjected to an exhaustive test by the technical committee of the A. C. of Great Britain and Ireland, which issued a report on these tests, a copy of which you can probably get from the manufacturers.

We do not believe that so far as the float and the float valve are concerned any reasonable pressure would give any trouble. The actual limiting pressure is a matter for experiment.

The only objection to the system of feeding gasoline by air pressure is that when the tank is to be refilled the compressed air in it which is charged with gasoline must be allowed to escape, which involves some fire danger. The need of an air pump might also be considered an objection.

As regards equalization of brake action, this is largely a matter of opinion or personal choice. Personally we should prefer to have both sets equalized.

If both brakes act on the rear wheel hubs the most rational plan would seem to be to have both drums of the same diameter, but the foot brake drums wider, so as to reduce the wear of the most frequently used brakes.—Ed.]

"Factors of Safety in Automobile Construction."

Editor Horseless Age:

In a recent issue of The Horseless Age you published an article by Mr. David Landau on "Some Factors of Safety Used in Automobile Construction." I have enjoyed the article, which is very well written, but unless I am greatly mistaken Mr. Landau has committed one or two errors of which I wish to write.

In his calculations for the factor of safety of a semi-floating type of rear axle there is an error in the equivalent twisting moment and the results dependent on it.

There is a slight error in figuring M but its effect is small and may be neglected.

$$M_t = \frac{63025 \times 30}{1600 \times .083} = 14237 \text{ pounds-inches.}$$

This is for both wheels, and the moment being divided at the differential gear we have 7119 pounds-inches on each side.

$$M_b = Wl = 1033 \times 3.75 = 3874 \text{ pounds-inches.}$$

Here again is a slight error that may have been due to use of the slide rule, but in the following calculation of *Met* is the error of which I write:

$$M_{et} = 3874 + \sqrt{3874^2 + 7119^2} = 11979$$

We get, then, 11,979, instead of 7,992, which is Mr. Landau's result.

From the equation M = SZ, where M = 11980 and Z = .705, we get S = 16993, or say 17,000 pounds. With an elastic limit of 100,000 pounds this only gives a factor of safety of 5.88, instead of the 8.325 which was found in the original article.

On one other point I wish to differ with the article, and that is in the use of the tensile strength as representing the torsional strength of shafts. It is well known that the stress produced by torsion is a shearing stress, and although the article does not say that the elastic limits used are those for tension I assume that they are, since in the calculation of the *fs* for feathers in the transmission I find the author correcting the elastic limit by four-fifths to get the shearing strength. Clearly, then, the same corrections should be made to get the torsional strength, and correcting the calculations for the shaft above so as to use 80,000 pounds as the elastic limit, instead of 100,000 pounds, we have a factor of safety of only 4.7, or nearly one-half of what Mr. Landau gets.

One other point I would like permission to correct. In calculating the factor of safety of the feathers in the transmission we are given a stress of 565 pounds per square inch, and an elastic limit of 72,000 pounds, which gives a factor of safety of 127.5, instead of 12.75, unless my early training in arithmetic is sadly in error. I feel that out of justice to Mr. Landau and his article, which is well written, these errors should be brought to his attention, and also the attention of the readers of the article.

E. B. Norris.

The American Runabout (?)

Editor Horseless Age:

The writer read with much interest the admirable article by Roy Lindsay in your last issue relating to British runabouts. While the article is largely historical and descriptive in its character, the author has, quite unconsciously, by his clear descriptions and by very contrast, succeeded in producing a severe arraignment of the runabout situation in this country, a situation which is worthy of more than passing note. The writer of this letter broke into the "auto game" in a small way in 1902, and has driven a car and ridden a motorcycle continuously since, covering upwards of 40,000 miles in the four wheelers and perhaps half that on the motorcycles. In that time he has driven seven or eight different makes of cars and as many motorcycles, and strange to say he still has and runs daily the small runabout which he purchased in 1902, and which has carried him upwards of 25,000 miles. It is needless to say that this machine was not of American make, for in 1902, at least, America did not produce a runabout capable of such longevity. The little curved dash runabout, which went around the world commercially, was all very well as an American starter in the runabout class, but even its most persistent friends never claimed it was made to last. From this small beginning the American automobile industry jumped to the big four; then to the bigger four and six, and the runabout man was turned down as of no account. This was natural and all very well as long as the supply of $4,000 and $8,000 people held out, but the time has been fast coming—if it is not actually now at hand—when the "four figure" man is becoming an extinct species, and the manufacturers of this country, dimly realizing this, are now backing up to the runabout man in a way all their own. Instead of building a runabout in truth, the American manufacturer has, however, put out a little touring car—a machine which will seldom or never do the work of a touring car, and which demands all the attention of one and more. The experienced runabout man does not want a four cylinder runabout, if he looks after it in his spare moments himself; he does not even want a two cylinder one, unless he has to take it. Neither does he enjoy the horizontal, single cylinder rocking horse which is so truly American and so thoroughly unmechanical. Again, he does not need and does not want, if he knows his business, 15 or 20 horse power, or even 10.

The single cylinder, vertical, De Dion type of engine has been strangely neglected in this country. One or two firms tried for a time to make it, until seduced by the glitter of the 4-40 and the 6-60. One or two firms, it is a pleasure to note, are reviving it this year in a way not yet capable of fair judgment. There is no possible type of engine that will wear as long, work as hard, stand as much abuse and return as faithful service, year in and year out, with as little care as this type, if well and honestly made. The real truth of the matter is: First, that Americans do not know how to make this type of engine as well as the French; and second, we cannot or do not put the same grade of high class materials into their construction.

Again, the American runabout, so far, must apparently ape the touring car and have the engine in front under a bonnet, for the sole reason, apparently, that the power plant may be placed as far from the point where the power is to be applied as possible, and so compel the construction of yards of shaft, chain and pipe to bridge the gap; use up fuel, waste power, and vex the unwary. If the power plant must be put in front (and this is certainly a good place for it for many reasons), why not be logical and use the front wheel drive? It can be done, and done well.

The French manufacturer who turned out the little 6 horse power runabout referred to in the article of Mr. Lindsay (which, alas! is made no more) was wiser by about ten years than his generation. He made an engine that ran, that lasted, and that worked overtime. He made a transmission and a clutch that were built like a watch, and could be depended on at all times. He put his power plant close to the point of application, and he built a rear axle drive that has never been surpassed. He suspended his working parts on good springs, and while he had some features on his little machine which must have been designed when someone was suffering from severe mental aberration, yet that little runabout stands today unsurpassed in the salient features of what a runabout should be.

If our American manufacturers would seriously take that type of machine and study it faithfully and well, eliminate its faults and mistakes, preserve its good features, use the same fine material and honest work which the De Dion factory used then, and uses today, and mix with it all some of the brains which produced ten years before its time this little noisy, fussy, but really great runabout, the American runabout would today have a typical existence which it does not now possess.

Such a car cannot be made cheap or cheaply; it can, however, be made at a reasonable figure, and one which compares favorably with that charged for the trappy American runabout of today, and when it comes the manufacturer who produces it will not miss the decadence of the "four figure" man, or the disappearance from general use of the ponderous and money burning 6-60 and its relatives, for the "runabout man" will come to him in a solid phalanx, and the "runabout man," actual or prospective, is legion.

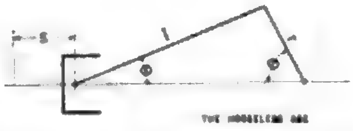
CARL H. SMITH.

Engine Vibration Formulæ.

Editor HORSELESS AGE:

I note on page 498 of your October 7 number a question by G. W. Shilson in regard to the derivation of a formula used by E. J. aBrtlett in his article on "Crank Effort Diagrams."

On May 6, 1908, page 511 of THE HORSELESS AGE, I published an article on the same subject, but also including a consideration of vibration and flywheel size. In this article I used the same two formulæ in question, omitting, however, the derivation in order not to burden your readers with too much mathematics. As the subject is an important one, and not nearly so complicated as Mr. Bartlett would have us believe, it seems unnecessary to ask your readers to purchase an expensive volume for the sake of a little information which may so easily be supplied through the medium of your valuable paper. I therefore take pleasure in enclosing the derivation desired, and will be glad to answer further questions in regard to same if required.



Let l = length of connecting rod, r = length of crank.

S distance piston has moved from end of stroke,

ϕ = connecting rod angle, θ = crank angle. Then

$$S = r + l - r\cos\theta - l\cos\phi$$

$$S = r(l - \cos\theta) + l(1 - \cos\phi)$$

$$S = r(1 - \cos\theta) + l(1 - \sqrt{1 - \frac{r^2}{l^2}\sin^2\theta}$$

Taking $\sqrt{1 - \frac{r^2}{l^2}\sin^2\theta} = 1 - \frac{r^2}{2l^2}\sin^2\theta$ (approximately)

$$S = r(1 - \cos\theta) + l(1 - 1 + \frac{r^2}{2l^2}\sin^2\theta)$$

$$S = r(1 - \cos\theta) + \frac{r^2}{2l}\sin^2\theta.$$

The differential of the distance is the velocity; therefore, differentiating the above, we have

$$\frac{ds}{dt} = v = r\sin\theta\frac{d\theta}{dt} + \frac{r^2}{l}\sin\theta\cos\theta\frac{d\theta}{dt} \therefore v$$

$$= \frac{\pi N}{30}\left(r\sin\theta + \frac{r^2}{2l}\sin 2\theta\right)$$

The differential of the velocity is the acceleration, then

$$\frac{dv}{dt} = \frac{d^2s}{dt^2} = \frac{\pi N}{30}\left(r\cos\theta + \frac{r^2}{l}\cos 2\theta\right)\frac{d\theta}{dt}$$

$$= \frac{\pi^2 N^2}{900}\left(r\cos\theta + \frac{r^2}{l}\cos 2\theta\right)$$

Then the force required to produce this acceleration is

$$F = \frac{W}{g}\frac{\pi^2 N^2}{900}\left(r\cos\theta + \frac{r^2}{l}\cos 2\theta\right)$$

or

$$\frac{F}{a} = .00034\frac{W}{a}N^2 r\left(\cos\theta + \frac{r}{l}\cos 2\theta\right)$$

It will be noted that an approximation was used above. To be theoretically exact the portion of the formula enclosed in brackets should be a decreasing series of which the first two portions are all that is required, the others being so small as to be entirely negligible for all practical purposes.

L. E. FRENCH.

Motorcar Company Becomes Cartercar Company and Expands.

Announcement is made by the Motorcar Company, of Detroit, builders of the friction driven Cartercar, that they have filed papers for an increase in capitalization to $350,000, and that the name of the organization has been changed to "Cartercar Company." The plant of the Pontiac Spring and Wagon Works at Pontiac, Mich., has been purchased and the work of moving the factory from its present location on Twenty-first and Baker streets, Detroit, will be commenced at once. It is expected that in about thirty days' time all of the equipment will be in the new plant ready to commence work on the 1909 product.

The new plant is located at the junction of the Detroit, Grand Haven and Milwaukee and the Michigan Air Line railroads. The Detroit and Pontiac Electric Line also passes the door, making it convenient for visitors. The buildings are of brick and concrete, covering about 2 acres of ground, and are five stories high. The road conditions about Pontiac are said to be ideal the year around for road tests.

The Cartercar Company will bring out at once a new Model K runabout, selling at $1,000. The Model G gentleman's roadster will, with a few refinements, be continued for another season. An entirely new touring car, Model H, is ready and will succeed the Model A. The Cartercar Company will also continue building the "Pontiac," a high wheeled vehicle.

Commercial Applications.

Operating Cost Data of Motor Station Wagons.

The light two horse stage, carrying six to eight passengers, is still the most widely used type of vehicle in connection with season resorts, etc., located at a distance from railroads, but the automobile is gradually finding a place in this field of service. As is but natural, the higher grade and more expensive resorts have been the leaders in this movement, the adoption of motor stages or buses being evidently in most cases regarded chiefly as a profitable advertising venture. But it results from some figures of operating cost furnished us by the Kramer-Allen Motor Company of Attica, Ind., who conduct a service between that town and the health resort, Mudlavia, 5 miles distant, that if properly managed such a service may also come much lower than a horse service. The resort owns two twelve passenger buses and one motor truck, which meet all incoming trains at Attica. The drive of 5 miles is accomplished in about thirty minutes, the road winding over hills and through valleys along the historic Pine Creek. The hotel accommodates about 200 guests, we are informed, which may possibly, in connection with the length of the trip, give some idea of the amount of service required of these three vehicles.

The operating company follows the commendable practice of keeping accurate records of the work done and expense occasioned by each car, and we have been furnished one of the printed blanks on which the various items of work done and expenses are recorded. In addition to guests and their baggage, express goods are also carried.

The operating company states that the best of service is maintained at a saving of about $250 per month over the cost of livery service. The average cost of operation is about 8 cents per mile; the number of miles per gallon of gasoline is 7; the average cost of operation on cars per month is $75, including driver's salary. Besides making from four to eight round trips per day with each car, they are able to meet all trains, eliminate any long waits for conveyances, and to give passengers quick service. The table below gives a list of operating expenses for each of the three vehicles from January to June, 1908, inclusive.

Motor Depot Wagons of the Mudlavia Sanitarium.

Commercial Notes.

Dr. G. P. Folks plans to operate an automobile line from Waycross, Ga., to the Satilla River, pending the construction of a trolley line between these points.

The City Council of Portland, Me., has decided to have repairs made to its motor fire engine at a cost of $3,458, according to the estimate of the company who built the engine.

A. A. A. Meeting.

The quarterly meeting of the A. A. A. board of directors was held in New York, October 9. In addition to the directors, presidents of several of the largest member clubs were present by invitation. In the absence of President Hotchkiss first vice president L. R. Speare presided. It was decided to amend the by-laws as follows: The Touring Board is hereafter to be known as the Touring Information and Maps Board, and is to have its headquarters in New York city. The Technical Board is hereafter to be known as the Contest Board, and is to have charge of all contests other than racing, including hill climbs. The Racing Board will hereafter have charge only of races.

Powell Evans, president of the Philadelphia A. C., was named chairman of the Touring Information and Maps Board, and Frank B. Howell, president of the Buffalo A. C., chairman of the Contest Board. Powell Evans offered to donate to the association a $2,000 trophy, to be competed for annually by commercial vehicles, and his offer was accepted.

It was decided to amend the by-laws so that each affiliated club shall be represented by a director, the State associations naming such directors from all of their clubs. This will double the number of the directors. The association accepted with thanks the offer of space at the coming Grand Central Palace Show, and decided to hold open meetings during both of the forthcoming New York shows. Application for reduced railroad fares to these meetings will be made to the Trunk Line Association. A recommendation made by President Hotchkiss and Secretary Elliott, after an investigation of the club situation in California, that the possibility of two State associations in States of such large geographical extent as California be provided for, was adopted.

RECORD ON RAPID CARS.

	January.			February.			March.		
	Bus No. 1.	Bus No. 2.	Bus No. 3.	Bus No. 1.	Bus No. 2.	Truck.	Bus No. 1.	Bus No. 2.	Truck.
Total cost of operation	$62.65	$57.75	.....	$25.23	$31.17	.....	$29.79	$43.20	.....
Cost per day	3.48	2.51	.....	2.52	3.12	.....	2.97	2.27	.....
Cost per mile	.16	.079	.....	.08	.118	.....	.087	.06	.....
Cost per trip	1.46	.85	.....	1.05	1.30	.....	.96	.654	.....
Number miles per gallon gasoline	5	6	.....	8	6	.....	6	8	.....

	April.			May.			June.		
Total cost of operation	$97.51	$72.73	$90.80	$113.39	$101.43	$123.21	$93.08	$89.49	$109.52
Cost per day	3.48	2.65	3.35	4.04	3.75	4.10	5.17	3.31	3.77
Cost per mile	.10	.10	.14	.154	.115	.183	.182	.093	.165
Cost per trip	1.08	1.17	1.56	1.69	1.26	2.02	1.03	.993	.172
Number miles per gallon gasoline	6	7	6	5	6	6	5	7	6

Google

The Chicago 1,000 Mile Reliability Run.

A thousand mile reliability run was held by the Chicago Motor Club over routes in the vicinity of Chicago on Tuesday, Wednesday, Thursday and Friday of last week. Nine cars out of the seventeen starters finished the four daily runs of about 250 miles each with perfect scores, but after the technical committee completed its examination of the cars and imposed penalties for any imperfections found, there remained only five perfect scores. Four cars finished with penalizations against them, three non-contestant cars finished with the others, and one car was withdrawn during the first day of the contest. The cars were divided into the following seven classes:

Class A—Cars selling at from $650 to $999.
Class B—Runabouts at from $1,000 to $1,999.
Class C—Cars at from $2,000 to $2,499.
Class D—Roadsters at from $2,500 up.
Class G—Touring cars at from $2,500 to $3,999.
Class H—Touring cars at from $4,000 up.
Class E—Touring cars up to $1,999.

The first day's itinerary started at Chicago and included the cities of Kenosha, Rochelle and Janesville, Wis., and Geneva, Ill., the total distance being 262 miles; all of the seventeen starters finished with clean scores. The second day's run led through Ottawa, La Salle and Aurora, Ill., and eleven cars retained their perfect scores during this stage, the remainder being either penalized or eliminated. A Midland car was driven into the ditch near La Salle, Ill., the front axle being damaged and the driver slightly injured, and the car was withdrawn from the contest. A Reliable Dayton, the only motor buggy entered in the contest, suffered a broken frame, and was laid up for repairs, but continued the run as a non-contestant on the third day. The Rainier car had trouble with the water connections, and the driver was obliged to break the seal on the tool box in order to get at the tools necessary to repair the leaks. As in addition to this trouble the frame showed signs of sagging, it was thought wise to withdraw from the contest, but the car continued in the following day's run as a non-contestant. The Studebaker car was also withdrawn from the contest, and continued as a non-contestant, while the Maxwell and Apperson cars were penalized.

The routes of the third day's run led through Indiana, touching the towns of Crown Point, Valparaiso, La Porte, South Bend, Michigan City, Hobart and Hammond, the total distance being 257.2 miles. The Apperson car was penalized twenty-two points for breaking the seal and for work done on the car. A Pierce-Arrow was struck by a trolley car just as it was leaving South Bend, but got off with no more serious damage than a broken lamp and a bent fender. It rained continuously during this day's run and a number of sandy stretches of road were encountered, but all the cars that started in the morning came through to the finish, and ten perfect scores remained.

The final day's run on Friday led through Illinois, passing through Elgin, Rockford, Oregon, Rochelle and Aurora, the distance being 240 miles. A White steamer driven by Sheridan was penalized twenty-four points for breaking a seal to make repairs to the oiler belt, and the Mason, driven by F. Dusenberg, was penalized 136 points for making repairs, these being the only two penalizations imposed. An examination of the cars that completed the run was made by the technical committee on Saturday, and at the conclusion of this examination the awards were made. The five cars which made perfect scores on each of the four running days, and also successfully withstood the xamination, were the two Haynes entries, the Pierce Arrow driven by Kumpf, the Premier and the Franklin. The Premier car, in addition to being awarded a perfect score certificate, was awarded the cup given by the Standard Oil Company for the car consuming the least amount of fuel during the contest.

Following is a list of the winners in the different classes, with their scores:

Class B.—20 Mason, F. Dusenberg, 2 penalty points.

Class C.—30 Apperson, M. McLain, 32 penalty points.

Class D.—Tie between 30 Premier, R. McNamara, and 35 Haynes, F. Nutt, both perfect scores.

Class E.—20 Mason, F. Harn, 2 penalty points.

Class G.—Tie between 28 Franklin, L. Springer, and 30 Haynes, L. Wagoner, both perfect scores.

Class H.—40 Pierce Arrow, E. Kumpf, perfect score.

The Motor Parkway Sweepstakes.

Herbert Lytle, driving a 60 horse power Isotta-Fraschini car fitted with Michelin tires won the 234.5 mile race held on the new Long Island Motor Parkway on Saturday last, October 10. Lytle's time was 3 hours 39 minutes and 10 seconds. Lewis Strang on a 45 horse power Renault came in second, and Gus Lechleitner on a 40 horse power Itala finished third. The course was 23.45 miles long, and included that portion of the Motor Parkway which has already been finished, and which is to be used for the Vanderbilt Cup race on October 24. The contesting cars made ten laps, a total distance of 234.5 miles. At 9 a. m. the cars were started off, Lytle taking the lead and maintaining it throughout the race. His fastest time for one lap was 21:11. Strang and Lechleitner fought for second place, which Strang finally took, having the faster car. Lescault on the Simplex ran well, but could not keep up with the leaders, nor could Haupt's Chadwick, which came several times near being overturned on the sharp curves of the course. The Hotchkiss car, driven by Fitzpatrick, lost a rear wheel on the fourth lap, and did not re-enter the race, and the Knox, driven by Basle, also withdrew. Of the seven entries only five finished, the pace being gruelling, the three leaders averaging over 60 miles an hour.

A number of minor events were also run off. The first of these was the Meadowbrook Sweepstakes for 211 miles, and was won by Hughes driving a 35 horse power Allen-Kingston. A Rainier got second place. The 16 horse power Lancia car, which got third place, made very good time, averaging 47.9 miles per hour for the race. The Garden City Sweepstakes, for 187.6 miles, brought out seven cars, but four did not finish, the Stoddard-Dayton driven by Tuttle and the Buick driven by Burman being disabled by running off the road, and a Chalmers-Detroit and a Palmer & Singer withdrew. The Sharp Arrow, a car built by its owner, William Sharp, won in 3 hours 19 minutes and 34 seconds. The Jericho Sweepstakes, for 140.7 miles, brought out six cars. A Maxwell, a Selden and a Mitchell got into difficulties, and did not finish. Two Chalmers-Detroit cars, driven respectively by Burns and Ainslee, took first and second places. Eight cars were entered in the final event, the Nassau Sweepstakes, for cars selling under $1,000. The distance covered was 93.8 miles. A Buick, driven by C. E. Easter, was the winner. A Cameron, which suffered somewhat from tire and mechanical troubles, was second, while a Mitchell was third. The Reo and Gyroscope cars, which started, did not finish.

The mechanic on the Stoddard-Dayton, which was disabled in the Garden City event, was injured, and two spectators were cut and bruised by some spare parts which flew from one of the racing acrs as it made the turn at Jericho. The cars as a whole suffered from tire troubles, and some from mechanical troubles as well. These races were held to inaugurate the Long Island Motor Parkway, and were substituted for the contemplated Vanderbilt Cup elimination race for which there was no need. Following are the final results:

MOTOR PARKWAY RACE.

Car and Driver.	Time.
60 Isotta, H. Lytle	3:39:10
45 Renault, L. Strang	3:50:25
40 Itala, G. Lechleitner	4:13:09
50 Simplex, M. Lescault	4:16:21
50 Chadwick, W. Haupt	4:27:57

MEADOWBROOK SWEEPSTAKES.

Car and Driver.	Time.
35 Allen-Kingston, H. Hughes	4:00:07
50 Rainier, L. Disbrow	4:03:42
16 Lancia, H. Hillard	4:24:15

GARDEN CITY SWEEPSTAKES.

Car and Driver.	Time.
— Sharp Arrow, W. Sharp	3:19:34
30 Knox, W. Bourque	4:07:11
35 Stoddard-Dayton, A. Miller	4:11:52

JERICHO SWEEPSTAKES.

Car and Driver.	Time.
30 Chalmers-Detroit, W. Burns	3:02:36
30 Chalmers-Detroit, G. Ainslie	3:12:00
30 Mitchell, F. Zirbies	3:46:07

NASSAU SWEEPSTAKES.

Car and Driver.	Time.
24 Buick, C. E. Easter	2:07:58
24 Cameron, F. Cameron	2:15:53
20 Mitchell, W. Olney	2:22:23
20 Mitchell, H. Cousins	2:30:02
22 Buick, L. H. Titus	2:30:04
10 Cadillac, F. Darnstadt	3:14:13

Taxicab Strike Continues.

A temporary injunction was issued by Supreme Court Justice Blanchard on October 5 restraining the officers of the Chauffeurs' Union and those of the Teamsters' Union, with which the former is affiliated, from interfering with or obstructing the New York Taxicab Company in the operation of its cars. The expectation that the conference on the 6th would lead to a settlement of the differences between the company and the drivers was not fulfilled. The strike still continues, and attacks by strikers on the cabs of the company continued throughout the week. As a measure of protection the company sent out some cabs filled with "plain clothes" detectives, and these effected a number of arrests of rioting strikers. In several instances windows in hotels and restaurants in front of which the cabs were lined up were broken by missiles thrown at the drivers by strikers. There has been considerable complaint regarding the failure of the police to prevent the rioting.

Pope Company Report for September.

Following is an abstract of the Pope Manufacturing Company receivers' report for September:

Balance in banks and cash in hand August 31	$314,530.65
Total receipts during the month	50,241.01
	$364,771.66
DISBURSEMENTS.	
Refund of deposits, receivers' expenses, payrolls, material, etc.	$69,541.44
Special advances for expenses	715.29
Receivers' fees	1,000.00
To receivers in other States	1,924.56
	$73,540.29
Balance in American National Bank	288,028.24
Cash in office	3,223.18
	$291,251.42
Accrued liabilities of receivers	27,376.45
Balance due from other receivers, accounts receivable August 31, and sales in September	84,754.34
Less cash collections and deposits credited to accounts	46,050.00
Balance September 30	$38,704.34
Balance due from receivers in other districts	4,190.85

Deflection Test of a Two Bearing Four Cylinder Crank Shaft.

A test of a Chalmers-Detroit "30" crank shaft has been made at the University of Michigan on a 100,000 pounds testing machine by George E. Ackerman. From Mr. Ackerman's report on the test we gather that the crank shaft was supported at the bearing points upon the crank shaft ends. The load was applied at the centre of the shaft. The load was gradually increased from zero up to 31,000 pounds. The elastic limit of the crank shaft (that is the point where it yielded under the load) was reached at 26,000 pounds. When the shaft began to yield, the bend did not take place through the straight centre portion of the shaft, nor in the pins, but in the heavy webs between cylinders 1 and 2, and between cylinders 3 and 4. "Examination of the dimensions of this shaft will prove conclusively that no strain sufficient to distort these webs could ever occur under service when in the motor," concludes the report.

Model Highway for Milwaukee.

Engineers of the Wisconsin State Geological Survey, under direction of W. O. Hotchkiss, chief of the highway division, are making surveys and other arrangements for the proposed model highway in Milwaukee, extending from the city limits, at the beginning of Grand avenue, 5 miles westward to the county limits. The road will be boulevard, 85 feet wide, with rows of trees, perfect grade, reinforced curbing and other features of the city boulevards. It is an experiment that will be the basis of an extensive system of highways in Wisconsin. At present the highway is the chief thoroughfare for golfers and members of other elite clubs that lie outside of the city. The road will be of macadam, with a binding of either tar, asphaltic oil or asphalt. It will be ready for traffic in about two years.

To Proceed Against a Speed Trap Grafter.

The New Jersey Automobile and Motor Club, with headquarters at Newark, has taken steps to proceed against a justice of the peace in that State who is claimed to have failed to turn in to the State Motor Vehicle Commission the fines he collected from motorists for speeding. The papers have been prepared by the attorney for the club and submitted to State Attorney General Robert N. McCarter. The present motor vehicle law of New Jersey requires that all moneys collected from motorists for fines must be turned into the Motor Vehicle Commission within thirty days. The club's suspicion was aroused by the relatively small amount of money received by the commission, in spite of the fact that motorists were being held up by justices of the peace in every part of the State. A system of espionage was devised and about two months ago it was found that $50 collected from an automobilist in a small place in the northern part of the State was not turned over to the Motor Vehicle Commission within the thirty days following its payment to the justice of the peace. In order to give the justice every chance another month was allowed to pass without taking action, but when at the end of that month the money had not been turned over the club drew up a report and laid the facts before the Attorney General.

To Test the Massachusetts Law.

Like a number of other State laws the automobile law of Massachusetts grants non-resident motorcar owners a limited exemption from registration, but does not grant such exemption to chauffeurs or hired operators. This seemingly unconstitutional feature is now to be tested in a suit which came up in the Dedham, Mass., court recently, and will be carried to the United States Supreme Court if necessary. B. D. Gray, chief engineer of the American Locomotive Automobile Company of Providence, R. I., was found guilty in the Dedham court of having operated a car in Massachusetts without having registered with the Highway Commission of the State. Automobile owners registered in other States are exempt in Massachusetts for seven days; Mr. Gray is not registered in Rhode Island as an owner, but drives in that State under the blanket license issued to his company. The Rhode Island law does not require that each individual agent or operator for an automobile company shall carry license, one license being issued to the company for all operators. Fourteen requests for rulings embodying constitutional points were made by the defendant's counsel, but were refused. Should an adverse decision be found in the Supreme Court the United States Supreme Court will be appealed to.

American Truck Company Adds Electrics.

The American Motor Truck Company, of Lockport, N. Y., will extend their line considerably in the near future. They have designs under way for a complete line of trucks ranging in capacity from 1,000 pounds to 5 tons. These trucks will be very similar to their well known 3 and 5 ton models. In addition to these gasoline propelled machines, the company will market electric trucks of from 1 to 5 tons capacity. They report the prospects for sales as very encouraging, but do not expect to close much business before spring.

Trade Personals.

"Pete" Estey, formerly with the Chicago *Inter Ocean*, has accepted a position with the Everitt-Metzger-Flanders Co. as assistant to Mr. Pelletier, the advertising manager of the E-M-F Co.

George B. Levy, formerly secretary and sales manager for C. A. Coey & Co., Chicago, has resigned that position to take charge of the Standard Automobile Supply Co., 1428 Michigan avenue, Chicago.

Frank Lowry, a former Indianapolis newspaper man, has accepted a position as advertising manager with the Moline Automobile Co. Mr. Lowry has been connected with the automobile industry for two years.

L. E. Horton, manager of the Northwestern Cadillac Co., Minneapolis, Minn., has been presented with a gold watch by the Cadillac Motor Car Co. for having done the largest amount of business in 1908 of any Cadillac agent.

George Campbell, who established the Boston branch of the Fisk Rubber Co., has resigned as manager of that branch to become Eastern factory representative of the Fisk Co., with headquarters in New York. He will be succeeded by F. H. Ayers.

W. E. Partridge, recently manager of the Metropolitan Motor Car Co., Cleveland, Ohio, was seriously injured on October 5, when his car skidded on Clifton boulevard in that city, and he was thrown out. Mr. Partridge's head struck the cement pavement and he suffered a fracture of the skull.

MINOR MENTION

The Oakland Motor Car Company, Pontiac, Mich., has filed notice of an increase in capital from $200,000 to $300,000.

It is reported that 300 employees are now at work on 1909 models at the factory of the Electric Vehicle Company, Hartford, Conn.

The Grout Automobile Company's plant at Orange, Mass., has been shut down for fourteen days for necessary repairs and an inventory.

The Crescent Motor Car Company, of Detroit, has obtained an option on the factory of the Cosmo Buttermilk Soap Company, at Goshen, Ind.

The Kissell Motor Car Company, Hartford, Wis., have decided to use the Remy high tension magneto, with dry batteries for reserve for their smaller models.

The firm of Lawrence & Welch, composed of Douglas H. Lawrence and G. M. Welch, has opened a factory in Sterling, Ill., for the manufacture of the Cinch automobile tire shield.

A factory for manufacturing shock absorbers is to be established at Farmington, Me., by W. Prince Knapp and Lester Greenwood, who have invented a new absorber of the hydraulic type.

The Davis Manufacturing Company, Sixth street, Milwaukee, are planning the erection of a new building at Fifteenth avenue and Park street, in that city, on a tract 205x218 feet. The main building will be 100x150 feet.

Thomas F. Hart, of the new automobile company which is being organized in Muncie, Ind., after a popular competition for the suggestion of names for the car to be produced by the company, has decided on the name "Interstate."

The automobile of E. J. Hertz, of Philadelphia, was destroyed, and the garage in which it was kept was considerably damaged, by an explosion resulting from a short circuit on Mr. Hertz's car while being repaired by the chauffeur recently.

A meeting of the Retail Automobile Dealers' Association of Cleveland took place in the Hollenden Hotel on October 1. The report of the show committee was accepted, but the fixing of a date for the next show was deferred until a later meeting.

Bids for road improvements in nearly every county of the State outside of Greater New York, involving an expenditure of about $3,000,000, for about 282 miles of road, will be opened by State Engineer Skene on November 9, 11 and 11.

The Packard Motor Car Company last week broke ground for the first of a series of buildings on the oposite side of the boulevard from the main factory. The plowing of the excavating was done by hitching the plows to motor trucks of the company's manufacture.

It is reported that a Rochester, N. Y., firm manufacturing small air pumps is considering locating in Seneca Falls, N. Y., in either the American La France Fire Engine Works or the Iroquois Motor Car Company Works, both of which are now vacant.

The contract for printing the 1909 hand book of the Association of Licensed Automobile Manufacturers has been let. The changes in the new edition of the hand book are said to be slight so far as the arrangement of the matter is concerned.

The plant of the Stanley Automobile Company, of Mooreland, Ind., has been moved to Troy, Ohio, where a larger factory will be operated. The company was organized about two years ago and has manufactured a line of gasoline runabouts.

Considerable damage was done to the car and garage of Dr. W. S. Stewart, Wilkes-Barre, Pa., by a fire on October 8, which was caused by the chauffeur lighting a cigarette after having cleaned the car with gasoline and used considerable of the fluid.

De Witt Carpenter, 1907 Talbot avenue, Indianapolis, Ind., has invented a locking device for automobiles and motor boats. It comprises a Yale lock, furnished with duplicate keys. When locked it automatically breaks the spark circuit so that the motor cannot be started.

The Brush Runabout Company, Detroit, Mich., are preparing a booklet on the recent efficiency run of five of their cars from Detroit to Boston, Washington, D. C., Denver, Minneapolis and Milwaukee, respectively. The book will contain illustrations of beautiful scenery in the Catskills, Alleghenies and Rockies.

According to a report from Detroit a block of $100,000 stock in one of the local automobile companies was sold there at par for cash last Thursday, which is thought to be the largest deal in local industrial stock effected there. It was stipulated in the deal that the names of the seller and buyer should not be made public.

Samuel W. Watkins, of Milwaukee, has secured a lease on the factory plant in Kenosha, Wis., formerly occupied by the defunct Earl Motor Car Company. Mr. Watkins has been connected with a motor manufacturing firm in Milwaukee, and it is said that he contemplates organizing a company to manufacture cars in the old Earl plant.

The property of the Muncie Auto Parts Company, Muncie, Ind., which has been in the hands of a receiver for some months, was sold on October 6 to Kendall & Boyer, glass manufacturers of Daleville, Ind., for $11,000. It is understood that the factory on First and Birch streets is to be opened again by the new proprietors for the manufacture of various automobile parts.

The Hart-Parr Company, Charles City, Ia., who have been in the gasoline tractor business for a considerable number of years, have engaged in the construction of automobiles, being engaged in the completion of a lot of two cylinder, 20 horse power motor buggies, with 42 inch wheels and solid rubber tires. It is understood that the cars are to be used by the traveling salesmen of the company.

The Southwestern Kansas and Oklahoma Implement and Hardware Dealers' Association intends to hold an automobile show in connection with its annual convention, which will be held at Wichita, Kan., December 8, 9 and 10. They have secured an auditorium with an exhibition space of 50x120 feet, and with a seating capacity of about 1,000. F. L. Wright, Wichita, Kan., is secretary of the association.

Space for the Grand Central Palace Show was allotted last week. It is stated that the demand was so great that it was necessary to cut down the allotments to vehicle manufacturers an average of 30 per cent., while the accessory exhibitors were given all the space they desired. No less than seventy different makes of cars will be represented at the Show, the foreign element being quite strong.

In Pennsylvania 24,000 automobile licenses have been issued thus far this year, from which the State has derived a revenue of about $70,000. The money is to be spent for experiments with dust preventives and in road construction. The license plates for 1909 will have black numbers on a white background, to distinguish them from the 1908 plates with yellow background, and will be ready for distribution about the middle of December.

The Goodyear Tire and Rubber Company, Akron, Ohio, are preparing to put on the market a new solid tire for motor trucks, comprising a hard rubber base and a soft rubber tread, vulcanized together. Tires of this general design have been in use in Europe for some years. The chief advantage of the construction is claimed to be that the fastening is more secure than the usual wire fastening and the tire may be worn out completely.

The Governors of the State of Massachusetts, Connecticut, Vermont, New Hampshire and Maine will shortly hold a three days' conference on the promotion of New England's interests and the preservation of its resources in Boston. The third day will be given over to a discussion of the construction and maintenance of highways, and the uniform regulation and taxation of automobiles. Experts are to be invited by the Governors to address the meeting on these subjects, and a discussion restricted to accredited delegates will follow.

The Automobile Drivers' and Mechanics' Association of Atlanta, Ga., was organized at a meeting held on October 4 at Federation Hall, which was attended by fifty-nine drivers, mechanics and garage men. Another meeting was scheduled for October 11, at which a constitution and bylaws were to be adopted. Later on the association intends to apply for membership in the Federation of Labor. The question of the admission of colored chauffeurs was brought up, but no action was taken on it. There are said to be about 250 men eligible to membership in the city.

The Boston branch of the Firestone Tire and Rubber Company has been removed from 9 Park square to 145 Columbus avenue, into the store recently vacated by the Rambler local branch.

Club Notes.

A meeting of automobile owners with the object of forming a club was held at Hazleton, Pa., on October 5.

The Automobile Club of Vermont has called a meeting for October 15 to determine whether the club shall take out incorporation papers under the laws of the State.

The chauffeurs in Washington, D. C., who are said to number about 300, are endeavoring to form a club. The manager of the Central Garage, New York avenue near Thirteenth street, has offered to provide a clubroom.

The Berkshire Automobile Association will place 100 road signs bearing the word "Pittsfield" on the main road from Pittsfield to New York. Next summer the club intends to similarly mark the road from Pittsfield to Boston.

The case of E. R. Thomas, who was to have appeared before the New Jersey Automobile and Motor Club on October 5 to show cause why he should not be expelled from the club for reckless driving, has been postponed until October 14.

The A. C. A. membership committee on September 22 reported that the membership of the club on that date consisted of 25 honorary members, 31 life members, 1,332 active members, 344 associate members and 290 subscribers, a total of 2,022.

The Raleigh A. C. was organized at a meeting in the Carolina Trust Building, Raleigh, N. C., on September 24. Constitution and bylaws were adopted, and the following officers were elected: R. D. Godwin, president; James J. Thomas, Jr., vice president; John A. Parke, secretary, and L. A. Mahler, treasurer.

The Monroe A. C. was organized at a meeting held at the office of Col. D. A. Stearns, Monroe, Wis., on September 25. The club will be affiliated with the Wisconsin State A. A. The following officers have been elected: President, R. D. Gorham; first vice president, Dr. W. D. Monroe; second vice president, J. C. Murdock; treasurer, J. H. Theiler; secretary, P. J. Weirich.

The Fort Wayne Automobile Owners' Protective Association was formed at a meeting held at the Anthony Wayne Club, Fort Wayne, Ind., September 30. The association proposes to establish a fund of $500 for the apprehension and conviction of auto thieves. The following officers were elected: E. H. Merritt, president; George DeWald, vice president; A. L. Randall, secretary, and Van B. Perrine, treasurer.

At a recent meeting of motor car owners at Natchez, Miss., it was decided to form an automobile club, to be affiliated with the American Motor League. The officers elected were S. H. Lowenburg, president; S. H. L. Landin, vice president, and Dr. W. H. Aikman, secretary and treasurer. The club was organized through the efforts of Robert B. Bridge, a local dealer, who will also endeavor to organize clubs in other places in the State.

The A. C. of America has established two new classes of members, viz., women members and clubroom members. Until now women have only been admitted to the ladies' rooms under the stairs, but hereafter they will have all the privileges of ordinary members, except those of voting, holding office, and use of the restaurant and assembly room. The clubroom membership is limited to 100, and is designed specially for the convenience of manufacturers who may wish a quiet spot to talk business, etc.

The New Jersey Automobile and Motor Club is considering the question of changing its name to the New Jersey Automobile Club, and the matter will come up for discussion at the next meeting. When the club was organized some five years ago the intention was to admit both automobilists and motor cyclists to membership, but two years ago, when it was found that no motor cyclists had as yet joined the club the constitution was changed so as to debar them.

Motor Cycle Manufacturers Form Association.

At a meeting of representatives of the twenty-one manufacturers of motor cycles in the United States held in New York on September 24 an association was formed under the name of the Motor Cycle Manufacturers' Association. The following temporary officers were elected: W. F. Remppis, president; Percy Pierce, vice president; Edward Buffum, secretary, and George H. Curtis, treasurer. The association resolved to exhibit at the Madison Square Garden Show in January next, and have obtained practically the same accommodations as were given last year to the exhibitors of motor cycles. These spaces were in the basement occupying the lateral passage from one side of the Garden to the other, and including spaces at the ends of the passage.

While the members of the association are mostly manufacturers of motor cycles, there are two members handling imported motor cycles, viz., E. L. Ovington (F. N.) and J. W. McLaughlin (N. S. U.). A number of motor cycle parts and accessories manufacturers are reported to have asked for membership in this association, but no statement has been given out regarding this. At a meeting to be held the latter part of October or the first week in November permanent officers will be elected.

A motor truck operating company is being organized in Dresden, Germany, with 200,000 marks capital stock. At first Dixi motor trucks will be used.

Locomobile Wins Fairmount Park 200 Mile Race.

The 200 mile road race held in Fairmount Park, Philadelphia, Pa., on October 10 in connection with the celebration of Founders' Week in that city, was won by George Robertson in a 40 horse power Locomobile, fitted with Firestone tires, his time being 4 hours 2 minutes and 30 seconds. Cyrus Patchke, driving a 50 horse power Acme, was second, in 4 hours 14 minutes and 54 seconds, and Ralph Mulford, driving a 40 horse power Lozier, was third in 4 hours 17 minutes and 26 seconds.

The course was a little over 8 miles long, and was laid out entirely in Fairmount Park. The finely graded West River and Neil drives, the latter with a number of dangerous turns, were included in the course, as well as Belmont and City Line avenues, and the steep Sweet Briar Hill. The course was to be covered twenty-five times, making 200 miles altogether. At 6:30 a. m. the competing cars were lined up in front of the grand stand and Memorial Hall, and at 7 o'clock a gun was fired announcing the start of the race. The first car, a Maxwell, was sent off on the gun, and thirty seconds later the Apperson was dispatched, followed by the remaining fifteen cars at intervals of thirty seconds. The seventeen cars entered were all on thier way by 7:08.

The Thomas car, driven by Salzman, starting fifth, made the best time for the six laps during which it was in the race, but withdrew owing to motor troubles just after finishing the sixth lap. Salzman's time of 8:57 for the first lap stands as a record for the course. The Palmer & Singer car, driven by Wallace, held second place in point of speed for the first two rounds, but the superiority in speed of the two Locomobiles and the Apperson soon became apparent, and after a game fight of twenty laps Wallace withdrew. The Apperson withdrew during the twenty-first lap, owing to motor troubles. The Lozier, driven by Michener, made only one lap and then withdrew, and the Maxwell was out after its third lap.

As the time went on a gradual elimination took place, tire and small mechanical troubles being numerous. The Pullman car, driven by La Roche, did not finish the fifth lap, and the Stoddard-Dayton went out on the sixth. The eleventh lap saw Zengle, driving the Pennsylvania, out of the race. The Chadwick, driven by Harkins, was out on its thirteenth lap. Bergdoll's American Locomotive car went out on the twentieth, and Florida's Locomobile on the twenty-fourth. The race up to the twenty-third lap was a ding-dong affair between Robertson, Florida and Maucher on the Peerless, but with Florida out Robertson kept the lead till the end.

Following is the final score:

Car and Driver.	Time.
40 Locomobile, G. Robertson	4:02:30
50 Acme, C. Patchke	4:14:54
40 Lozier, R. Mulford	4:17:26
40 Peerless, B. Macher	4:21:26

Garage Notes.

F. M. Anderson has leased a garage at Oskaloosa, Ia.

William Steffen has opened a garage in the Clemmer Flats, Beatrice, Neb.

W. J. Friel, Portsmouth, Ohio, moved into his new garage the past week.

The Mitchell Automobile Co., of Chicago, has increased its capital stock from $1,000 to $20,000.

A salesroom has been opened on Washington street, Providence, R. I., for the Welch and Jackson cars.

William Pauber will open a repair shop on the corner of Strong avenue and Ellis street, Stevens Point, Wis.

The Iroquois garage has recently been opened at 225 North Clinton street, Syracuse, N. Y., with J. S. Leggett as manager.

Work has been resumed on the Owego Motor Co.'s garage on Central avenue, Owego, N. Y., and will be pushed until the building is completed.

The Cleveland branch of the Buick Motor Co. was opened last week on Euclid avenue and East Seventeenth street, in charge of Manager Colwell.

A garage is being built by A. Hitch on Monroe street, Bloomington, Ill. The cement floor has been put down and the building is practically completed.

The garage of the Lone Star Auto Co., Midland, Tex., burned down on October 3. The damage is estimated at $20,000, and no insurance was carried on the property.

A. M. Hanson, agent for Rambler cars at Waupaca, Wis., is building a two story garage, 32x130 feet. Mr. Hanson conducts a general garage, livery and repair shop business.

Erb & Drury, automobile dealers of Bakersfield, Cal., have purchased a building site on Twentieth street and Chester avenue, on which they plan to erect a two story building.

Andrew A. Laird and Joseph P. Palmer have bought the interest of Perry Gable in the Model Machine Works, Frankfort, Ind. The firm conducts a repair shop and garage.

The Gove Automobile Co., Buick agents in Milwaukee, have been reorganized with a capital stock of $5,000. The incorporators are Richard Gove, E. G. Gove and B. J. Carroll.

Harry Depps, manager of the Almon Automobile Co., Cincinnati, Ohio, for four months, disappeared last week after having sold an interest in the business to William Eggebrecht for $500.

The Ohio Motor Car Co., 1938 Euclid avenue, Cleveland, Ohio, has made an assignment to William B. Woods. The company's liabilities are $24,000, and its assets are estimated to be worth $2,000.

The partnership existing between F. J. Stukel and John Fish, Menominee, Mich., under the name of the Michigan Automobile and Supply Co., has been dissolved. F. J. Stukel will continue the business.

A large garage and salesroom is being constructed on the west end of the property of the E-M-F Co. in Piquette street, Detroit, from where the E-M-F and Studebaker cars are to be retailed in that city.

A brick veneer garage, 50x75 feet, is to be erected at Maquoketa, Ia., for Mrs. J. A. Wherry. The building will be completed about December 1, and has been leased for a number of years to Charles Bauch.

Capt. O. L. Houts and Don Prentiss, Santa Rosa, Cal., will open a new garage about the first of the year, having secured the agencies for the Reo and Stoddard-Dayton cars. Don C. Prentiss is secretary of the Sonoma County A. A.

The American Locomotive Co. has leased the old Dowie Zion Tabernacle in Michigan avenue, Chicago, for its Chicago branch. The branch will be in charge of Benjamin C. Day, formerly manager of the Chicago Winton branch.

A new garage is being built in Hartford, Conn., for R. D. & C. O. Britton, agents for Maxwell cars. The garage is to be steam heated and an electric elevator will be installed for carrying cars to the upper floors. A carriage repository and salesroom will be connected with the garage, and the upper stories of the garage building proper will be used as a body building and top department.

C. M. Barber, Southwestern representative of the Reo Co. at El Paso, Tex., has sold his business to G. H. Totten, of Las Cruces, N. M. After selling the cars he still has on hand Mr. Barber will go to Canada to represent the Reo Co.

W. G. Gehring, Iowa Falls, Ia., has begun the construction of a two story, 32x50, garage, which will be fully equipped and placed in charge of an automobile mechanic. Mr. Gehring will represent the Ford and Reo cars, and will also handle supplies.

M. F. Loofbourrow has purchased the garage property of the R. O. Williams Auto Co., Columbus, Ohio, for which H. C. Moore was receiver. The proceeds of the sale amounted to $2,039.57, exclusive of an automobile which was sold for $147.50.

The Independent Automobile Co. has been organized at Indianopils, and has established quarters at 216 East Vermont street, in that city. At present the company will devote its attention exclusively to the Oakland, for which it has the Indiana agency.

John J. Vertrees, Nashville, Tenn., has purchased a building site on Broadway of that city on which he will erect a fireproof garage, to cost between $8,000 and $10,000. Mr. Vertrees expects to organize a company and to handle a complete line of pleasure and commercial cars.

The Hart Automobile Co., of which O. E. Hart is president, has been formed at Grand Island, Neb., and has leased a large brick livery barn on East Third street, where a stock of automobile supplies and sundries will be carried. Later on the company expects also to carry a line of automobiles.

Steps have been taken to incorporate the business of the Ohio Automobile Co. at Indianapolis. The company has been in business for some time on East Ohio street, in that city, and with the incorporation comes a reorganization of the company. Members of the reorganized concern are Herbert Woolen, T. D. Stevenson and F. M. Leary.

The Wisconsin Automobile Exchange is building a garage on Wisconsin street, between Marshall and Astor streets, Milwaukee, Wis. The building will be 50x100 feet, two stories high, and of brick and stone construction. The company handles the Stearns, Midland and other lines. Arthur Ekstein is manager, and Theodore and Ludwig Deetjen are partners.

The Standard Auto and Supply Co., Tiffin, Ohio, are building a two story, 51x100, garage at 12 East Perry street. There are two living suites in the second story. The building is of vitrified brick and fireproof, and is hot water heated throughout. The front portion of the first floor is taken up with the offices and with a ladies' parlor finished in quartered oak. The company will do general repairs and handle supplies, but no lines of cars have yet been taken on. G. C. Kalbfleish and J. E. Dun are in charge. The garage will be formally opened about January 1.

New Incorporations.

Los Angeles Motor Car Co., Los Angeles, Cal.—Capital, $50,000.

Chery Auto Cab Co., New York.—Capital, $25,000. Directors, Leonard Stein, Leo L. Doblin and Abraham S. Gilbert.

Rambler Automobile Co., St. Louis, Mo.—Capital, $10,000. Incorporators, Wiles Lacey, Edwin G. Anderson, Estel Scott.

International Nut Co., Niagara Falls, N. Y.—Capital, $225,000. Incorporators, R. A. Ellis, E. D. Cleghorn and W. Chambers.

Blue Ribbon Garage Co., Bridgeport, Conn.—Capital, $10,000. Incorporators, Johannes Schott, William E. Seeley and John T. King.

Carrizozo Automobile Co., Carrizozo, N. M.—Capital, $2,000. Directors, Ira O. Wetmore, Wayne Van Schoeck and A. C. Wingfield.

Triumph Automobile Fire Engine Co., Wheeling, W. Va.—Capital, $1,000,000. Incorporators, Henry E. Keyes, Charles O. Derr and Wareham E. Johnson. To manufacture and sell automobile tires and accessories.

Auto Purchasing and Exchange Co., Cleveland, Ohio.—Capital, $10,000. Francis G. Wallace and others.

Queens Motor Works, Rockaway Beach, N. Y.—Capital, $3,000. Directors, John P. Levins, Edward Herin and Francis W. Heitman.

Packard Auto Renting and Service Co., New York.—Capital, $5,000. Directors, John J. Andreas, Cora N. Andreas and Harry W. Meacham.

Independent Automobile Repair Co., Denver, Col.—Capital, $5,000. Incorporators, John E. Button, George E. Diegel and James R. Glendinning.

Road Runner Auto Co., Los Angeles, Cal.—Capital, $1,500,000. Directors, C. A. Markwell, M. H. Magic, M. D. L. Scott, A. E. Yerkes and J. D. Works.

Delahaye Import Co., New York.—Capital, $100,000. Incorporators, W. H. Barnard, W. H. Macilroy, R. Kelly. To manufacture and deal in automobiles.

Cavicchi-McDonald Motor Car Co., Boston, Mass.—The officers are: President, Fred Cavicchi; vice president, D. M. McDonald; treasurer, E. F. Cavicchi.

Tennessee Auto Co., Davidson County, Tenn.—Capital, $13,000. Incorporators, J. K. Polk, Jr., J. J. Vertrees, Jr., W. O. Vertrees, Buford Duke and W. J. Wallace.

Johnson Auto Co., Vincennes, Ind.—Capital, $10,000. Directors, Marshall T. Johnson, Frank P. Emison and Charles E. Daily. To operate a garage and auto livery.

Broad Oak Automobile Co., Columbus, Ohio.—Capital, $10,000. Incorporators, M. W. Kouns, M. F. Loofbourrow, O. W. Loofbourrow, Delton T. Hoch and Charles C. Pavey.

Rex Electric Co., Kingston, N. Y.—Capital, $600,000. Incorporators, E. M. Betts, C. J. Kieber and B. B. Maloney. To manufacture and deal in lamps, burners and fixtures.

Shore Line Garage Co., Hartford, Conn.—Capital, $10,000. The officers are: John T. Mason, president; Winthrop G. Bushnell, secretary, and Minotte E. Chatfield, treasurer.

Non-Blow-Out Auto Tire Co., Newark, N. J.—Capital, $600,000. Incorporators, Edward D. Birkholz, Frederick R. Tyrell and Robert S. Terhune. To manufacture non-blow-out automobile tires.

Jackson Motor Co., Newark, N. J.—Capital, $100,000. Incorporators, Charles F. Oatout, Newton A. Merritt and Walter F. White. To manufacture airships, flying machines, dirigible balloons, etc.

Standard Universal Rim Co., Jersey City, N. J.—Capital, $50,000. Incorporators, B. S. Mantz, John R. Turner and Sidney A. Anderson. To manufacture and deal in metal wheels, rims and parts.

Twin City Motor Co., Hancock, Minn.—Capital, $30,000. Incorporators, Dan Fisher, John Ruhl, R. S. Dunstan and Charles B. Ulrich. To operate six passenger automobiles between Hancock and Houghton.

New Agencies.

Peoria, Ill.—J. H. Bontjes, Thomas.

Lakota, N. Dak.—Beck & Floren, Reo.

Faribault, Minn.—Walter Scott, Buick.

Mankato, Minn.—Larson Brothers, Ford.

Aurora, Ind.—John H. Donner, Wolfe.

Watertown, S. Dak.—C. C. Barr, E-M-F.

Eau Claire, Wis.—Tanberg Auto Co., Buick.

Utica, N. Y.—Franklin Motor Co., Franklin.

Redfield, S. Dak.—Crain & Darling, Cadillac.

Oklahoma City, Okla.—Midland Auto Co., Brush.

Somerville, Mass.—Boulevard Automobile Co., Stanley.

Louisville, Ky.—Hubert Levy Automobile Co., 50 Fourth avenue, Franklin.

Spokane, Wash.—Washington Motor Car Co., 425 Holland Block, Cameron.

Allentown, Pa.—Detroit Motor Car Co., 24 North Tenth street, Franklin.

New York City, N. Y.—Bryant Motor Co., 41 West Sixty-third street, Selden.

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Some Jigs and Special Tools for Automobile Manufacture—I.

By Robert G. Pilkington.

There was a day, not long past, when a motor car manufacturer could sell almost anything that would run. The novelty of the new means of locomotion was so great that cars could not be turned out fast enough to supply the demand. Changes in design were so frequent that little thought was given to interchangeable manufacturing beyond that necessary to secure a large output. Small tools, fixtures, jigs, etc., were only supplied in crude form, and in as few cases as could be made to serve.

Happily for all concerned this day is past. Owing to a healthy increase in competition, an approximate standardization of design and an educated public, no manufacturer of note now cares to offer anything that is not the best he can make. As much attention is paid to the design and the accuracy of shop accessories as in ,any other line of manufacture requiring correspondingly good work.

The variety and large number of operations entering into the manufacture of a motor car make it an interesting subject for which to design tools, and for this reason this and succeeding articles will discuss a few suggested small tool designs. Most of these will be for the more important operations. It is not claimed that these tools represent any one man's designs, but are the result of experience wherever obtained. In the words of the author of a well known handbook, the writer "is a compiler rather than an authority." It is not expected that any suggestion will be adopted in its entirety. No two designers of equal skill will produce similar tools for any given operation, and some designers are so constituted that they dislike very much to find anything so good that they have to copy it. The best that can be hoped for from these discussions is that they will give some bright mind an idea.

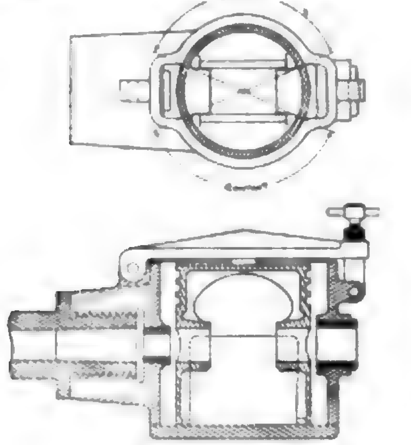

Fig. 1.

Note large area of contact between jig and work to prevent deformation.

The piston is the natural "beginning of things" in a gasoline car, and may serve as a subject for the first suggestions. The machining of the outside of the piston, considered as of the usual trunk type, presents no difficulties out of the ordinary. The diameter and the width of the piston ring grooves are the only dimensions calling for especial accuracy. However, there are two other operations that often do not receive the care they deserve.

It is of prime importance that the hole for the piston pin should be of correct size, have a fine finish and be exactly at a right angle to the line of motion. The piston pin and its hole should be of the same nominal size with a limit of variation of ± .00025 inch. This will give what is ordinarily known as a "wring fit." The slightest looseness of the pin the hole tends to increase and eventually to deform and destroy the piston. The small hole or holes in the piston pin bosses which locate the pin endwise should be accurately placed with reference to the outside of the piston. It is a too common experience to see a cylinder badly damaged by negligence in properly placing these holes.

Fig. 1 shows a drilling and reaming jig for machining the piston pin hole, adapted to use in the turret lathe. The reamer drill in this case will naturally be of Novo steel or its equivalent, while the floating reamer may well be of Styrian or a like quality. The latter steel will give the fine finish to the wall of the hole that is necessary. The cheap form of jig so often used for this operation is merely a V block with clamps, the whole adapted to use on a face plate. A serious objection to this fixture, aside from its time consuming qualities, is the insufficient contact it gives with the finished surface of the piston, and its lack of support. The contact, which is only a line contact, often marks the piston deeply. The heavy thrust allowable on a Novo drill deforms the light casting. The fixture shown avoids this marking and deformation by having a contact extending nearly around the piston, an ample groove being left on each side for the exit of chips as fast as made. One end of the jig is bolted on permanently and carries lugs which straddle the piston pin hubs and centre them with the tool. The other end is simply a yoke which swings aside for placing the piston, and clamps it firmly in place by means of the small yoke and screw.

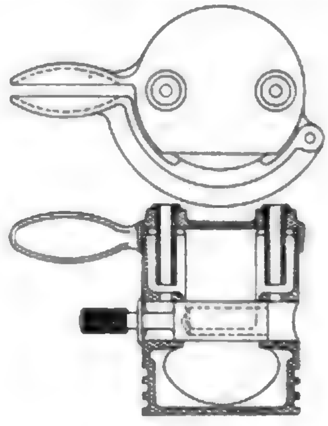

Fig. 2.

On the entering side of the jig a slip bushing is used, two being furnished, of a proper size for the drill and reamer, respectively. In the close grained iron suitable for pistons, it is not probable that the drill will find sand holes or flaws great enough to make it "run out" seriously. It will therefore break through the first boss cleanly, bridge the space and start fair in the second, without necessitating the use of a bushing inside. If by chance it does run out the hole will probably not be so much out of alignment that the reamer will not correct it. The reamer is, of course, guided at the point and on the body, the style being too common to illustrate. It is a good plan to do this job on a lathe supplied with a compressed air jet for blowing out dust and chips, and to use it thoroughly after each piston is machined. The drill and reamer belonging to this job will ordinarily be kept together in a small box under their own check in the tool room, but if not it is a good plan to keep the reamer in a piece of brass tubing or in a tin tube made especially for it.

In drilling the hole or holes to locate the piston pin in its bearing the jig shown in Fig. 2 is used. This tool is of a simplicity commensurate with the operation to be performed. It is made in two parts, a body and a clamp which form handles convenient to grasp in one hand while the other feeds the drill. When so grasped the jig is held firmly clamped in place on

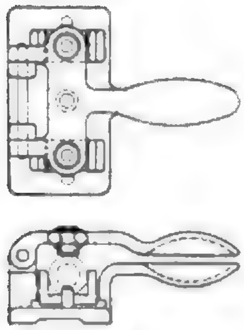

FIG. 3.

the piston and prevented from being pulled off in raising the drill out of the bushing. It will be noticed that a hardened steel guide pin is placed in the piston pin hole, serving to centre the bushings with the hole by means of machined surfaces straddling the guide pin.

The practice of locating the small holes by straddling the boss is no guarantee that they will be in alignment with the hole. If a maximum length of piston pin is desired it must be accurately located with reference to the cylinder bore, and it is better to locate the piston pin by means of a plain straight pin fitting straight holes in the piston pin and boss. No tap can be depended upon to cut truly enough to centre a set screw with its straight point. This will be especially noticeable if two locating pins are used. In making any jig it is the usual thing to use one point on a line as a base of all dimensions on that line, and in this case the base for locating bushings should be the centre of the bored portion which fits the piston.

In Fig. 3 the centre distance of the drill bushings will, of course, be the same as in Fig. 2, the base of operations being the centre of one of the bushings. The distances from centre to centre of bushings and from bushings to stops are important and determine the value of the jig. The stops are commonly hardened pins driven into the base of the jig and ground off, after assembling, to an accurate relation to the bushings. This jig will drill the holes in the piston pin to correspond with those in the piston. There is nothing especially novel in this jig, it merely representing the best practice. Grasping the handles clamps the piston pin into square grooved blocks. Where it is desired to drill holes accurately on the centre line of a round piece many shops prefer the square groove to the V, as it is easier to grind them, after hardening, to an accurate relation to the bushings.

The machining of a valve is too simple a process for especial comment, unless the valve is made in two pieces, as now often happens. It then becomes necessary to make a separate finishing operation of the seat to insure its accurate relation to the stem centrally, and to the lower end of the stem lengthwise. A simple test fixture for this purpose is shown in Fig. 4. D-D are tool steel blocks, hardened, and ground after being mounted on machine steel spindle B. C is a hardened tool steel piece pressed on B, and is, of course, ground after being pressed on. The length to be tested is A, the variation above and below normal being shown by a mark engraved on needle E, and marks F. Small pins G prevent the displacement of E.

A fixture made in this way is very simple and cheap, and there is no reason why the length A cannot easily be checked within narrow limits, the needle ordinarily giving a multiplication of 10 to 1.

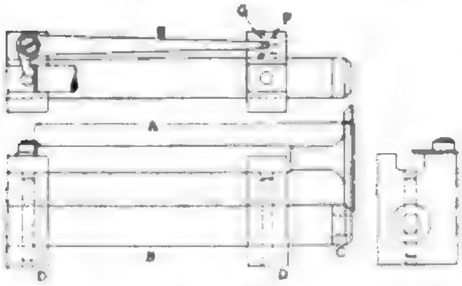

FIG. 4.

Some Road Tests of Cheap Fuels.

By ALBERT L. CLOUGH.

The following road tests of various fuels were carried on by the writer at odd moments during the past summer, and are necessarily somewhat crude and inconclusive. It is believed, however, that they may be of some interest in showing upon what a wide range of fuels an ordinary car, with a common carburetor, will readily operate. They may furnish suggestions to some users as to how to reduce the fuel bill by the employment of cheaper grades of liquid combustible.

The car used was one which the writer has used for the past eight seasons for experimental and pleasure purposes. It has a double cylinder motor and a transmission of extreme wastefulness, four spur gears and a chain being concerned on all speeds. This accounts for the rather low mileages recorded in all experiments. The carburetor was of the so called Venturi tube type, with fuel pool and with no auxiliary air inlet. Distances were measured with a Veeder odometer, and the fuel under test was supplied from a small auxiliary tank mounted on the dash, holding 1 gallon, which was filled with a carefully measured quantity of fuel.

HEATER COIL PROVIDED.

It not being practical to provide a hot water jacket for the carburetor, a heater coil was arranged to warm the fuel before entering the float chamber. The cylindrical muffler on this car is hung transversely, directly under the head end of the horizontal twin motor, and three turns of the copper fuel pipe were taken about one end thereof. These coils were kept warm by contact with the muffler, and the fuel was heated in passing therethrough, before reaching the carburetor. This heater coil could be cut in or out of circuit at will.

The heater coils were originally vertical, circular coils, arranged as in the accompanying diagrams. But it was found, as really ought to have been foreseen, that when the car was stopped with the muffler hot no gasoline would be supplied to the carburetor when the attempt was made to start the engine again.

A VAPOR LOCK.

This was a case of "vapor lock" which is perhaps worthy of explanation. When the flow of gasoline ceases, upon the stopping of the engine, the fluid in the coils becomes excessively hot and a portion vaporizes, the vapor filling the upper portions of the coils, as shown in Fig. 1. When the tank pressure is again turned on a flow can take place only when the liquid in each coil reaches the topmost portion of the same. The tank pressure is thus opposed by the hydrostatic pressure of a liquid column in each coil, which may have a height of the full diameter of the coil. This condition is shown in Fig. 2.

If the combined height of the three columns of liquid in the coils is greater than the height of the liquid in the tank above the carburetor connection no liquid can flow to the latter. "Pigtails" are sometimes left in gasoline pipes, and if these are in a sufficiently warm position trouble such as the above may occur in practice. The vapor lock here referred to was done away with by using heater coils disposed horizontally around the muffler from end to end, thus preventing any back head from being developed.

As was anticipated, this muffler heating coil could not be successfully used with ordinary volatile gasoline, for an obvious reason. After hard running the muffler became very hot, and the gasoline furnished the float chamber was quite highly heated, so much so that the liquid in the standpipe and its passages vaporized under the reduced pressure existing during the suction stroke, and vapor instead of liquid entered the vaporizing chamber through the spraying nozzle, or at least liquid gasoline so highly expanded that its fuel value per unit of volume was much reduced. The quantity of fuel which could enter the mixing chamber, in the form of vapor, through the minute spraying orifice, was so small as to give an extremely weak mixture, developing very slight power and resulting in severe knocking. A good many owners of a popular runabout, the gasoline pipe of which runs in too close proximity to the exhaust piping, have experienced this same difficulty.

With fuels of low volatility the heating coils worked well, as a substitute for the water jacketed float chamber. In these experiments the carburetor intake pipe was arranged to furnish hot air taken from

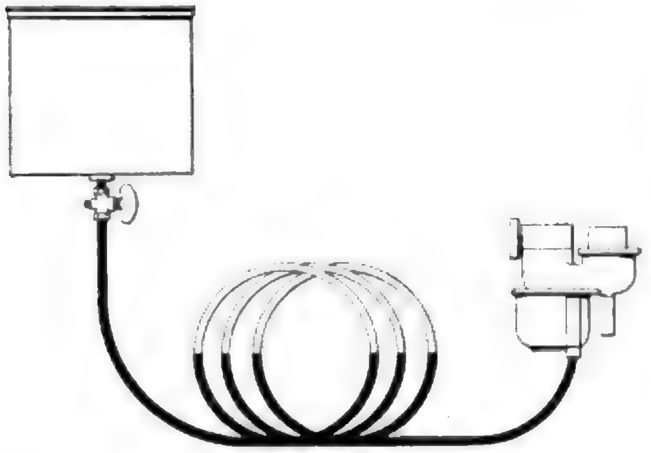

FIG. 1.

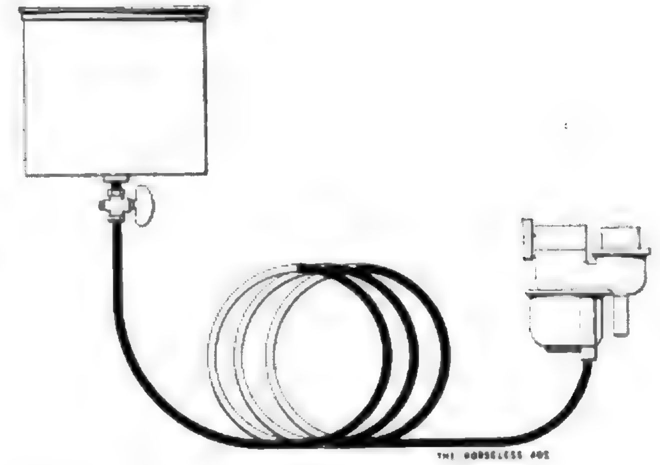

FIG. 2.

around the muffler, an adjustable cold air intake also being provided.

GASOLINE-KEROSENE MIXTURE.

A mixture of one part of ordinary 68 degree gasoline and one part of ordinary kerosene was first used, and was found to give practically the same mileage as straight gasoline, with no perceptible difference in the running of the car. The motor could be readily started on this mixture after standing overnight. A distance of 14¾ miles was covered with a gallon of the mixture, and the same distance to within a few hundred feet with "straight gasoline" in several consecutive tests. There was no difference in the two mixtures noted in the short distance run, so far as sooting of the plugs was concerned, and there was no missing of explosions with the kerosene mixture. No white smoke was noticed in the exhaust, when the kerosene mixture was used, nor was there any dripping at the carburetor of the heavier portions of the fuel. The odor of kerosene was quite noticeable. The same needle valve adjustment was used for the mixed fuel as for straight gasoline, as changes of adjustment did not seem to better the mixture. Hot air was used, but there seemed to be no necessity of preheating the fuel.

A great many motorists live where gasoline is very much more expensive than kerosene, and it is certainly possible for them to reduce their fuel bills by using a half and half mixture, and at the same time not sacrifice the ability to start the motor easily, at least in warm weather. In many localities gasoline costs at least one-half more per gallon than kerosene, and in some districts the discrepancy is much greater. With gasoline retailing at 18 cents and kerosene at 12 cents the half and half mixture costs 15 cents, and the fuel bill is cut down 16⅔ per cent., assuming that the same distance can be covered on a gallon of the mixture as upon plain gasoline. With a water jacketed carburetor and intake manifold the writer has no doubt that such a result could be at all times obtained. The half and half mixture ought to be excellent for commercial vehicles, as the odor of the exhaust would be a minor consideration in the case of such cars.

We all know the objections currently urged against the use of undiluted kerosene; that it preignites unless low compression is employed, that it "splits" and forms deposits in the cylinders, and that it is "nasty" to handle. It must be admitted that the last objection is a true one, but the half and half mixture showed no sign of preignition in about 30 miles of running, nor was any tendency manifested to form deposits on the valves or plugs. A long test would have to be made to furnish conclusive results. The power possessed by the vapors of volatile bodies in carrying along the vapors of less evaporable compounds may be involved in the use of the half and half mixture.

It is believed that conclusive experiments should be made and given publicity in regard to the use of these kerosene-gasoline mixtures.

ENGINE NAPHTHA.

A quantity of "engine naphtha" was obtained. This is a heavy naphtha which sells at 8 cents per gallon in the drum. It has a somewhat unpleasant odor, but the exhaust is not seriously obnoxious. The refiners recommend that it be preheated to a temperature of 100° Fahr.

However, it was found that the motor started readily on it when cold (summer temperature). In using the heater coil with this fuel no trouble due to gas instead of liquid passing the carburetor jet was experienced. So far as the power developed and the general running of the motor were concerned, no difference between this fuel and ordinary gasoline was noticeable. In the test made with this fuel a distance of 16⅜ miles was covered on a gallon, the same route and weight of passengers being adhered to in all these experiments. Some time had elapsed since the runs previously recorded, and, although the car had not been changed or adjusted in any way, some conditions may have changed. Therefore no close quantitative comparison should be made between this and the preceding mileages. With good jacketing of the carburetor and inlet passages a cheap naphtha of this grade should be at least as good a business proposition as ordinary gasoline, and probably very considerably better.

SOLAR OIL.

A sample of a very crude petroleum of a "keroseny" nature, known as "solar oil," and sold at 5 cents in the drum, was on hand, and, more out of curiosity than otherwise, a mixture was made consisting of equal parts of this product and engine naphtha. After coming in from the above described run and before the motor was entirely cooled, a gallon of this mixture was placed in the tank. The engine started very readily, and a distance of 14¾ miles was made before the gallon was exhausted. The motor developed full maximum power, as far as could be observed, and there was no missing. At nearly closed throttle, however, when the carburetor was operating by surface evaporation from the fuel pool, the mixture was slightly weak owing, it is presumed, to the low volatility of the mixture. At larger openings, when the jet action was effective, the operation of the motor was indistinguishable from its action with gasoline fuel. Although the heater coil was used, considerable of the fuel probably passed the exhaust unconsumed, as white smoke could at times be noticed. This gallon of fuel cost 6½ cents as compared with 11 cents for gasoline in drum lots. The distance traveled on the two fuels was the same. With thoroughly water jacketed gas passages I believe that a mixture of this kind can be successfully used on commercial cars. The odor is not pleasant, however, and there might be trouble in starting the engine cold, although I believe that the naphtha in the fuel pool would fractionate off and give sufficient vapor for the purpose. No trouble was experienced with the spark plugs in the distance run, and I do not believe that any difficulty would arise from this cause, in practice, if proper plugs were used.

BENZOL.

A sample of crude benzol was next obtained. This fuel sells at 12½ cents per gallon, in the drum, and its odor is rather curious. First one gets a whiff of the rather sweet characteristic smell of pure benzol, and then a waft of the highly disagreeable odor of carbon bisulphide. Two consecutive runs with 1 gallon of this fluid gave distances of 16⅝ miles, the car stopping within a few feet of the same point on both trials. The heater coil was not used, starting was as easy as with gasoline, and the operation of the motor distinctly smoother, the full normal power being developed. My experience is that a noisy engine runs much more quietly on benzol than on gasoline.

After finishing the last benzol run, one of the automatic inlet valves, which have very light springs, was found lightly stuck to its seat, but as this frequently happens with gasoline it is not specially significant. Benzol at 12½ cents per gallon, giving a mileage of 16⅝, is cheaper than 68 degree gasoline at 11 cents, giving a mileage of 14¾. It is in every way a fine fuel, and, as far as my experience goes, the best one to be had. The benzol tests above described accord very well in point of mileage with some the results of which I published some time since in these columns.

The writer has always been an advocate of the use of the heavier and cheaper grades of liquid fuel wherever practicable, on account of the economic advantage obtainable. Now that 76 degree gasoline is practically out of the market, and the 68 degree grade is found to answer all purposes perfectly well, there is rather less conservatism in regard to trying less volatile fuels. Anyone who has a car and a little leisure time can make his own tests of cheap fuels and decide for himself whether he can reduce his own motive power bills. It is to be hoped that active interest may be taken in this matter by owners, and the results of the experiments made public.

The chauffeur anxious to keep his employer's car in the pink of condition and to reduce his running expenses will use a rainy day to good advantage by painting the rims to protect the tires from rust. Prop up the two axles and remove all four tires. First clean the rims of all dirt and rust, and then give them a coat of japan. Apply another coat after five or six hours, and replace the tires only after the japan has become hard and no longer feels sticky when touched. Iron rust is very destructive to fabric and a protective coating on the rims, as here described, tends greatly to preserve the tire beads.

A commercial vehicle contest will be conducted by the German Imperial A. C. May 7 to 27, 1909. The trials will start at Berlin and lead through a considerable number of important cities, including Dessau, Nordhausen, Cassel, Bielefeld, Hanover, Bremen, Osnabruck, Wesel, Aix-la-Chapelle, Coblenz, Mannheim, Strassburg, Freiburg, Karlsruhe and Stuttgart.

Stresses and Factors of Safety in Torque Rods.

By David Landau and Asher Golden.

The very nature of the service that the torque rod has to perform is so comparatively simple that the stresses may be very readily determined, and no reason should exist for failure of these parts. Faulty design has been the cause of failure in some few instances, but more often lack of proper workmanship. The determination of the stresses and the factors of safety adopted by various makers for this part is of interest.

The shaft driven car has the torque reaction of the driving effort imposed on its own structure, and this reaction is transmitted through the agency of a torque rod. The reaction in some cases is taken through the rear springs and in some very recent constructions through steel tubes in which the propeller shaft is enclosed. In the above cases the spring or casing takes the reaction, and they must necessarily be designed to withstand the additional stress imposed.

The materials used for torque rods are generally steel tubing, steel castings, malleable iron castings, pressed steel sections, and in some commercial vehicles wooden beams.

The torque rod as generally made, Fig. 1, may be treated as a cantilever, fixed in the rear axle casing, and with a load applied at the other end equal to the maximum reaction. The bending and shearing actions are of the greatest consequence, although in some constructions (which constructions cannot be said to be correct) there is a slight torsion. The bending moments are at a maximum at the point of fixture to the case. The rod of Fig. 1 was designed to take the torque reaction of a 60 horse power motor, the gear ratios being such as to give a speed of 130 r. p. m. on the first gear to the rear axle shafts. The distance N was 31.125 inches. The pressure at the point B is

$$\frac{63025 \times 60}{130 \times 31.125} = 930 \text{ pounds.}$$

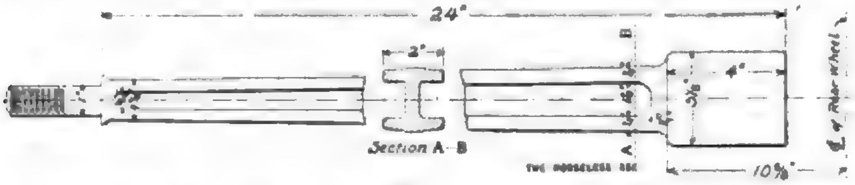

Fig. 1.

The section at any point along its length is subject to shear and bending, and the shear is the same throughout the whole length of the section. The smallest section is at B, which is 1 inch in diameter; hence its area is .7854 square inch. The unit shear is, therefore,

$$\frac{930}{.7854} = 1,180 \text{ pounds per square inch}$$

The material from which this rod is made is malleable iron, and its tensile strength may be taken at 35,000 pounds per square inch; assuming the strength in shear to be .8 of that in tension, we have a factor of safety for shear of 23.7. Now considering the bending at the section A B, which is I section and distant 19.5 inches from the load, the bending moment at this point will be 930 × 19.5 = 18,150 pounds-inches. The moment of inertia of this section is 2.04; the distance from the neutral axis to the outermost fibre is 1.0625 inches; hence, the resisting moment of this section is

$$\frac{35,000 \times 2.04}{1.0625} = 67,250 \text{ pounds-inches.}$$

The factor of safety for bending is then 67,250/18,150 = 3.7.

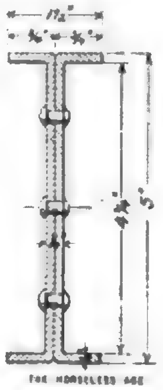

Fig. 2.

The question of cheapness combined with lightness was proposed by this same designer. The newly designed torsion lever is made of pressed steel frame channel sections placed back to back and riveted as shown in Fig. 2. The material is of low carbon steel; the section where the stress is a maximum is that shown in the figure. This section has a moment of inertia of 4.46. The tensile strength of the material is about 47,000 pounds per square inch. Hence the resisting moment of this section is

$$\frac{47,000 \times 4.46}{2.5} = 83,500 \text{ pounds-inches.}$$

The factor of safety is 83,500/18,150 = 4.6. The weights of these two torque rods will be very nearly in direct proportion to their areas. The area of the first section was found to be 2.56 square inches, and the area of the second section 1.56; hence the ratio of the weights is

$$\frac{2.56}{1.56} = 1.64.$$ That is, the weaker section weighs 64 per cent. more than the stronger section. This is a simple means of increasing strength and decreasing weight and manufacturing cost.

The design shown in Fig. 3 is intended for a car the engine of which develops 24 horse power at 1,200 r. p. m. The gear reduction on the first speed is 1 to 11.1. The rod is made of seamless steel tubing having an ultimate tensile strength of 82,000 pounds per square inch. The distance of the centre of the rear axle to the suspension of the torque rod is 27.5 inches. Then the pressure at the ball is

$$\frac{63025 \times 24}{\frac{1200}{11.1} \times 47.5} = 507.5 \text{ pounds.}$$

The bending moment at the point A, distant 22 inches from the point of application of the pressure, is 507.5 × 22 = 11,160 pounds-inches. Since the moment of inertia of a hollow tube or shaft is $.049(D^4 - d^4)$, we have by substitution, $I = .049(1.25^4 - .9375^4) = .0816$.

The distance from the neutral axis to the outermost fibre of the section is .56 inch; hence the resisting moment is

$$\frac{82{,}000 \times .0816}{.56} = 11{,}900 \text{ pounds-inches,}$$

and the factor of safety is

$$\frac{11{,}900}{11{,}160} = 1.07$$

Manufacturers of parts often make it a practice to supply the same torque rod for cars of various powers, so that the rods for cars of lower power will have higher factors of safety than the rods of higher powered cars. One manufacturer, however, while keeping the outside dimensions of the rod the same, increases the strength of the rod by a simple expedient of inserting tubes of varying lengths into one another, as shown in Fig. 4. The particular rod shown in the figure is intended for a 35 horse power car.

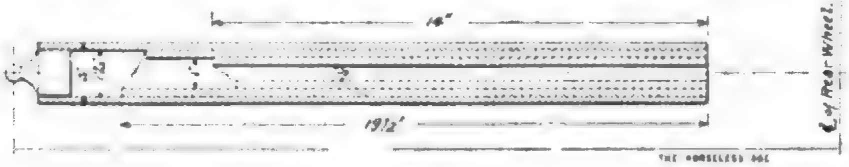

FIG. 4.

Now, assuming an engine speed of 1,200 r. p. m., the gear reduction on first speed is 11.1; the distance from the rear axle centre to the ball is 26.5 inches; the maximum reaction at the ball is found to be

$$\frac{63025 \times 35}{\frac{1200}{11.1} \times 26.5} = 770 \text{ pounds.}$$

The bending moment at the end A, which is distant 24.5 inches from the ball, is

$$770 \times 24.5 = 18{,}865 \text{ pounds-inches.}$$

The moment of inertia of the section at the point A is .778. The material of which these tubes are made has a tensile strength of 85,000 pounds per square inch. Then the resisting moment of the section is

$$\frac{85{,}000 \times .778}{1} = 66{,}130 \text{ pounds-inches,}$$

and the factor of safety is 66,130/18,865 = 3.4.

The stresses in the torque rod shown in Fig. 5 are of a different character than those of the other rods. It will be assumed that the car is moving forward. Here the

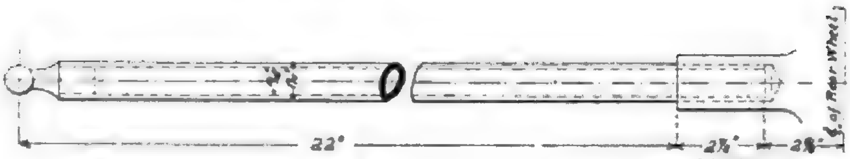

FIG. 3.

upper member of the rod is subjected to combined bending and compression and the lower member is subjected to combined tension and bending. The absolute value of the compression is the same as the tension. If P is the pressure at the point A, then the compression or tension in each member of the rod is P sin θ and the bending force is P cos θ.

It is seen from the above that the tension produced by placing the rods at an angle is small in comparison with the bending and may be safely neglected in the calculation of the stresses. By placing the two rods as shown in Fig. 5 a very light structure having a comparatively great resisting moment may thus be obtained.

The torque rod shown in the figure was designed for a small high powered runabout, where weight is of importance. The rod ends were inserted into steel forgings having a tensile strength (section AB) of 75,000 pounds per square inch. The torque reaction of the motor on this car produced a pressure at the point C of 376 pounds.

We can now determine the bending and tension at the section AB, where the bending moment is a maximum. The bending moment at this section is found as follows:

Referring to the force diagram, Fig. 5, we see that

$$P_1 = P \cos \theta$$
$$P_h = P \sin \theta$$

The unit stress in the section AB due to tension or compression is $\frac{P \sin \theta}{A}$, where A is the cross sectional area of the section AB. The bending moment is then equal to L P cos θ; hence the fibre stress due to bending is $\frac{L\,P \cos \theta}{Z}$, where Z is the section modulus of the section considered.

The equivalent fibre stress is then found to be

$$f = P\left(\frac{L \cos \theta}{Z} + \frac{\sin \theta}{A}\right)$$

Applying this to the rod shown in Fig. 5 we have:

L = 29 inches
P = 376 pounds
θ = 9 degrees
Z = 2.6
A = .3068 square inch.

Substituting in the above equation, we then have

$$f = 376\left(\frac{29 \times .9877}{2.6} + \frac{.1564}{.3068}\right)$$
$$= 4350 \text{ pounds per square inch.}$$

Of this fibre stress that part due to tension, P, is

$$\frac{376 \times .1564}{.3068} = 192 \text{ pounds per square inch.}$$

Hence it is seen that we may safely neglect the tension or compression, as was pointed out above, and regard the torque rod as being subjected to pure bending only.

The factor of safety of this rod is 75,000/4350 = 17 (about).

Having determined the strength at the section of maximum fibre stress, it is now of interest to find the strength at some other point of the rod, as, for example, at a plane passing through the middle of the rod. At this point we have the following conditions:

L = 14.5 inches
P = 376 pounds
θ = 9 degrees
Z = .9375
A = .2455 square inch.

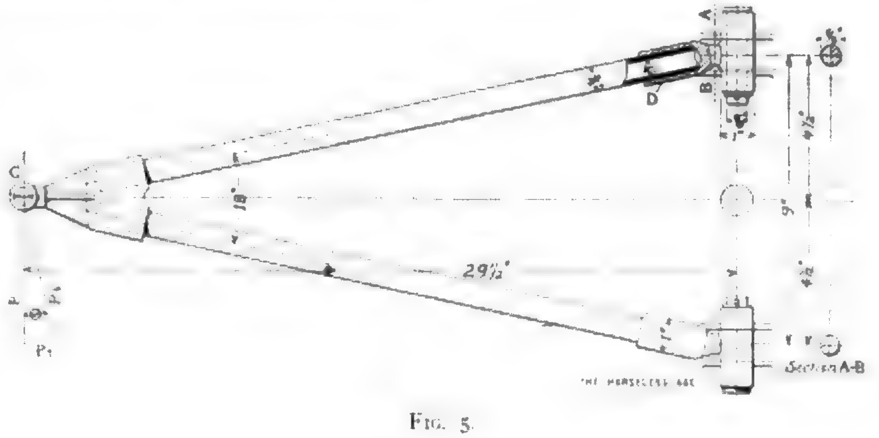

FIG. 5.

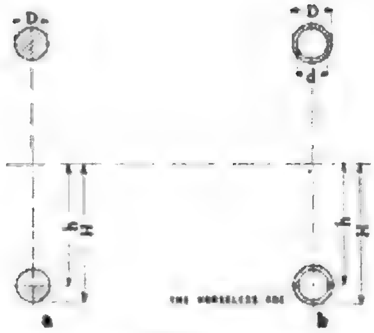

FIG. 6.

The fibre stress at this section, considering bending and tension, is then

$$f = 376\left(\frac{14.5 \times .9877}{.9375} + \frac{.1564}{.2455}\right)$$

= 5,990 pounds per square inch.

The material of the tubes has an ultimate tensile strength of 85,000 pounds per square inch. The factor of safety of the tube is then 85,000/5990 = 14.3. From this it is seen that the rod is nearly of uniform strength throughout its entire length.

In the history of this car there has never occurred an instance of breakage of these rods, although in one or two instances the brazed joints at D have pulled out.

The first section modulus used in the above numerical example was obtained from the following formula (see Fig. 6a):

$$Z = \frac{\pi D^2}{H}\left(\frac{D^2}{32} + \frac{h^2}{2}\right)$$

and the second section modulus from the formula (see Fig. 6b):

$$Z = \frac{\pi D^2}{H}\left[\left(\frac{D^2}{32} + \frac{h^2}{2}\right) - d^2\left(\frac{d^2}{32} + \frac{h^2}{2}\right)\right]$$

It is interesting now to discuss the torque rod, a section of which is shown in Fig. 7, and to study the effect of the variation of strength due to the removal of metal at the section *a*, *b* and *c*. Referring to Fig. 7, it will be found that the section modulus of the section through AB is

$$Z = \frac{B H^3 - b h^3 - t\left[(2d + 2c + D)^3 + (2c + D)^3 - D^3\right]}{6 H}$$

The following figures were taken from an actual case:

$B = 1.75$ inches
$b = 1.625$ inches
$H = 6$ inches
$h = 5.75$ inches
$t = .125$ inch
$d = .5$ inch
$c = .375$ inch
$D = 3.5$ inches

Substituting these numbers in the above formula, we find the section modulus to be 1.3. If we take a solid channel section of the same dimensions we find its section modulus to be 1.91. From this it is seen that by punching out the amount of metal shown in the figure the strength is decreased about 32 per cent. It will be found on further calculation that while the strength of the section shown has been decreased by 32 per cent., the weight has been practically cut in two. If we assume that the initial factor of safety before removing the metal was 14, then the factor of safety of the punched section will be .68 × 14 = 8.8. This factor of safety is sufficiently large, considering factors of safety in general in automobile practice.

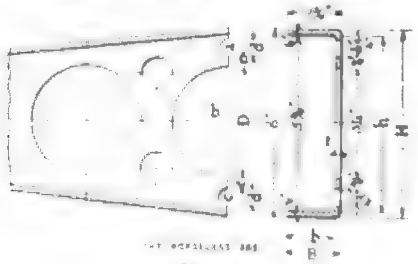

FIG. 7.

An investigation of the designs in which the propeller shaft casings act as a torque rod shows that the factors of safety of these constructions is in the neighborhood of 10. As regards the use of wooden beams on motor trucks, we have never investigated their factors of safety, but from the limited number of these in use and considering the exposure of the wood to the weather and washing, we cannot see any advantage in the use of wood for this purpose. A factor of safety of at least 15 should be used to allow for all contingencies.

A New Field in Honduras, C. A.

By OBSERVER.

At one time the prospects seemed very bright for automobiles in Honduras; but that was before the revolution of Bonilla. The one suitable road was then in good order, comparatively speaking, and the general public seemed to be favorably impressed with the work of the few automobiles then in use. Inquiries were plentiful, and the leading merchants were considering the pros and cons of the question, with the true Central American tardiness.

During and after the war fiasco the roads throughout the country were allowed to fall into a bad state of repair, and the natural shortness of ready cash since that period has not been conducive to the good of the highways. Truly speaking, there is but one road that is suitable to automobile traffic, and at the present time a not too vigorous attempt is being made to bring it up to a fair degree of surface and grade. There are other roads, it is true, but the absence of bridges and the stony and narrow surfaces present almost impossible conditions to the automobilist. If the road which extends from the Pacific Coast to the capital, Tegucigalpa, were finished, an enormous field would be open. A short length has been built at the capital, and a few influential men are trying to see the matter through. Personally, I have no hopes of such a thing taking place in the near future; the average Honduranian does not take sufficient interest in his country to worry about such a thing as roads. So long as he can manage to spur his mule through the mud holes and up the precipices he says that the roads are "muy galan."

A short time ago the writer personally investigated the prospects and probabilities of an international road, joining Nicaragua, Honduras, Salvador and Guatemala. It did not take long to find out that insuperable obstacles were in the way of such a project. If such a scheme could be carried through, though, lots of cars could be used in the service.

TRANSPORTATION EXPENSIVE.

These Central Americans pay a good price to a mail contractor, while passengers can be charged a heavy price, and yet be carried cheaper than they can go on mule back. Freight also pays heavily, and the entire question simply hangs upon the state of the roads. For such a service a fairly light car would be the most serviceable, although some points would require to be specially attended to to suit the climatic and road conditions.

A few runabouts might be sold to some of the wealthier citizens, provided the first sample car turned out well; it would be closely watched by other intending purchasers. I am in favor of having three point suspension for this tropical work, as no rigid frame is able to withstand the frightful shocks and jolts a car gets down here. There would not be much scope for cars of over 30 horse power; in fact, I think that it would do a manufacturer harm to sell such a car, as the conditions will not permit a high speed at any time.

LOCAL REQUIREMENTS.

A car should be sold complete with all accessories, and a set of spare parts; these people don't understand paying big prices for insignificant pieces of machinery. Tops should be quoted for, as the sun is very hot, and a heavy price must not be asked because a car has a fancy body. Paint and varnish don't count for much down here, and a dealer should quote for plainly painted and furnished bodies. Some kind of spring buffers or checks are almost a necessity, and a very big clearance is essential. Solid tires are quite suitable for all classes of vehicles, pleasure and commercial; pneumatics will not stand up to the work. A carburetor to use coal oil would be a "talking point," and double ignition should be fitted. A thermosiphon system should be fitted, provided it has been "tried out" in a hot, mountainous country like this.

As to lubrication, this should be absolutely automatic and independent of the driver, or else the car will get a bad reputation as a "bearing" user.

Cars sold down here must be thoroughly tested before shipment, as there is very little labor here suitable to do it, besides the bad opinion it would give of the manufacturer's products. By the way, catalogues and printed matter should be in Spanish, and a few testimonials of other tropical users would add much weight to your statements. National prejudice is equally divided between European and American products.

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Another Commercial Vehicle Competition in Prospect.

The offer of a $2,000 trophy by Powell Evans, of Philadelphia, to be competed for annually by commercial vehicles, as announced in our last week's issue, makes it likely that another commercial vehicle contest will be held in this country next year. It will then be five years since the last contest of this nature was held, and there has certainly been enough progress made in commercial vehicle construction in the intervening period to warrant the organization of another trial. Besides, quite a number of the old established touring car manufacturers will shortly enter the commercial vehicle branch, and the impetus to the commercial vehicle by a trial covering the chief industrial centres of the East and extending over several weeks would come at an opportune time. In our opinion such a trial must be regarded mainly as a means of propaganda, for as a test of economy of operation and commercial practicability it would hardly be conclusive, no matter what the regulations might be.

Without questioning for a moment the good intentions of Mr. Evans or depreciating his worthy action, we do not think that a perpetual trophy is the most desirable basis for organizing a commercial vehicle trial. There is naturally a vast difference between a commercial vehicle contest and a speed trial, and rules of sport can have no place in the former kind of competition. In the first place, it would be absolutely necessary to divide the entrants into several classes, as it would be impracticable to run 500 pound livery wagons and 5 ton trucks in the same class. In fact, a considerable number of classes is necessary, if all the vehicles are to be required to run at about their normal average speed, as there is quite a difference in the speed of trucks and omnibuses on the one hand and between rubber tired and steel tired trucks on the other. But to make the event a success prizes must be offered in each class, or, at least, there must be a number of winners, and there seems to be no more reason for offering a trophy in one class than in another. We also believe that if such contests were held annually the manufacturers would soon be asking for a respite.

The effort to evolve a single winner in each class might also meet with some difficulty, as in several of the recent reliability trials for touring cars. What if a number of cars in any one class came through the contest with perfect scores? In that event it would neither be satisfactory to select the winner by a vote of the remaining contestants, as was done in one of the early Glidden tours, nor to break the tie by pitting the survivors against each other in a speed trial on the Long Island Motor Parkway, after the fashion of recent English and German pleasure car trials. The only logical method of breaking a tie would be to continue the trial under the original conditions until only a single perfect score remained, and the prospect of a long drawn out "run off" would not be encouraging to prospective entrants. Logically, there should be no necessity for a single winner —and right here we have the main reason why a perpetual trophy does not meet the requirements of a practical contest. Cash prizes and medals would be more to the point, as there would be no difficulty in making awards in case of a tie.

Finally, a word should be said with regard to the question of speed in such a trial. Average speeds of from one and one-half to twice the speed of equally loaded horse drawn vehicles should be required; but it would be a repetition of an old mistake if the awards were to be made on the basis of maximum average speed. It would encourage uncommercial speeds, and though the trial would probably be more extended than the two A. C. A. commercial vehicle trials in 1903 and 1904, its duration would hardly be sufficient to make the metal fatigue effects due to high speeds apparent. The proper procedure would seem to be to penalize all involuntary stops, and this would necessitate the provision of official observers, without whom a practical trial is hardly conceivable at this late day.

The Assembled Car and the Tendency Toward Specialization.

The question of the assembled car is one which has often been referred to in these columns, and upon which discussion is decidedly rife at the present time. It is certain that the time has long passed when the assembled car can be ignored as an immensely important factor in the industry, and it is a fact that a considerable portion of the public is becoming interested in the relative merits of the car which is produced in all its essential parts in a single plant and the vehicle the important essential parts of which are produced in outside factories devoted to these particular specialties and later assembled in the shop of the company which gives its name to the finished machine.

Some manufacturers still cling to the statement that all parts of their cars are produced in their own factories, an assertion which, as a matter of fact, should not be and is perhaps not intended to be taken literally.

As a contrast to the familiar statement above referred to may be mentioned that of one of the largest producers of low priced cars who takes pains to impress upon the public that his motors are not built in his own plant, but by a manufacturer making an exclusive specialty of engine building, the motors being turned out in accordance with the automobile company's specifications under the direction of the automobile company's engineers. Such an assertion as this shows that the manufacturer making it has faith that the public appreciates the advantages, economical and technical, to be gained by the practice of entrusting to specialists the manufacture of motor car elements requiring highly specialized knowledge and wide experience. As an analogue of the assembled automobile may be mentioned the electric trolley car. The builders of these cars are, almost without exception, assemblers. The car body is constructed in the car builder's plant, but the trucks, motors, controllers, heaters, and practically all other parts of the equipment are produced by the truck makers and the large electrical manufacturers, and the car builder assembles these essential parts upon the structural part of the car which he has produced. Hardly anyone would feel like denying that the General Electric Company or the Westinghouse Company, with their immense plants and worldwide experience, can build better motors and controllers than can the car manufacturer if he should try to produce them in his own restricted plant.

Universal, underlying economic tendencies are inflexible and irresistible and fully applicable to the industrial world. The movement toward minute differentiation in manufacturing is going farther and farther each year, restricting each manufacturer more and more closely to a single, narrowly defined line of production. The old adages, "every man to his trade" and "jack at all trades good at none," are merely homely expressions of the now accepted law that the economic efficiency of each producer is at its maximum when he produces that for which he is by knowledge and experience best fitted to produce, and nothing else. It is further to be remarked that highly differentiated production is specially characteristic of American manufacturing methods, and responsible in great measure for their success.

It would seem that the above considerations must apply with increasing force to the motor car industry, especially as standardization of design becomes more closely realized. There may always be a restricted demand for cars built exclusively in the home factory, but it is not easy to see how the industry, as a whole, can resist the tendency toward becoming in a greater degree designers and assemblers.

Controlling the Glare of Searchlights.

The dazzling effect produced upon other users of the road by the powerful gas headlights and searchlights now in common use upon motor cars has repeatedly been alluded to in these columns. The use of such lamps, throwing a concentrated, nearly parallel beam, is so objectionable that the evil has been recognized by the authorities in some cities. Nevertheless a light beam of this character, capable of illuminating objects at a considerable distance, is almost a necessity in country driving at night. For driving through lighted streets a widely diffused beam capable of lighting the road for a short distance in front of the vehicle, and warning opposing traffic of its approach, is all that is desirable.

Lamps have been for some time on the market which throw two sets of beams, the diffused divergent ones for lighting the highway immediately in front of the car, and the concentrated beam of nearly parallel rays for long distance lighting. Such lamps are excellent. On entering or leaving cities, from or into the country, in order not to offend fellow travelers, it is courtesy to extinguish and relight the gas lamps, and this involves some inconvenience. This difficulty seems to be neatly overcome in a recent device applied to double ray lamps by means of which the concentrated beam may be cut off from the driver's seat by the dropping of an opaque screen back of the gas flame of each lamp. The operator is thus enabled without inconvenience to use only the diffused beam when passing through traffic, and to resume the use of the long distance projected beam when in the open country. Automobilists probably do not fully realize the inconvenience which their projectors cause traffic moving in the opposite direction unless perchance they themselves have at times been dazed and bewildered by the glare of the lamps of other cars. In the interest of road courtesy it behooves all operators to use every care to make their lighting arrangements as inoffensive as possible to fellow users of the highway.

Revolutionary Changes and the Interests of Owners of Old Models.

Owners of cars have always considered it their good fortune if the manufacturers of their machines did not make any changes of importance from one season to the other, and this sentiment found particularly frequent expression in connection with the well known curved dash runabout, which throughout its lease of life of several seasons retained substantially the same outward appearance and general arrangement of mechanism. This stability of type and general form tends to induce the view that the car has been found satisfactory by its makers, and it also tends to maintain the selling value of used cars, partly as a direct consequence of the above effect and partly because a model three or four years old, which closely resembles the latest model of the manufacturer, cannot be called out of date. But progress is essential, and the manufacturer is under no moral obligation to his former customers to stick to his old designs, if he sees a chance for a marked improvement.

This question of the effect of revolutionary changes in design on the owners of the manufacturer's former models has recently been revived in England, in connection with the adoption of the valveless Knight engine by the Daimler Motor Company. No doubt the action of the company will tend to slightly reduce the selling value of used cars of its make, and those owners of its cars who pride themselves on driving only up to date cars may feel compelled to buy vehicles with the new engine. It is obvious, however, that a radical departure from what may be called conventional design cannot have nearly so far reaching an influence on the selling value of old models as a change the other way. A freakish or unconventional model soon loses practically its whole value when abandoned by the manufacturer.

Cold Weather Precautions.

With the approach of cold weather it is well to remind motorists to look out for the cooling system of their cars so it will not be injured by freezing. Although every owner of a car knows that a water cooled machine will not stand exposure to frost unless special precautions are taken, numerous cylinders are cracked and radiators injured by frost each year, and it is especially in the late fall that such accidents occur. It is well to introduce the non-freezing solution into the cooling system as soon as the temperature drops below the freezing point during the night, as then a sharp frost may occur any time, and the non-freezing fluid is practically equally efficient and no more troublesome than ordinary water.

Probably the choice of a non-freezing liquid will this year be mainly between a denatured alcohol solution and a salt solution, as being the cheapest and generally most satisfactory fluids known. A 20 per cent. alcohol solution will stand freezing temperatures down to about 5° Fahr., and a 30 per cent. solution to about —9°. A 20 per cent. salt solution, rendered slightly alkaline by the addition of a little sal soda, has also been recommended in these columns. It shows 22 degrees Baumé when tested with the hydrometer, and will withstand 15° below zero, it is claimed. Extensive tests by several independent parties have shown this solution to be non-corrosive.

Some Notes on the Runabout Situation in France.

By P. Maisonneuve.

Ever since the beginning of the automobile movement some farsighted spirits have seen the future open to the motor vehicle as a practical means of conveyance aside from any considerations of sport. Unfortunately the imperfection of the early cars and the unsuccessful trials timidly made with business vehicles led to the conclusion that the automobile was destined to become merely an object of sport and luxury. This condition of affairs obtained in France until about 1905. But from that time on there has been a certain interest shown both in commercial vehicles for heavy goods and passenger transportation, and in the light business automobile for individual use.

In the following article I shall confine myself to the latter type of vehicle, which corresponds closely to the light runabout as manufactured in the United States. I believe that in America vehicles of 20-50 horse power are sold also under the name of runabouts. This latter type of car is very rare in France, where it is referred to as a "voiture légère type special course."

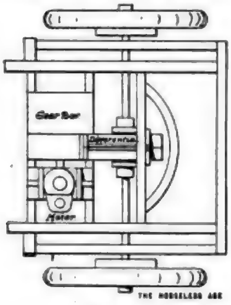
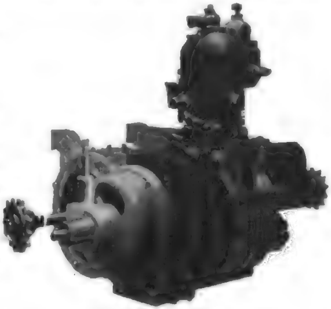


Fig. 1.

It is a most peculiar thing that in France, in spite of the demands of the public, the big manufacturers at first refused to bring out a low priced serviceable vehicle. There were then on the French market a certain number of voiturettes, but with the exception of a few makes (De Dion, Sizaire-Naudin, etc.) they were built by second rate concerns not disposing of the necessary capital to properly develop a new type of car. For this reason these voiturettes in the majority of cases are simply reductions of larger cars and often frail and unreliable. And yet in order to develop an ideal voiturette for use on the excellent highways of France, it would have been sufficient to take as a model the little 4½ horse power De Dion chassis then on the market, and to improve it in a few particulars.

As will be seen from Fig. 1 the characteristic feature of this small car consists in the use of a motor and transmission unit placed toward the rear of the vehicle and driving the differential gear directly. As is well known, the driving axle of the De Dion-Bouton cars comprises a spring suspended central portion which is connected to the two wheels by shafts with universal joints. The most important improvements to be made in this type of chassis are as follows: (1) A simple sgliding gear or planetary gear should be substituted for the individual clutch change speed gear. (2) Another type of body is desirable, as the vis-a-vis does not appeal to the fancy of the purchaser and gives the vehicle an out of date appearance. (3) An inclined wheel steering gear should replace the vertical steering column.



Ivry Power Unit.

This basis for the establishment of a practical, low priced runabout was at hand since 1903, but it is only recently that it has been taken advantage of by a French manufacturer, viz., the Compagnie Générale d'Electricité, Ateliers d'Ivry. The voiturette manufactured by this firm is equipped with a power unit comprising a single cylinder motor with magneto, a change speed gear with two sliding sets, and a differential gear with shafts and sprocket pinions, the whole forming a single, substantial unit fixed to the frame, which latter carries no other mechanical attachments, except the steering gear.

The two conditions which should always be aimed at in the design of runabouts are low cost of construction and low upkeep cost. The second requirement necessitates the use of the higher grade of materials and first-class workmanship. The cost of production must be reduced by manufacture on a large scale and the use of economical assembling methods. In the writer's opinion, the division of the mechanical parts into several units, which may be allowable for touring cars, cannot be permitted in light runabouts. It is necessary to combine all these parts in a single unit, which can be secured to the frame by means of four bolts; in no case should there be more than two assemblies, viz., the motor in front and the change gear and differential at the rear, but suspended from the frame.

The writer does not favor shaft transmission for light runabouts, for the reason that in spite of the relatively low speed of such vehicles the rear axle must withstand

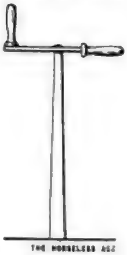


Fig. 2.

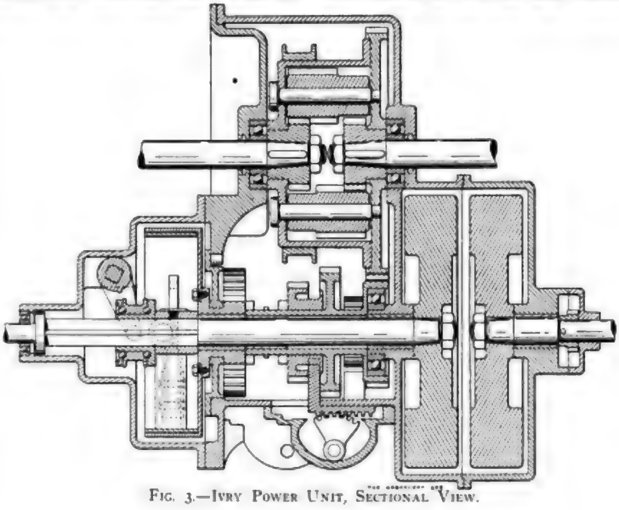


Fig. 3.—Ivry Power Unit, Sectional View.

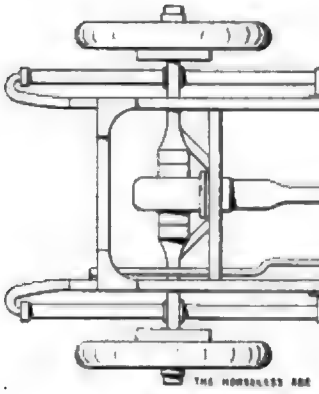


FIG. 4.

considerable stresses, which are the greater the heavier the axle. Now the shaft driven axle is heavier than the chain driven axle, and in the majority of cases it is not so strong. The several substantial rear axles of which the writer knows are rather expensive in construction, whether they belong to the De Dion type, with transverse universal shafts, or comprise a truss system of the Peugeot type, as shown in Fig. 4. The Chenard & Walcker combination of separate driving and carrying axles gives very good results in practice, and the large scale of production of this firm permits of fairly low cost of manufacture in spite of the complicated design, and these vehicles are among the lowest priced on the French market. The only objection to the chain is that it is exposed to dust and mud, but it may be effectively protected by suitable chain cases.

Since about a year ago a tendency toward gear changing rear axles has been manifest in France. This idea is in line with the tendency to combine various portions of the mechanism into a single unit, and from this viewpoint is justifiable, but from a strictly technical standpoint it represents poor practice, though in actual use it offers certain advantages. It is indisputable that the mechanical parts directly fixed to the axle are subjected to shocks and stresses which must have a destructive effect. Now this is exactly what takes place in a speed changing rear axle which carries not only the differential gear but also the entire gear box. Moreover, the wear of the tires, whether they be of the pneumatic or solid rubber type, is largely proportional to the unsuspended weight resting upon them. In spite of these disadvantages, which are certainly not ignored by the manufacturers employing this system, these vehicles find a ready sale in France. This system is embodied in the Sizaire & Naudin voiturette, the Darracq taxicab and the new Brouhot light cars.

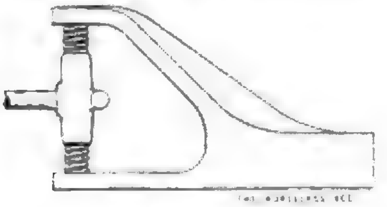


FIG. 5.

The latter vehicle is particularly interesting for the reason that it employs belt transmission. The motor is provided with a pulley for carrying the belt, as is also the change gear shaft on the rear axle. Three of these small vehicles fitted with cab bodies took part in the recent commercial vehicle contest and showed up excellently. The belt is a perfect transmission device, as in transmitting motion it absorbs any abrupt variations, but few manufacturers have been successful with it. Brouhot places the belt between the motor and the change gear, with the result that the tension in the belt is light, while the speed is high, consequently the danger of the belt stretching or breaking is largely eliminated. It is also advisable in using the belt drive to have the two pulleys connected of substantially the same diameter.

It is absolutely necessary that the transmission devices of an automobile should be somewhat flexible, so that the sudden impulses of the motor and shocks due to road obstructions transmitted to the driving shafts, differential and change gear may be absorbed. Among all the runabouts on the French market the writer knows of only a single one in which the need of a flexible transmission mechanism has been taken into account. In this vehicle a coiled spring is interposed between the crown of the differential and the differential itself, which spring absorbs most of the inequalities in motion. The interposition of a shock absorbing device into the transmitting mechanism considerably reduces the wear and liability to breakage of these parts, and is really imperative in a light business vehicle.

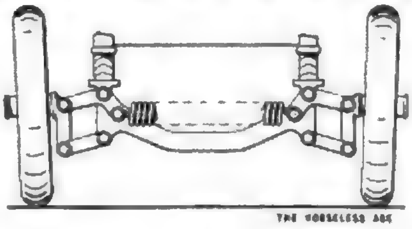


FIG. 6.

One or two French manufacturers sell light cars with solid rubber tires, and even with steel tires, thus catering to that section of the public who are disgusted with the frailties of the pneumatic. But simply substituting solid tires for pneumatics does not solve the main problem, that of vehicle suspension. Numerous elastic wheels have been brought out during the past few years, but none of them has given satisfactory results. An interesting recent solution of the suspension problem for light vehicles is presented in Fig. 5. By this arrangement the axle stubs of the steering axle are allowed a vertical motion with respect to the axle, being balanced between spiral springs. Each rear wheel runs on an axle stub connected to the end of the axle by means of parallel links of the same length, the top links forming one arm of bell cranks, the other arms of which are connected together by a coiled spring under tension (Fig. 6). This suspension is the invention of an Italian engineer, M. Granieri. Although such arrangements are not to be recommended for high speed vehicles, they are perfectly suitable for low speed, light and moderate powered cars, as they permit of dispensing with the use of pneumatic tires.

Increase in the Capacity of Storage Batteries with Increase in Temperature.

Various investigators have observed different rates of increase in the capacity of storage batteries with a rise in temperature. Thus Heim found an increase of 2.6—3 per cent. for a rise in temperature of 1° Cent. Gladstone and Hibbert obtained an increase in capacity of 50 per cent. by increasing the temperature from 15 degrees to 37 degrees. On the other hand, M. U. Schoop and the Accumulatoren Fabrik A. G. obtained only an increase of 1 per cent. for a temperature rise of 1 degree. As these great differences cannot be explained by variations in the active material and conditions of the tests (age, design, thickness of plates, current density, density of the electrolyte, etc.), a new series of tests have recently been carried out by Otto Hildebrand on Planté and Faure electrodes with varying current densities and concentrations of electrolytic. It was found that it is impossible to deduce from test results a generally applicable law regarding the variation of capacity with temperature, and that the determination of such laws for individual types offers great difficulty and requires much time. In a general way the test results admit of the following conclusions: The type, the age and the previous history of the storage battery, as well as the degree of temperature, have an influence on the increase in the capacity with the temperature. The latter is greater at low than at high temperatures (50° Cent.). The capacity of Planté electrodes is less affected by variations in temperature than the capacity of Faure electrodes. The former are more sensitive to variations in the rate of discharge than the latter. Continued temperature increases reduce the capacity and life of a storage battery. In the neighborhood of 15° Cent. the increase in capacity amounts to at least 1 per cent. per degree centigrade.

At a recent meeting of representatives of the German Imperial A. C., the Bavarian A. C., the Hungarian A. C. and the Austrian A. C., the route for the next year's Prince Henry Cup contest was tentatively laid down as follows: Berlin, Breslau, Carpathian Mountains, Budapest, Vienna, Linz, Salzburg, Munich. For the hill climb a suitable course would be selected in the Carpathian Mountains, while the level race would again be held in the Forstenrieder Park. The route will first be submitted for approval to Prince Henry of Prussia, and will be finally decided upon at a meeting to be held in Vienna in November.

A Plea for the American Chauffeur.

By Xenophon P. Huddy, Counsel for the Professional Chauffeurs' Club of America.

A new class of persons, representing a new calling, has sprung up in the United States. As a necessary outgrowth of the development of the automobile, the chauffeur has come into existence. Chauffeurs constitute quite a large class; at least the public would be so impressed if all the registered automobile drivers in the United States could be assembled together in a single convention hall, for instance.

THE CHAUFFEUR IS ENGAGED IN MANUAL LABOR.

The chauffeur is now a factor to be reckoned with. His calling is sometimes designated as a professional occupation, he being referred to as a professional chauffeur. This designation is not strictly correct, however. The chauffeur is the possessor of a trade and follows a mechanical occupation. He is engaged in manual labor. To properly and correctly classify the chauffeur's calling it would be necessary to place it among the great branches of labor. In fact, it has been held by the highest courts of England, under the employers' liability law, which gives certain rights to employees engaged in manual labor, that the chauffeur is employed in manual labor and comes within the provision of the law. We may, therefore, correctly call him a laboring man, and he is eligible to the labor class in this country.

NUMBER OF CHAUFFEURS IN UNITED STATES.

The number of persons engaged in driving automobiles for hire is by no means small. In most States of the Union chauffeurs must register in order to engage in their calling. Official records of all the licensed chauffeurs may be found at the capitals of these States covering a period of about six years past. In the State of New York, for example, during the past two years, about 20,000 chauffeurs were registered with the Secretary of State at Albany. It may be estimated that there are today in this country from 75,000 to 100,000 registered automobile drivers, the majority of whom are driving automobiles for their living. This constitutes a large class of citizens, who, if they are properly organized—which, by the way, is now being done—may constitute a powerful force in directing not only legislation but the machinery of the Government.

FOREIGN BORN AND UNNATURALIZED CHAUFFEURS.

Of this large number of individuals engaged in the chauffeur's calling possibly 25 per cent. are of foreign birth, and some of these are not naturalized. Perhaps 5 per cent. would be a fair estimate of the proportion who are not citizens of the United States. Since the chauffeur's calling is one of manual labor, it would be illegal for an owner of an automobile or the proprietor of a taxicab service to import foreign chauffeurs into this country under contract to work here. A chauffeur is not a domestic or menial servant. It is known that foreign chauffeurs do come to the United States and work for wages very much lower than the prevailing wages for American automobile drivers, but very little trouble has as yet been experienced in this respect. The American automobile drivers are on the alert to protect themselves against foreign competition. One or two instances are now known where foreign drivers have been imported for service in this country.

WAGES.

The wages of chauffeurs vary from $14 in some cases in the country districts to $50 a week in the larger cities. In some instances they are demanding more than $50. Aside from the regular wages, a great many automobile drivers receive their board and lodging, and their expenses are paid while they are touring. The calling is one which demands fair wages, at least. Liberal wages are generally paid, not only because a good chauffeur must necessarily be a man of intelligence and mechanical experience, and a safe driver, but people who hire automobile drivers can usually afford to pay liberally. Many automobile drivers—in fact, I may say most of them—were, previous to entering their present calling, engaged in some mechanical line of work. Many of the best of them were expert machinists. Some have been engineers on electric railways, others have been engineers on steam locomotives; the best of them usually had excellent mechanical training.

SOCIAL POSITION.

Socially the chauffeur's standing is neither one of great dignity nor is it one of inferiority. He, of course, is employed generally by an employer of some financial standing, and often of more or less social position. He is by no means on a level with the coachman, but stands far above him. The chauffeur is oftentimes a great companion for his employer, and in many instances he is far better educated. From my experience as counsel of the Professional Chauffeurs' Club of America, which is the representative organization of automobile drivers in the United States, I have come in touch with many hundreds of chauffeurs, and have found that the majority of them are men of keen insight and good education, and many of them are capable of speaking four or five languages. There are very few who have not traveled throughout Europe, and many of them go abroad every year. They have seen the sights of the world and are able to converse intelligently on all subjects. They are keen business men. Most of them are married and have families. Their calling is one that takes them away from their homes, and this seems to be the main objection which many chauffeurs have against their occupation. They are unable to enjoy their homes as much as men who are engaged in other pursuits. Necessarily, the chauffeur's calling takes him from place to place at the will of his employer. One day he may be in the city of his home, and the next day hundreds of miles away, and probably the week after thousands of miles. He may spend the greater part of one year in Europe and the next he may spend in California.

THEY ARE LIBERAL SPENDERS.

Ordinarily the chauffeur is quite liberal with money (sometimes not his own). He travels geenrally with an employer who spends money freely, and soon learns, to his misfortune, to disregard the value of money. This is one of the most pitiable aspects of the chauffeur's calling—his tendency to throw away the money which he has earned instead of saving it for the future. He generally buys expensive meals, because he has been accusomed to buy them and have somebody else pay the bills. He buys expensive clothes, because he sees his employer wear costly garments. He generally dresses in the best of taste, because he learns to do so from those whom he accompanies. He knows what is the proper thing to do under all circumstances, socially and otherwise. He knows how to conduct himself in the presence of ladies, because his keen observation has taught him what the correct thing is. He knows how to be polite and courteous, more so than his employer, in a great many instances. He attends social functions, and although not a guest he generally enjoys all the privileges of such functions, except those belonging to the guests who are invited. In fact, his environment during the course of his employment does everything to uplift him, and when he gets out of employment, or if he should take up another line of business, he finds himself burdened with expensive tastes.

ORGANIZATION OF CHAUFFEURS.

With many thousands of men in this country pursuing the same calling, it is natural that the desire to organize should have manifested itself. There is a mutual sympathy between people doing the same thing and working for the same objects. We already have in this country a national chauffeurs' organization, the Professional Chaffeurs' Club of America, which has a large clubhouse at 158 West Sixty-fifth street, in New York city. There are now about 1,000 members in this organization. In various other cities there are allied clubs. No one is permitted to join the association without first passing a severe examination, which is conducted by the examining committee composed of expert mechanics and drivers. This club is the representative organization of automobile drivers of America, and is now working to organize all the chauffeurs in the United States. It is working for fair and just legislation, for good roads and the general uplifting of the chauffeur. It advocates that before a chauffeur be given a license, he should be compelled to pass a strict examination covering qualifications, including hearing, eyesight and heart action, as well as mechanical ability and knowledge, and ability to drive safely. This latter qualification should cover the rules of the road and the automobile law of the State in which he drives.

The chauffeurs have commenced to realize that it is absolutely necessary that they should make the driver's license of value and not easy to obtain, and the privilege to be appreciated once it has been obtained. The laxity of the present requirements under the law permits any person to obtain a license, as, for example, in the State of New York, where a mere child may obtain a chauffeur's license, and even a blind person may become a chauffeur under the law. These are glaring instances of the looseness of our laws and the lack of protection not only to the public, but to those who drive automobiles for their bread and butter.

LEGISLATIVE STAND TAKEN BY CHAUFFEURS.

The chauffeur believes that all who drive automobiles on the public highways should possess the same qualifications and pass the same examination required by law, whether they are owners of automobiles or paid operators. Why the citizen who drives an automobile to support his wife and children should be subjected to greater restrictions than an owner of a motor vehicle who drives, is a question not easy to answer. The trained chauffeur is more of a mechanic and a better driver generally. If any distinction is to be made between the two classes, the situation should be the reverse. "But," it is said, "the chauffeur enjoys a franchise, a special privilege, which he should pay for; consequently he must become licensed and pay a fee or tax." This is what the American Automobile Association says. Very good. Then let the chauffeur be represented in the enactment of automobile legislation. "Taxation without representation is unjust. To regulate and tax the chauffeur's calling without permitting him to have some voice in the matter is disregarding the chauffeurs' rights as United States citizens. What right, may we ask, has the American Automobile Association to put through legislation regulating the trade by which the automobile driver earns his living? Has it come to pass in this free country that one class of citizens may rule another class with impunity? The chauffeur has been batted about here and there at the will of those who framed the present automobile laws in the several States, and he will still continue to be subjected to the will of others to his detriment, unless he asserts his citizenship rights and exercises the power which is at his command.

When the American Automobile Association attempted to obtain the enactment of a federal automobile law which would grant an interstate license to automobilists only owners of automobiles were considered in the bill. The chauffeur who drives for his bread and butter was totally ignored. Under the proposed law he would be compelled to pay for the individual State licenses, while the owner would be relieved of this responsibility. There can hardly be found a parallel to this instance of attempted injustice. In all probability the chauffeur was overlooked, but such neglect is inexcusable. The American Automobile Association was simply pursuing its ordinary tactics of proposing legislation with no regard for the automobile driver in so so far as permitting him to have a voice in the measures.

THE CHAUFFEUR IS GENERALLY THE SCAPEGOAT.

To be able to lay the blame on the shoulders of the chauffeur who drove the car when it was being operated illegally, or at the time it happened to collide with another person on the public highway, is at times well worth the salary which is paid by the owner to the driver. Moreover, it is not pleasant to have a criminal record attached to one's name. Therefore motoring is made more enjoyable if the stigma of criminal conviction is not apt to be connected with it. When an automobile is stopped because it exceeded the speed limit, the chauffeur, the man who is at the wheel at the time of the arrest, is accused of violating the law. He is compelled to answer to the charge, and in nine cases out of ten he is found guilty. Ordinarily, the speed at which he was going at the time of his arrest was sanctioned by the owner who sat in the tonneau, at least there was no objection made to the rate of speed, consequently it was acquiesced in. But the owner is not held criminally responsible for the violation of law. He may and often does pay the chauffeur's fine. However, he is not compelled to go into a filthy court room, wait all day for his case to be called and then be stamped with a criminal record. The chauffeur is often made the scapegoat upon whose shoulders criminal and civil responsibility are thrown for the purpose of protecting the man higher up, who oftentimes is not only depraved morally but is unworthy of association with clean minded men. Probably no one is as well acquainted with the conduct of the members of the fashionable set as the chauffeur. Reluctantly we are compelled to admit that the automobile is often devoted to immoral purposes. Those who thus use it seem to think that it affords a shelter or shield of protection from publicity, and it probably does, unless an accident happens, which generally reveals some kind of a scandal.

GRAFT.

The chauffeur, speaking for the class, is not a grafter. He did not originate the custom of paying commissions to employees who buy automobile supplies, nor is it a general rule among the better class of men that secret commissions are accepted without the consent of their employers. There is a great deal to be said in favor of giving chauffeurs commissions; equally as much as can be said against it. Garage keepers and supply men are all in the same boat, so to speak, and there can be little objection on the part of automobile owners if their chauffeurs do receive commissions; provided, of course, purchases are made to the best interests of the employers, if they themselves are unable to get any reduction in prices if they buy directly. The period of the grafting chauffeur is passed. Most certainly the representative chauffeurs' associations will not stand for their members receiving illegal commissions on supplies purchased for employers, and it cannot be rightfully said that the chauffeur is in any sense of the word a grafter. I personally know of many chauffeurs who receive commissions on supplies purchased, but generally it is with the express knowledge of their employers.

Let us give the chauffeur a "square deal."

Baker Motor Vehicle Company of New York Fails.

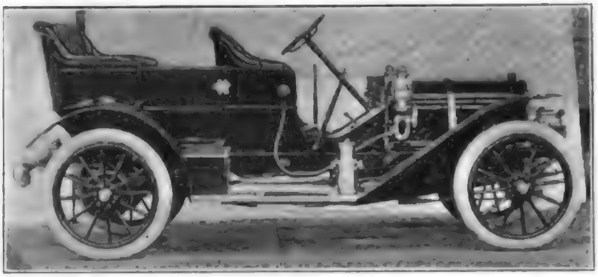
A petition in bankruptcy was filed last week against the Baker Motor Vehicle Company of New York, 1788 and 1790 Broadway, New York. Among the creditors are the Electric Storage Battery Company, with $7,464; the Diamond Rubber Company, with $1,439, and Anthony G. Imhoff, with $600. These were represented by Willard P. Jessup, who filed the petition. James N. Rosenberg was appointed receiver and ordered to continue the business until further notice.

The company was incorporated under New York laws on August 16, 1907, with a capital stock of $20,000, with Nathaniel Platt as president, to act as New York agent for the Baker Motor Vehicle Company of Cleveland, Ohio. The liabilities are reported to be $100,000, and the assets from $20,000 to $30,000. It is stated that the Baker Motor Vehicle Company of Cleveland, a creditor for $25,000, claims that it has a prior lien on the assets over all the other creditors. The question as to the rights of the various creditors will probably have to be decided by the courts.

Union Carriage Company Enters Auto Field.

The Union Carriage Company, of St. Louis, which has been building horse vehicles for the past seventeen years, has been experimenting with automobiles for more than a year and expects to market 500 cars the coming season. The first lot of twenty-five cars are now coming through the factory and will be ready for shipment to agents in about two weeks. The Union car will be guaranteed for a year from date of the original purchase. The officers of the company are: Geo. E. Deeds, president; W. C. Ingram, vice president; Geo. A. Laws, secretary; John B. Keough, treasurer.

NEW VEHICLES AND PARTS

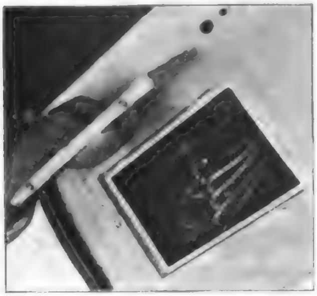


Rambler Model 44, Thirty-four Horse Power Touring Car.

Rambler 1909 Models.

The Rambler line for 1909 consists of a 34 horse power, four cylinder, five passenger touring car, Model 44, successor to the 1908 Model 34; an entirely new 45 horse power, four cylinder model, furnished either as a roadster, seven passenger touring car or limousine; a 22 horse power, two cylinder model, the Rambler "utility car," to succeed the 1908 Model 31, and a two cylinder runabout, Model 47. Models 44 and 45 are alike in design, differing only in engine size and power, wheel base, tire size and body capacity. Changes from 1908 design are matters of either refinement or convenience only.

The engine of Model 44 has a 4½ inch bore and a 4½ inch stroke. As used in 1908 this engine delivered 32 horse power; by increasing the valve size and carburetor capacity 34 horse power is now obtained. The most distinctive motor feature is an offset crank shaft. On account of this, it is claimed, and the straight line drive, it is possible to throttle the four cylinder Rambler models to 3 miles per hour on the high gear, and the power at low engine speeds is greatly increased. The flexibility and power at low speeds are further augmented by adding 26 pounds to the weight of the flywheel rim.



Trap Door in Floor Over Oiler.

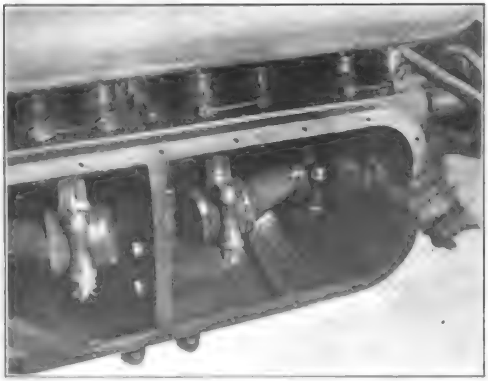
The cam gears have been doubled in width. The drive gear is of rawhide, of great width and claimed to be absolutely silent. The crank case is of one piece, the shaft and assembled bearings being inserted from the rear end. These bearings are of the marine connecting rod wedge type. This permits adjustment from the handhole opening. The handhole is located at the right side and is 8x23 inches, of sufficient size to give perfect access both to main and connecting rod bearings. With this design necessity of removing the mud apron and oil pan, a long and awkward task, is eliminated. The front guards are of the quick detachable type, so that the engine handhole cover and bearings can be reached from the side of the car without any inconvenience.

In the 1908 engine the exhaust manifold was set at an angle of abount 45 degrees. The new exhaust manifold is raised and permits better access to the valve stems and adjusting nuts and springs. The timer is raised somewhat, so that it can be more easily reached. Flexible cable is now used for the primary as well as for the secondary current.

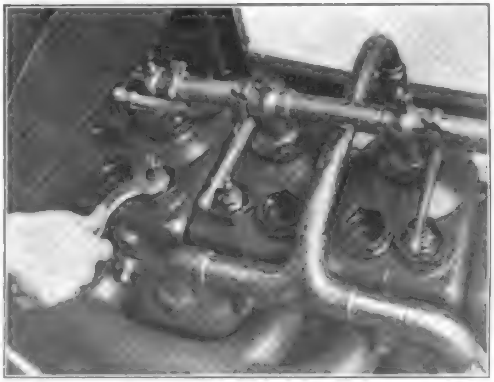
A new and convenient device is provided for a spark plug terminal. The wire terminates in a fibre block. This block is in turn retained in a bracket attached to the upper water pipe. A thumb screw locks the bracket in any desired position. A metal strip fastened to the fibre block completes the circuit between the wire and the plug. This metal strip is placed on the flat metal spark plug top. Should missing occur because of soot at the spark plug points, raising the fibre block a little will create a spark gap, and the missing can be temporarily overcome without changing the plug. If it be desired to remove the plug the fibre block is raised clear from the plug, so that the wire does not have to be disconnected or changed to remove the plug. The arrangement is both mechanical and convenient.

The pump is now driven from a separate shaft on the side opposite to the cam shaft. The pump also is entirely detached from the gear case, so that should a leak arise water cannot enter through the cam gear or crank case. This pump shaft is arranged to permit the fitting, if desired, of a magneto. The standard Bosch high tension magneto will be carried in stock. The magneto is placed at sufficient distance from the crank case and the oiler to permit perfect access to it for inspection and adjustment.

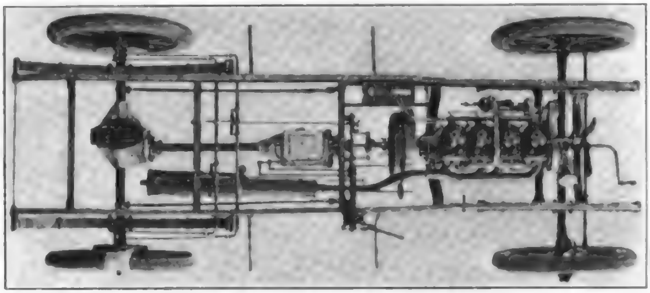
The relief cocks for the cylinders, instead of being of the ordinary pet cock



Large Handhole in Crank Case.



Terminal for Secondary Wire.



Rambler Model 44 Chassis.

type, are provided with check valves, which are held closed by springs and the compression from within the cylinders. The greater the pressure against the check valve, the tighter they will come. Lubrication is provided by a force feed oiler, of 50 per cent. greater capacity than that of 1908. The oiler is also located a little farther back, to permit better access to the magneto. It is placed in an oil tray to catch any slopover and flying oil from the flywheel, and the clutch is taken care of by a metal flywheel guard.

The balanced type of inverted cone clutch formerly used has been replaced with the direct thrust type. This cone is made of pressed steel instead of aluminum, thus being less susceptible to variation that might result from severe use, and is provided with surface increased about 50 per cent. This clutch differs from other cone clutches principally because of its greater amount of surface and by virtue of a provision for varying the tension of the clutch spring. The adjustment, as the illustration shows, is easily accomplished by means of three accessibly located nuts. Should there be any tendency of the clutch to start slipping the tension of the spring can be increased to overcome it. The adjustment can easily be made on the road at any time, thus eliminating the necessity for burning clutch leathers. The studs which can be seen extending from the inner circumference of the clutch cone contain spiral springs placed under the leather to assure gradual engagement of the clutch.

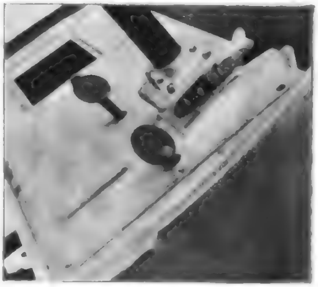
A rosewood block is placed in the bearing provided for releasing the clutch, the friction of this block acting as a brake to stop the clutch spinning when released.

The clutch can be released by a pedal or the brake lever. The throw of the pedal has been reduced about 50 per cent. from 1908. The connection between the brake lever and clutch is so arranged that the clutch is entirely released by the first two inches movement of the lever. The brake can, therefore, be so adjusted as to act independently of the clutch. That is, the clutch can be released and held out by the brake lever without applying the brake, further movement of the lever making no change in the clutch position. The illustrations well show the great leverage provided by the Rambler design of pedal.

The change gear itself is the same as in 1908, the only change being in the shifting mechanism. The rocker arms and brackets formerly located at the rear of the gear box, to carry the shifting levers, have been abandoned, and gear shifting is now accomplished by direct thrust through sector gears and rods. The present arrangement is much simpler and more positive.

The reverse gear is engaged by a lever position directly back of that for the first forward speed. To prevent an inexperienced operator going into reverse when it is desired to change from first to second speed, a bell crank is located so as to interfere with the backward movement of the lever which engages the reverse, and which extends downward from the lower operating sector gear. When it is desired to engage the reverse gear, this obstructing crank can be removed by pressing a small button in the floor.

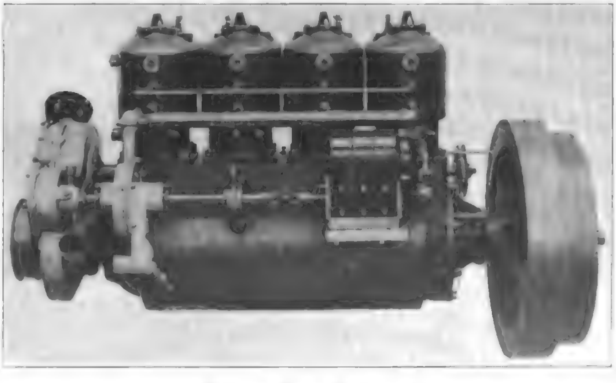
In order to retain the grease in the gear box a stuffing box is placed on the propeller shaft just back of the rear bearing, and another around the large front bearing located in the housing, through which the grease has heretofore had a tendency to get out. Stuffing boxes are similarly located on the rear axle shafts to retain in the differential the grease placed there for lubrication. The rear hubs are increased in diameter, to correspond with the front, and the hub caps are now interchangeable.



Aluminum Floor and Adjustment of Steering Column.

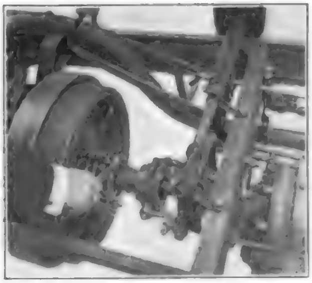
The gear box is supported by a bracket attached to a cross girder, which provides a sliding joint at its attachment to the gear box. This bracket is now secured to a girder by three bolts. When these bolts are removed the gear box can be lowered, and access be had to both the clutch and universal point. Simplification of the method of attaching this bracket greatly lessens the labor of taking down the clutch and universal joint.

Probably the one new Rambler feature which will be most appreciated by owners is the provision for brake adjustment. Both the foot and lever brakes are adjusted by shortening the rods which connect the lever and pedal to the equalizing shafts. At the front end of these rods are placed large thumb nuts that can be easily reached by raising the aluminum front floor and adjusted, as the illustration shows, by the hand. This arrangement makes brake adjustment possible on the road without stopping the car.



Rambler Model 44 Motor.

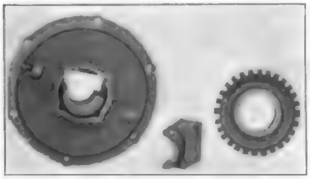
Showing separate pump shaft, pump detached from cam gear case, and magneto location.



Adjusting Rambler Clutch.

The brakes are of the same size as before, but the leverage is increased by changing the position of the brake shoe and band operating lever. The brackets supporting these levers were before of such design as to limit the backward position at which the brake levers would be at rest. The brackets have now been hollowed out, so that when at rest the brake levers stand at an angle to the brake rods of 45 degrees, and when the brakes are applied, at 90 degrees. That is the position which provides the greatest leverage.

The Rambler steering outfit is based on the same nut and screw principle as employed for six successive years. For 1909 the steering parts are heavier. Better provision is made to guard against and compensate for wear. Downward thrust is provided for by a ball thrust bearing located at the top of the steering column. Wear in the nut and screw is guarded against by the use of a hard bronze nut. In the earlier models babbitt was used. The steering arm is carried well out to the frame, so that the connecting rod to the steering knuckle does not interfere with the mud pan and travels nearly parallel with the frame in a straight line.



Centre Engine Bearing, Self Centring. (Model 41.)

The new Ramblers are particularly noticeable for their features of increased comfort or convenience. One of the most important of these is an adjustable steering column. The wheel can be placed in any desired position to suit the purchaser, and then securely locked in place by means of the brackets shown in the illustration. This illustration also shows the upper section of the aluminum floor. Both this and the horizontal sections will for 1909 be aluminum. The large square opening is a provision made for boiler inspection. This opening is closed by an aluminum cover.

Improved riding qualities are secured in the new models by springs which are called triple action. Besides the flexibility provided by the auxiliary coils these springs are unusually long.

The body is of the straight line type, with front and rear seat backs of nearly uniform height. The tonneau doors are provided with a special lock—a Jeffery patent—which operates as nicely as any house door latch and holds the door securely in place when closed, it is claimed. A detachable toe rail is placed in the tonneau. A simple design provides latitude for a variation in position of 10 inches, with a possibility of instant change without use of wrench or screwdriver.

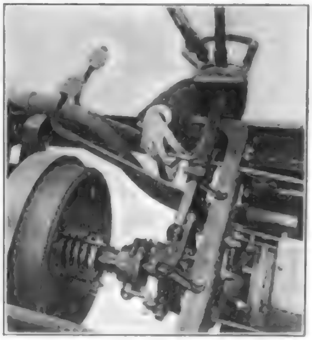
The two cylinder Rambler models for 1909 will be known as Model 41 (furnished either as a five passenger touring car or a two passenger runabout), and Model 47, a strictly runabout model—furnished for two or three passengers. Very little change from 1908 construction has been made in these models. The unit power plant is continued in the same form. The Rambler tilting body gives easy access to every part beneath it, including the main engine bearing, which is of the self centring type, and adjustment is accomplished by drawing together the two halves placed in a tapered box, by turning in the adjusting ring. A floating type rear axle is used. The car weight is carried on heavy roller bearings, located on the axle tube, instead of within it. The aluminum rear axle housing of the last two seasons has been replaced by a heavy forged yoke, which provides greater strength without need for a truss, and gives a much higher clearance. The lowest point of this car is the rear sprocket, and as this is located to one side of the centre it clears the ridges which centrally located sprockets would encounter. Then the wheels are 34 inch in diameter, and there is 15¼ inches from the ground to the axles.

The rear wheels are provided with pressed steel drums for the brakes, 13 inches in diameter and 2½ inches wide. This provides about double the braking surface of earlier models, and hereafter the rear wheel brake will be used for the primary brake, and that on the transmission only for emergencies. A sheet steel mud apron provides thorough protection to the carburetor, timer and the other mechanism. A wire net apron was used before.

To add both to appearance and the comfort of driving, the steering wheel has been increased in diameter from 14 to 17 inches. The wheel now is also built up of solid mahogany. Slight alterations have been made in the carburetor, which is of the simple puddle type, and in the valve timing, to increase the power. Although still rated at 22 horse power, greater power than this is now actually delivered, it is claimed. The wheel base of this model is 106 inches. The wheels are 34x4 inches, and with the special type of full elliptic springs, with scroll ends, it is claimed that unusually good riding qualities are provided.

Thomas 1909 Models.

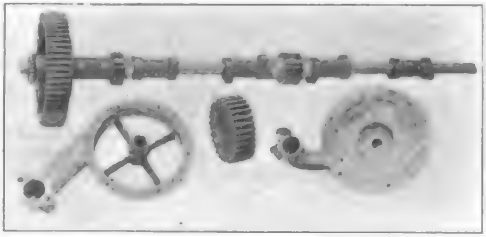
The E. R. Thomas Motor Company, of Buffalo, offer a very complete line for the coming season. It comprises seventeen regular and some special models. This variety is obtained by placing different styles of bodies on several sizes of chasses. These are designated by a compound numeral descriptive of the motor. The first number represents the number of cylinders, and the last the horse power rating. We will take up these chasses in the order of decreasing size.



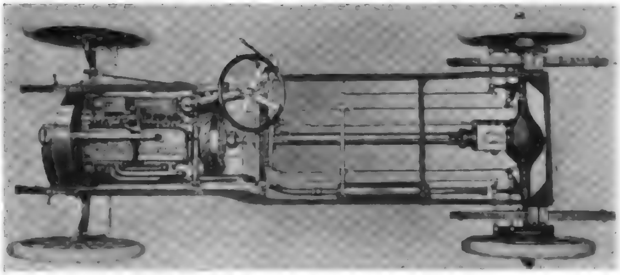
Adjusting Rambler Brake.

THE SIX-SEVENTY.

This is a very large car, built especially for the hardest touring conditions, to carry heavy passenger and baggage loads over



Rambler Cam Shaft, Cam Gear and Pump.



Thomas 6-40 Chassis.

all sorts of roads. Also for use with closed bodies by those who wish every luxury of equipment.

The motor has individual "T" head cylinders, and is water cooled by gear pump circulation. Extra good air circulation is provided for by a double fan system, consisting of a gear driven fan in front and blades on the periphery of the flywheel. A double system of ignition is furnished, consisting of a Bosch high tension magneto and an Atwater Kent spark generator. The clutch is the well known Thomas triple disc, with cork inserts and automatic brake. The change gear is a four speed selective, with annular ball bearings. The final drive is by side chains. The axles are I section forgings. Wheels are 36 inches in diameter. The tire sections vary with the style of body employed. All springs are long semi-elliptics, and are provided with rebound clips. In addition to these, shock absorbers are regularly fitted. The steering gear is a large diameter worm and sector. Expanding brakes are provided on the rear wheels and contracting brakes on the countershaft. The wheel base is 140 inches, and the tread is standard. Great attention has been paid to neatness of detail and the arrangement of small parts.

THE FOUR-SIXTY.

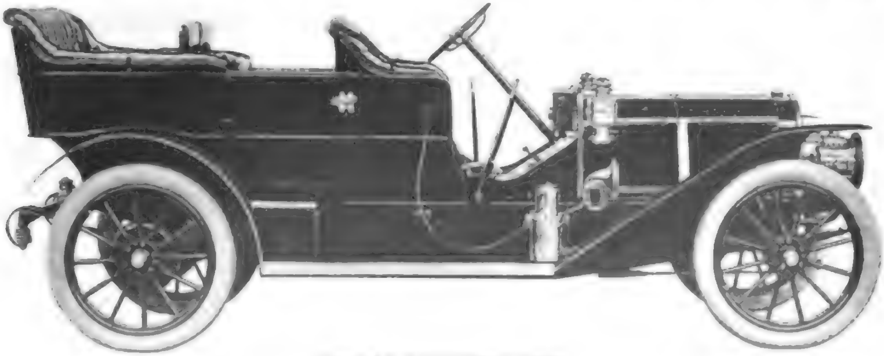
The four cylinder model is similar to the six, except for such changes as are made necessary by its smaller size. It has a wheel base of 127 inches. It differs from the Thomas car which won the New York-Paris race only in a few minor details. In fact it will be seen from the foregoing that these two models are very similar to the corresponding 1908 models, differing from them mainly in small details.

THE SIX-FORTY.

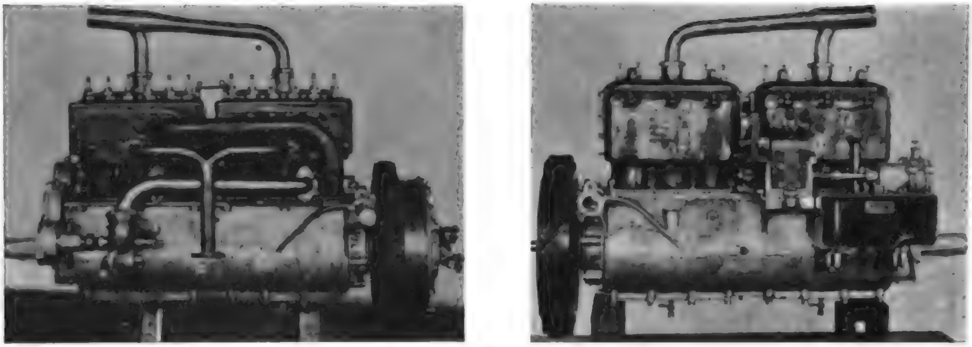
This is an entirely new model, no previous car of this size having been built by the Thomas Company. It has been designed with the idea of getting a very high car of considerable size. The cylinders are cast in two units of three cylinders each. The crank case is of the barrel type, with large hand holes on the cam shaft side. The nickel steel crank shaft is carried on three annular ball bearings. Cooling and ignition systems are similar to those of the larger cars, except that only the flywheel fan is used. The clutch is the standard Thomas plate type. Shaft driving is employed on this lighter car. The propeller shaft has two universal joints and moves independently of its encasing tube, which also acts as a torsion member. A very compact three speed selective change gear is housed with the driving bevels. Gears, axle shafts and rear wheels have annular ball bearings. The front wheels have taper roller bearings. Semi-elliptic springs are used in front and scroll full elliptic in the rear. They are made of vanadium steel and fitted with rebound clips. Steering is by

Water Circulating Pump.

Thomas Plate Clutch.



Thomas 6-40 with Special Body.

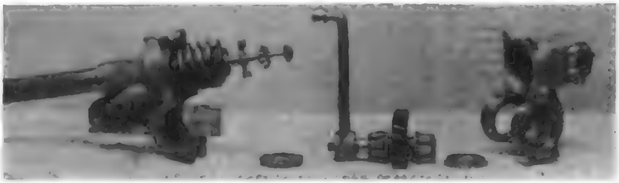


VALVE SIDE—THOMAS SIX-FORTY MOTOR—RIGHT SIDE.

worm and sector gear. Both sets of brakes are on the rear hubs. The wheels are 36 inches in diameter. The front wheels have 3½ and the rear ones 4 inch tires. The wheel base is 122 inches and the tread is standard. The frame is given an unusually large drop, which brings the centre of gravity low, even with the large wheels and good spring clearance.

THE FOUR-SIXTEEN.

This model is intended mainly for city use. The chassis is similar to that of the well known Thomas taxicab, which has been fully described in these columns. It has a wheel base of 103 inches and 54 inch tread. The wheels are 32 inch, with 4 inch tires. The motor is of the new block construction. Clutch drive shaft and change gear are similar to those used on the 6-40 models.

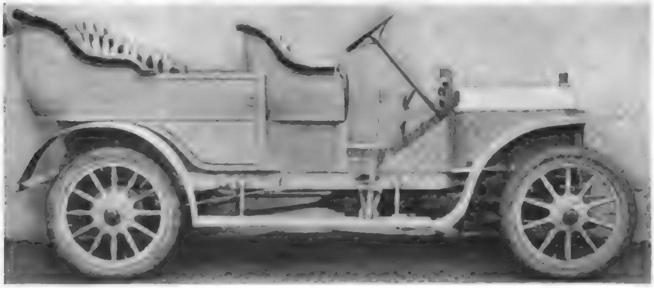


THOMAS STEERING GEAR.

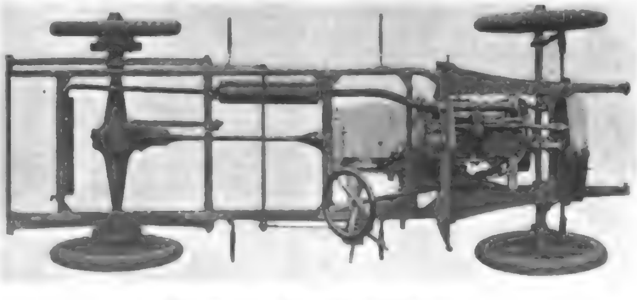
A description of all the bodies offered with these chasses would be far beyond the scope of this article. It is sufficient to say that the variety offered should meet the needs of practically every purchaser. The body illustrated on the 4-60 is a special design, and is not regularly furnished.

The 15 Horse Power Napier.

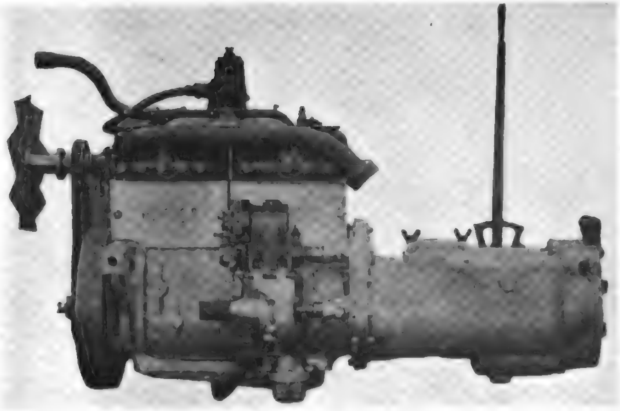
The Napier Works at Acton, England, have made a distinct departure from their former practice in bringing out a four cylinder, 15 horse power, worm gear driven car for 1909. This car is the result of an increasing demand for a lighter car than their regular six cylinder models. The motor is of the four cycle, water cooled type, with four cylinders, cast in pairs, with integral heads and water jackets. The bore is 3¼ inches, with a stroke of 5 inches, and the motor is rated at 15 horse power. The inlet and exhaust valves are located side by side in a pocket in the side of the combustion chamber, and are actuated through push rods from the cam shaft inside the crank case. Large removable oil and dust tight plates cover the valve springs and push rods, thus affording them perfect protection. The crank case is cast in two parts, the lower part forming the oil reservoir. The cam shaft gears and gears for driving the magneto and water pump are at the rear of the motor, the flywheel being placed in front. The housing for these gears is an integral part of the casting which forms the housing for the clutch and change gear mechanism,



FIFTEEN HORSE POWER NAPIER TOURING CAR.



FIFTEEN HORSE POWER NAPIER CHASSIS.



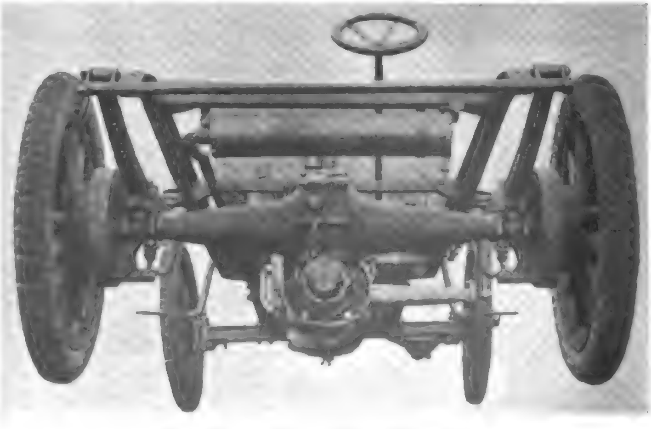
Fifteen Horse Power Napier Engine, Ignition Side.

thus making a unit of the motor, clutch and change speed gears, the whole being supported on the frame on the three point principle, two lugs, cast integral with the forward part of the crank case, forming the forward support, and the rear end being bolted to one of the cross members of the frame. A rotary, gear driven pump circulates the cooling water, with a fan in front to create the air draught. The fan spindle is secured to a bracket bolted to the forward cylinder, runs on ball bearings, and is belt driven from a pulley secured to the flywheel. The carburetor arrangement is somewhat peculiar. The float chamber is located on the right hand float of the engine, and is secured to the crank case. From the float chamber a pipe leads up and over the engine to the mixing chamber and throttle located on the inlet manifold over the engine. The pipe from the float chamber is water jacketed for about a foot of its length, the water jacket of the forward pair of cylinders being tapped for the hot water supply. With this arrangement a correct mixture is said to be obtained at all engine speeds with a marked economy of fuel. Lubrication is effected by a mechanically operated pump, just below the water pump, forming part of the crank case. This pump draws oil from the reservoir in the bottom of the crank case and forces it to all the bearings of the engine, the oil returning to the sump by gravity. A pressure gauge on the dash indicates at a glance whether the oil is circulating. Both the inlet and exhaust pipes are of large size, reducing to a minimum wire drawing in the inlet pipe and back pressure in the exhaust. Ignition is by a high tension Bosch magneto, shown just above the water pump. It is readily removable by loosening the strap which passes over the field magnets. Power is transmitted through a multiple disc clutch to the change gear mechanism, contained, as before mentioned, in a single housing and running in oil. The top of this case is provided with a large removable cover, which is, in turn, provided with a hand hole for inspection and application of lubricant. The change gear mechanism provides three speeds forward and reverse, and is operated selectively. A tube integral with the gear case projects outward, and has secured to it the change speed gate quadrant, thus forming a neat and protective casing for the gear shifting shaft. The final drive is by a Cardan shaft, fitted with one universal joint, to the live rear axle. The rear axle drive is by worm and wheel gearing, the worm being secured to the under side of the differential casing. The rear axle casing is a tapered construction of large size, fitted with mechanical anti-friction bearings. The axle is of the full floating type, the wheels being secured to the driving shafts by tapered, castellated ends. The torque rod, shown in the top view of the chassis, is secured to the cross member of the frame by a hinged pin, secured between two coiled springs, and is splayed for attaching to the axle. The frame is of pressed steel, channel section, tapered at the front to give greater steering range. It is supported on semi-elliptic springs, front and rear. The front axle is an I-section drop forging, with a slight drop at the centre. The wheels are of wood, artillery type, fitted with 32x3½ inch tires in front and 32x4 inch tires in the rear, and run on ball bearings. Two sets of brakes are fitted, a service brake of the contracting type acting on the transmission and two internal expanding brakes acting on each rear wheel hub. Steering is by wheel through a worm and segment, the steering column being rated to bring the wheel in a convenient position for the driver. Inasmuch as this worm drive reduces the clearance considerably, a regular bevel gear drive is fitted when the car is to be used in countries where road conditions require more clearance. The Napier firm this year manufacture two, four and six cylinder models.

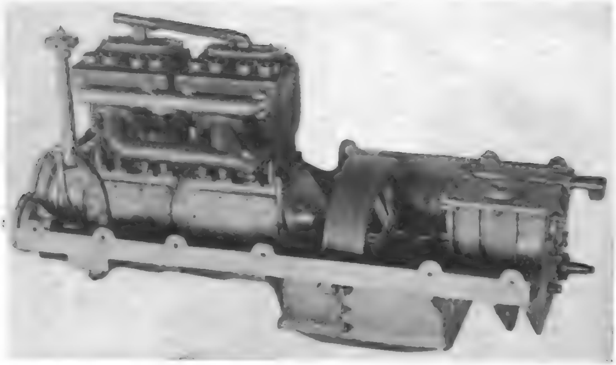
The Mora Light Four.

This car is similar in many respects to the corresponding 1908 model. Its motor has a 4 inch bore and 5⅛ inch stroke. The cylinder, valve and manifold construction are plainly shown in the accompanying illustrations. The crank shaft is of the three bearing type, and all these bearings are supported on the base of the motor. The upper part of the crank case is merely a distance piece which holds the cylinders in place and retains the oil. The pistons are unusually long and are bronze bushed for the piston pin, which is held fast in the rod and by a tapered bolt. Lubrication is by splash, the oil being fed by a pressure oiler through two sight feeds on the dash to the compartments of the crank case. A third sight feed is furnished, which ordinarily is closed, but may be opened wide to raise the oil level in the crank case should unusually heavy going render this necessary. Water circulation is by gear pump.

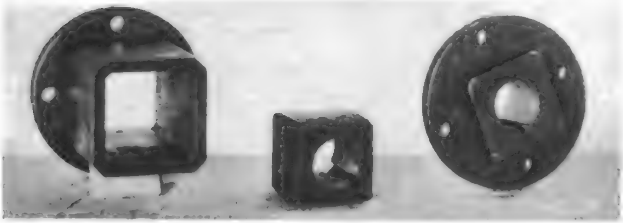
The clutch is a leather faced cone with cork inserts. A three speed selective



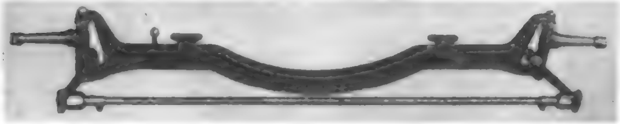
Rear View of Fifteen Horse Power Napier



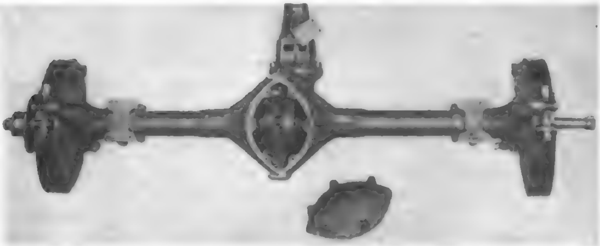
MORA MOTOR AND CHANGE GEAR ASSEMBLY.



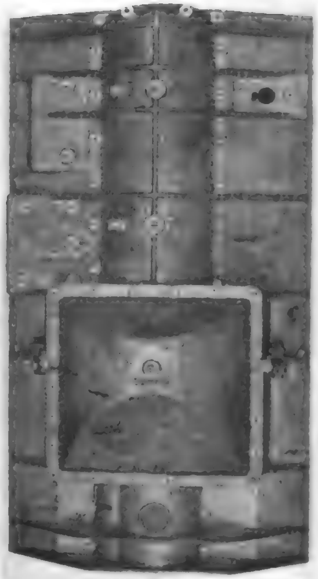
UNIVERSAL JOINT.



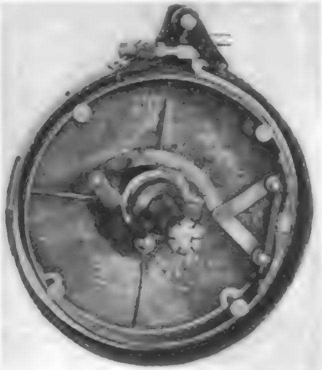
I BEAM FRONT AXLE



REAR AXLE AND DIFFERENTIAL, MORA LIGHT FOUR, 1909.



MUDPROOF ALUMINUM PAN CONSTRUCTION.



DETAIL BRAKE CONSTRUCTION.

change gear is lined up with the motor by fitting in ways machined in the rear end of the power plant support. This cast supporting pan has been a feature of the Mora for some time past. Transmission to the rear axle is through a hardened steel block, square in the direction of rotation and rounded fore and aft: this slides in a square hole in a hardened steel casing fixed to the change gear shaft.

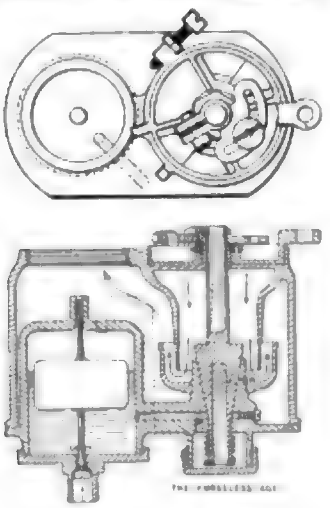
The rear axle is a modified Weston Mott construction, with four pitch driving levels mounted on special ball bearings. A neat adjustment is provided for the bevel pinion. The brakes are all on the rear axle and act on drums 14 inches in diameter. They are operated through long equalizers sliding in slots in the frame. The front axle is forged, and the wheels are fitted with ball bearings. A dropped pressed steel frame is used, which is a new departure for the Mora Company, armored wood having been employed on previous models. The front springs are semi-elliptic and the rear are of the platform type. Steering is by a combination of bevel gears with an internal gear and pinion. The emergency brake is interlocked with the clutch, but the foot brake is not interlocked.

A specially designed carburetor is used. It has a single nozzle concentric with the float. The regular air supply passes through holes in the side of the nozzle chamber, and a cylindrical shutter may be operated to close these holes for starting. Auxiliary air is admitted through a spring retained poppet valve.

The tires are 32x4 inch. The wheel base is 110 inches and the tread is standard. For this "light four" the Mora Company furnishes either a roadster body with room for four passengers and a touring trunk, or a "Racy-type" body with individual detachable rear seats.

The Harris Carburetor.

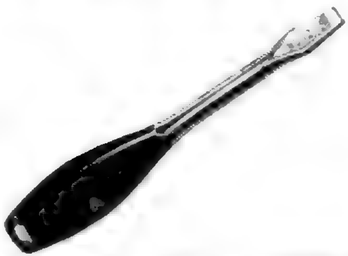
J. Harris, 2 Clinton street, Cleveland. Ohio, has brought out a new mixer or carburetor in which the gasoline feed is acted on whenever the throttle position is changed. A sectional elevation and a top view of the carburetor are shown herewith, these being reproduced from the drawings of the 1½ inch size of carburetor. By referring to the drawing it will be seen that the ordinary spray nozzle or standpipe is replaced by a conical plug valve. In the housing of this valve is a slot, and as the height of this slot is below the normal level of gasoline and the float chamber, when the engine is not running, the cup surrounding the valve will fill up with gasoline to the same level as the float chamber. This pool of gasoline at the bottom of the cup serves as a priming means in starting the motor. The air is drawn in at the top of the mixing chamber and is controlled by a register valve. The flow of gasoline through the slot is controlled by the plug valve, and the air throttle and gasoline valve are connected together on top of the mixing chamber by a slotted quadrant and screw, as shown. The inventor claims that if the air and gasoline valves have been once properly adjusted to each other the carburetor will give a correct mixture of all throttle openings, as whenever the throttle valve is moved the gasoline valve is also moved in the same sense. This size of carburetor when made in brass weighs 3¼ pounds.



Harris Carburetor.

The B. & S. "All Steel" Screwdriver.

A new and improved screwdriver complete in one piece has been brought out by the Billings & Spencer Company, Hartford, Conn. It is drop forged, of steel throughout, and the point is carefully tempered. The handle is of special design, insuring a positive and easy grip. The claims made for the new tool are that there is nothing about it to loosen or get out of order, and that it is simple, light, effective and durable. These screwdrivers are made in eleven sizes, including two of heavier model with square shank for the application of a wrench.



Book Review.

Geschwindigkeitsmesser (Speedmeters), by Fr. Pflug. Published by Julius Springer, Monbijouplatz 3, Berlin. Price, 9 marks, bound in cloth.

This work is the result of the speedometer competition organized by the Mid-European Motor Car Association of Berlin in 1905. It deals not only with the various speedmeters and speed and distance recorders used on automobiles, but also with similar instruments used in railroad service. The subject matter is suitably classified, and the general treatment is a very satisfactory one. The author first takes up the need and the requirements made of speedmeters in railroad, automobile and street railway service respectively, then discusses the methods of mounting and driving in the various services. In the following chapters the various principles on which speedmeters may be based are described. The author mentions the following classes: Speedmeter with pump, speedmeter with variable liquid level determined by centrifugal force, electro-magnetic speedmeters, electric speedmeters, centrifugal governor speedmeters, speedmeters with disengaging means for the indicating hand, speedmeters with friction disc drive and clockwork for comparison, and miscellaneous types of speedmeters.

The greater part of the book is descriptive, and no less than 312 illustrations are used, but as quite a number of these are manufacturers' cuts the effect is not a very happy one. Fairly complete accounts are given of three prize competitions for speedmeters, that of the Great Berlin Street Railway Company in 1901, that of the Mid-European Motor Car Association in 1905, and that of the A. C. of France in 1906. A review of the more important German patents on speedmeters and a reference list to articles on the subject in current periodical literature complete the volume.

A. L. A. M. Standard Spark Plug.

The A. L. A. M. standard spark plug, which we illustrated in our issue of October 7, is said to have been adopted by nearly all of the members of the association. The mechanical branch has spent much time in determining the desirable features and dimensions. The so called Autocar spark plug, which was used for a number of years, had a seven-eighth inch, eighteen straight thread, the form or profile of the thread being the so called United States standard, with flat top and bottom of a width equal to one-eighth the pitch. This was the extent of the standard, and there was considerable opposition to standardizing any more than this of the spark plug. But as time went on it became clear that certain other elements of the spark plug should be defined. At first the mechanical branch decided on a "preferred construction," but recently it decided to standardize certain further features and dimensions, still leaving other matters as preferred construction.

The diameter of the thread, seven-eighth inch, was considered necessary in order to leave the spark plug manufacturers plenty of room for insulating material in the plug. The straight thread, in combination with a shoulder or flange which seats upon a gasket close to the cylinder, always gives a gas tight joint when the plug is screwed into the cylinder the same distance comparatively. In this connection the pitch of the standard, 18, is proper. It will be recalled that the pitch of the seven-eighth inch diameter A. L. A. M. standard screw is 14, but there another function, namely, holding power, and not a gas tight joint, is the desideratum.

The stock used in the manufacture of the plug is 1⅛ inch round, the hexagon head, having a short diameter of seven-eighth inch, being milled on this stock. The shoulder, which is intended to seat upon a copper asbestos type of gasket, has the same diameter as the round stock from which the plug is made, and is one-eighth inch thick or deep, having a face, the part seating upon the gasket, one-eighth inch wide. The blank, that is the portion below the shoulder or flange, has a minimum length of one-half inch. The dimension of this portion of the plug cannot be standardized, owing to the requirements of different types of engines, as water cooled and air cooled and those having different thicknesses of water jacket, etc. There was considerable sentiment against even stipulating a minimum dimension for this blank.

The question of whether the spark plug should have a recess adjacent to the shoulder was a subject of sustained debate in the mechanical branch. If no recess were provided it would mean counterboring the cylinder, and many thousands of engines which have been in use for some time are not counterbored.

In determining the diameter of the packing gland nut head, that is the separable portion of the plug which holds the insulation in place, one determining factor was that the distance across the corners of this smaller hexagon should be less than the distance across the flats of the larger hexagon, in order to make it possible to remove the plug from the engine with a socket wrench

COMMUNICATIONS

Frame Beam Formulæ.

Editor HORSELESS AGE:

The writer has noted the criticisms of one of your correspondents of the formulæ used in the article on "Frames," which appeared in the issue of August 26. The writer does not hesitate to admit that the formula found in connection with the armored wooden frame is incorrect, and regrets that the error was allowed to pass through without his proper revision. But while your correspondent has criticised he, has failed to show the correct procedure in regard to the treatment of beams of this character. I believe that your readers will be interested in the correct discussion of this matter.

In the well known formula, $f = \frac{Mc}{I}$, for determining the stress in a beam, it is assumed that the material of the beam is homogeneous. For any other condition this formula must be modified. In the case of the armored wooden frame the modified formula affects the ultimate result only slightly.

Let us take a steel tube of rectangular section, Fig. 1, having a very thin strip of wood of area dA attached rigidly to the bottom, as shown, and at a distance y from the neutral axis. Let f_w and f_s denote, respectively, the stresses on a fibre of the wood and a fibre of the steel. Also let

E_w = modulus of elasticity of wood.

E_s = modulus of elasticity of steel.

Then by Hooke's law

$$\frac{f_s}{E_s} = \frac{f_w}{E_w} = y$$

From this we have

$$f_w = \frac{E_w}{E_s} f_s \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The moment of the stress acting on the area dA is $S = f_w y\, dA$. Substituting in this the value of f_w from (1), we have

$$S = y^2 \cdot \frac{E_w}{E_s} dA$$

That is, if we increase the area of the section of the casing in the ratio $\frac{E_w}{E_s}$, then we may consider the fibre stress over the whole section of the beam as being directly proportional to the distance from the neutral axis. We then have the section shown in Fig. 2.

If, now, we add enough of these wooden strips to completely fill the casing, dA becomes A (area of cross section of the core), and we can apply the same reasoning as in the case of the single thin strip. We then have the section shown in Fig. 3. If, now, we call I' the moment of inertia of this new section, then the actual fibre stress becomes

$$f = \frac{Mc}{I'}$$

A numerical example will make this clear. Let E_s = 30,000,000 pounds per square inch.

E_w = 2,500,000 pounds per square inch (about).

We will assume the dimensions to be as shown in Fig. 4. The ratio

$$\frac{E_w}{E_s} = \frac{2,500,000}{30,000,000} = \frac{1}{12}$$

The depth of the shaded portion of the steel section is the same as that of the wooden core, 3.75 inches. Hence we find the increased area of the steel to be

$$\frac{3.75 \times .125 \times 2}{12} = .078125 \text{ square inch};$$

the factor 2 is for the two portions A and B. The combined area of these portions is

$$2 \times 3.75 \times .125 = .9375 \text{ square inch.}$$

Therefore the total modified area is

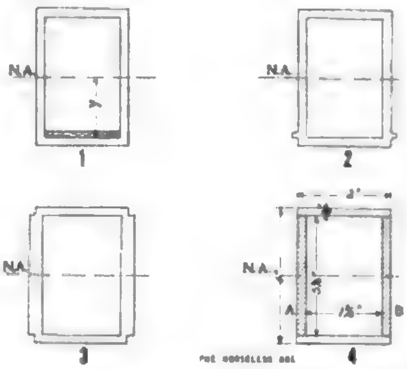
$$.078125 + .9375 = 1.015625 \text{ square inches,}$$

from which we find the thickness of the modified steel section to be

$$\frac{1.015625}{2 \times 3.75} = .1354 \text{ inch,}$$

as against .125 inch for the original thickness.

The moment of inertia of the steel section without the core is 2.976 and the moment of inertia of the modified section is 3.068. Hence, the actual fibre stress in the steel is



FIGS. 1 TO 4.

$$\frac{2M}{3.068} = \frac{M}{1.534} \text{ pounds per square inch,}$$

as against

$$\frac{2M}{2.976} = \frac{M}{1.488} \text{ pounds per square inch.}$$

for the original steel section.

In regard to the formula $Z = \frac{39 W}{E.L.}$, I regret very much that your correspondent has found this objectionable. I feel certain that engineers will be very thankful to him if he can suggest something better. His chief objection seems to be that the length of the frame is not taken into consideration. I beg to advise your correspondent that the length of the frame is considered, and in this way: The lengths of automobile frames as usually made vary between the limits 130 inches and 160 inches; that is, for the type of car for which the formula was found, namely, medium runabouts and touring cars, there are a few which have a length of less than 130, as well as a few having a length greater than 160 inches, with three or four as long as 190 inches; but practically 90 to 95 per cent. of the frames have lengths lying between the limits first given. We may then safely take a mean of these limits, or 145 inches, and regard this as the length of our ideal frame, in which case the length of the frame may be eliminated from our formula.

The formula given has been applied to a number of successful frames and found to be entirely satisfactory. It may be true that, as your correspondent says, the fact that "the formula has been derived from frames which have 'stood up' is no criterion that the frames were properly designed, as they may have been heavier than necessary." The fact that these frames have "stood up" is, however, a criterion that they were not too weak. Out of a number of frames examined some were found to have a constant much less than 39 and others much greater. Inquiry in regard to the former led to the same result, namely, that these frames invariably failed after short service. On the other hand, frames having a higher constant than 39 were found to have a higher factor of safety than was warranted.

In conclusion it will be of interest to have your correspondent give us a rational formula for the design of a frame, said formula to take into consideration the following conditions:

1. The frame regarded as a continuous beam supported at four points and irregularly loaded.
2. The length of the frame.
3. The width of the entire frame structure (this is necessary, since the width of the frame will affect its rigidity and, therefore, its strength).
4. The effect of cross members on the strength of the frame.
5. The additional stress imposed by the twist of the frame when one wheel passes over an obstacle. In other words, the extent of the twist must be determined, and from this an equivalent bending moment.
6. Offset and bends in the frame.

There are other factors, such as temperature, but it will be sufficient to take into account only those given above. No reasonable being would dare to undertake the problem. A result might possibly be obtained, but it would be of no value to an engineer.

The writer is pleased to note that the article has aroused some interest in this subject. He did not expect that it would be free of criticism. ASHER GOLDEN.

Is There a Scavenging Action in Four Cylinder Motors?

Editor HORSELESS AGE:

I have read with interest the many able articles on gas engine design which have appeared in your paper, particularly the articles on valve timing. I understand that the practice now is to cause the exhaust valve to open before the crank has reached the outer centre (say about 30 degrees) and to close it slightly after the inner centre has been reached so as to take advantage of the scavenging action of the momentum of the exhaust gas column. I can see how such a force could be present, under the above valve conditions, in the case of a single cylinder engine, but how it can exist in a four cylinder engine exhausting into one pipe I cannot understand.

It would seem to me that some time before the scavenging stroke in one of the cylinders has been finished the exhaust valve in another cylinder completing its combustion stroke would have opened, and a heavy rush of gas, under a pressure of perhaps 40 pounds, would have filled the exhaust pipe. If there is any back pressure it would be strongest at this moment, and yet this is the time when another cylinder is taking advantage of the momentum of its own exhaust gas column. Would not the rush of gas from one cylinder completely offset any possible momentum resulting from the previous explosion in another cylinder?

SUBSCRIBER.

[This matter was rather fully discussed in an article in our last week's issue (which, of course, you had not seen when you wrote your letter). There is undoubtedly a slight injector action with the usual form of exhaust manifold. Suppose, for instance, that the forward cylinder is exhausting, then the column of gases will rush through the manifold from the front at considerable speed, and owing to their inertia the gases cannot instantly reverse their direction of flow into the branch of the manifold to one or the rear cylinders which joins the main body of the manifold at an angle of, say, 45 degrees. This injector action would, of course, be increased by so arranging the manifold that the discharge from all of the branches is parallel to the main channel of the manifold and the discharge opening in the centre of the latter, instead of in the side wall. There would be practically no such injector action if the branches of the manifold join the main body at right angles, as is often the case.

It is to be doubted whether there is much object in the average engine in keeping the exhaust valve open longer than a few degrees past dead centre, as the pressure remaining in the cylinder at the end of the exhaust stroke must necessarily be less than the pressure in the cylinder whose exhaust valve has just been opened, and it is doubtful whether at this time there really is an injector action with the average form of manifold.—ED.]

Hart, Mich., Exceeds Waukesha's Auto Record.

Editor HORSELESS AGE:

I notice that an item in your issue of October 7, page 511, claims for Waukesha, Wis., the largest number of automobiles in proportion to population, that city having one to every 220 people. Now this little village of Hart, located in the fruit belt of Michigan, has one automobile to every forty-five inhabitants, having thirty-five autos and 1,600 people. We have no mineral waters nor good roads, nor are we visited by any large number of automobilists, but we do claim to produce the greatest variety of food products and the best class of citizens, whom we compel to drink pure, unadulterated artesian well water, because we have no saloons. There are many little towns that will beat Waukesha's record. The use of the automobile is spreading very fast in the country.

L. P. MUNGER, M. D.,
President Oceana Auto Club, Hart, Mich.

An Appreciation of the Runabout Number.

Editor HORSELESS AGE:

I consider the Runabout Number of THE HORSELESS AGE one of the best special numbers ever issued by you. After reading what the various physicians from all over the country have to say, I think it will be conceded that they are almost unanimous in their general specifications of the car most suited to their business. A few years ago such a condition of things could not have existed. The Runabout Number is full of meat to be digested by manufacturer, user and prospective user.

W. WEBSTER ENSEY.

A Cork Insert Brake.

Editor HORSELESS AGE:

Referring to H. L. A.'s inquiry concerning cork inserts being used in brake bands, you stated in the September 30 issue of THE HORSELESS AGE that such were in use by the F. B. Stearns Company, Matheson Motor Car Company and Chadwick Engineering Company.

Kindly be advised that the Premier Motor Manufacturing Company has successfully used cork inserts in connection with the brake shoe for the past season. In fact, we were among the first to use cork inserts, and some time ago the National Brake and Clutch Company, in a published article, called especial attention to the efficiency of the Premier brakes, as well as the general satisfaction which had resulted from the use of the cork inserts.

We are sending you under separate cover a photograph which is a fair illustration of the Premier brake bands. From this you can get an idea of the cork inserts such as are used in our internal brake shoe band. We are also sending a circular just issued by the National Brake and Clutch Company concerning cork inserts. On page 13 you will find that special reference is made to the Premier brake.

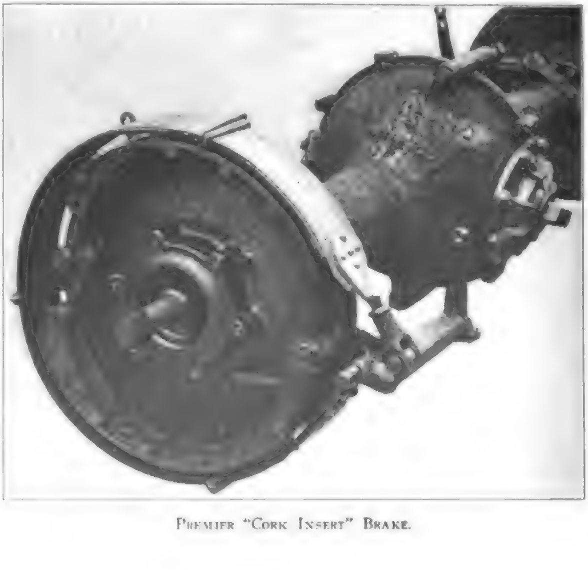
PREMIER MOTOR MANUFACTURING COMPANY,
R. W. Macey, Jr.

Unequal Splash Lubrication of Opposed Cylinders.

Editor HORSELESS AGE:

In your issue of July 22, page 114, you answer a correspondent who had trouble with heating one cylinder of a double opposed motor, and close by saying: "The sooting may be due to the fact that this cylinder may receive more oil than the other one, as often happens in double opposed motors with splash lubrication."

I am having a serious time with a motor of the same construction, but find myself unable to prevent the one cylinder from obtaining more than its share of oil—that is, always on opening the drain cocks after running even a few minutes the right or forward cylinder will show from a teaspoonful to a tablespoonful of oil, whereas the other hardly ever discharges oil, even when experimentally and for a short period the oiler



PREMIER "CORK INSERT" BRAKE.

to the right cylinder has been cut down to two drops per minute.

The machine is practically new and has not been abused. The piston rings are anchored in place, and the openings cannot be turned to the bottom. A suggestion would be thankfully received.

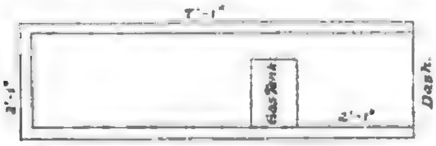
E. R. Shepherd.

[The only possible remedy that occurs to us is to place a baffle plate of sheet steel between the overlubricated cylinder and the crank case, with a slot in it to allow for the passage of the connecting rod. This expedient is resorted to in some vertical motors with splash lubrication to prevent overlubrication of the cylinders. If the piston should overtravel the cylinder bore it would of course be impossible to place the plate between the cylinder and crank case, but it might then be possible to secure it in place in the crank case. In any case it would be necessary to lay it out to dimensions very accurately.—Ed.]

Wants to Buy a Taxicab Body.

Editor Horseless Age:

I wrote you some days ago regarding a taxicab, but after overhauling my 1906 Autocar I find it in good condition, and I have about decided to put a low priced taxicab body on this chassis. I enclose you measurements; and can you assist me to buy one of these bodies complete of some body manufacturer? The only ad I noticed in your paper is of an aluminum body, but I think they would be too high priced for me.



H. A. Hubbard.

The Cameron Car in the Sweepstakes Races.

Editor Horseless Age:

On page 538 of your October 14 issue mention is made of the Sweepstakes races, held on Long Island October 10. Referring to the Nassau Sweepstakes, you say: "The Cameron, which suffered somewhat from tire and mechanical trouble, was second."

We beg to correct this, and advise that our car did not stop for a single second on any account whatever from the start to the finish of the race. We enclose herewith a little circular in reference to this event, and if you will take the trouble to notice the performance of the Cameron you will see that we made the course in the most regular manner, there being but 11 seconds difference between any two of the four laps.

We have laid a great deal of stress on this feat, as it is absolutely a fact, as stated in our circular, that we made the four circuits with more regularity than any of the competing cars, large or small. On this account, and also because we were the only air cooled contestant, we trust that you will correct the line referred to above.

Cameron Car Company,
H. W. Doherty,
Sales Manager.

Road Congress Deliberations.

The main topic of discussion at the International Good Roads Congress, which met in Paris last week, was the destructive effect of automobile traffic on macadam roads. It was held that when the traffic was confined to horse vehicles the roads tended to remain in repair, because the narrow iron tires crushed the stone and so formed new filling material to replace any that might be removed in the form of dust or mud. The broad tires of automobiles, on the other hand, exert a strong suction effect, which is estimated by Colonel Bromwell, superintendent of public buildings and grounds at Washington, at no less than 200 pounds per square inch, with the result that the filling material is drawn out from between the stones and blown away.

There was a marked unanimity as to the character of road required to withstand the ravages of auto traffic. Most of the delegates agreed that it must have a well trained solid foundation, and be built of some hard aggregate bound together by tough, elastic binder, waterproof and free from dust or mud. The road should be hard enough for automobiles, yet soft enough for horses' feet. How to realize this ideal road, however, caused much diversity of opinion.

Aside from methods of road bed construction, there was a general agreement upon the following points: Main highways must in the future, wherever possible, be air lines between important centres, with branch roads connecting up to the main lines for local traffic. There should be no curves on the main roads of smaller radii than 300 feet in the open country and less than 150 feet in the hills. Reverse curves should be avoided, also steep grades with curves, and level railway crossing and the outer edge of curves should be raised. Opinions as to width varied greatly, but the average was a minimum of about 30 feet.

In his paper on the subject Colonel Bromwell pointed out that if park roads cannot be modified to meet the new conditions they will rapidly deteriorate and become useless. Colonel Bromwell's idea is that park roads should be so constructed as to meet the somewhat contradictory requirements of being smooth and elastic in surface for horse vehicles and smooth and hard in surface, and not too slippery, in order to be suitable for the motor traffic. The road of the future, he thought, should be composed of some tough elastic material, bound together by another material possessing similar qualities. Such roads would cost more originally, but the maintenance would be less.

To obtain an ideal road Colonel Bromwell suggested the interposing between the base course of the macadam and the top course of a layer of asphaltic or tar compound, carried for convenience in a sand base. If the top course was then rolled and compacted the compound could be forced up into the interstices of the upper course, thus thoroughly binding the stones together and forming a top course of asphaltic or tar concrete. Just enough top dressing should be applied to fill up the larger interstices of the top course, and this top dressing should contain little or no dust or very fine material.

The congress created a permanent international committee to collect and disseminate the results of experiments. There was a marked tendency during the congress in favor of legislation to compel automobile manufacturers to build motor cars incapable of exceeding the speed limits. The next meeting will be held in Brussels in 1910.

More Combination Rumors.

Of the two amalgamations in the automobile industry, heralded some time ago, the Wayne-Northern combine has been completed, while the Maxwell-Buick negotiations have apparently fallen through. At least this conclusion was drawn from the announcement of a $500 runabout model by the Maxwell-Briscoe Company a few weeks ago. There are, however, renewed rumors of automobile combines in the air. Thus it was reported around late last week that negotiations were pending looking toward a combination of the Cadillac, E-M-F, Chalmers-Detroit and Maxwell interests. Benjamin Briscoe was in Detroit on Friday, which may have been one of the facts on which this rumor is founded. Another rumor is to the effect that the Buick and Olds companies are considering a proposition to combine. There can be little doubt that negotiations of this sort have been carried on for some time betwen various firms in the automobile industry, but, of course, in matters of this kind "there is many a slip."

Fort George Hill Climb Postponed.

The New York Automobile Trade Association has postponed its Fort George Hill Climb from Saturday, October 17, to Tuesday, November 3 (Election Day), owing to the fact that the mayor of New York city vetoed the bill granting permission for the climb. In a message to the Board of Aldermen the mayor said: "I am of the opinion that the speed regulations in this city should not be dispensed with except under the proper supervision of the police commissioner, at the request of responsible clubs or associations." A new bill has been drawn up and is expected to meet every objection of the mayor. The motorcycle event has been cancelled for the reason that on the new date set for the event the Federation of American Motorcyclists will hold its national championship contests. It is announced that in all probability the events will be contested under the rules and with the sanction of the American Automobile Association.

Commercial Applications.

Motor Farming in Western Kansas.

By J. W. Morrison.

In Cheyenne County, in the northwest corner of Kansas, two gasoline farm motors are being used to do the work of the farms, and they are claimed to do it much more cheaply and expeditiously than it could be done by men and horses. The motor tractors not only pull plows and discs to break up the heavy prairie sod, but they are used in harrowing, seeding and harvesting. And when the crops are harvested the motor tractors are used instead of horses to haul the grain to the nearest railroad towns.

Two men who had heard that these things were being done out in what has been called the "Great American Desert" started on a tour of exploration to find out. After driving many miles over the almost pathless prairie a cloud of dust attracted their attention, and on a nearer approach they heard the chug, chug of the motor and saw one of the machines at work. It was moving easily along, tearing into shreds a great swath of tough turf. On the seat of the motor sat a young man, H. C. Denny, who, together with his father, G. W. Denny, owns 3,500 acres of land 13 miles south of St. Francis. The travelers drove nearer for a closer view of the motor. In the immense drive wheels were spikes 3 inches long, that gave a firm hold on the ground and enabled them to exert the immense pulling power required of them. Hitched behind were two discs weighted down with sacks of stone.

"How much ground do you cover each time you circle the field?" the young man was asked.

"These two discs cover 19 feet of ground," said the farmer-engineer. "Father has just gone with our only team, however, to get another disc, as the motor is not doing all the work it can. When we hitch on the other disc we will cover 26 feet. The field is a mile long, and each time we go around it with the three discs we turn up 8 acres of sod."

The young man said he needed no helper. Enough water was put in in the morning for cooling purposes, and the tank held enough gasoline to last two days. The motor weighed between 5 and 6 tons. Its driver said a steamer of the same power would weigh 18 tons.

The elder Denny came back with the third disc. It was attached to the motor, which moved easily away, leaving 26 feet of sod undisturbed for ages torn to shreds. As the strangers watched the elder Denny talked:

"If you hire it done it costs $2 an acre to break prairie with a team, or you give probably 50 cents an acre and the first crop, which is more than $2. We have not kept accurate account, but my estimate is that when it is as dry as it is now we use 2 gallons of gasoline to the acre. I expect to thresh my grain by motor power and haul it to town in wagons strung behind the motor or in a big tank on trucks. I can pull two tanks easily that hold 300 bushels each. Our Western prairies lend themselves readily to the hauling of big loads.

"My estimate is that it will take $4 worth of gasoline to haul 500 bushels of wheat the 13 miles to town and bring the motor back home. The man's time, oil and other other expenses will bring the cost up to $9, possibly $10. With teams the same amount of hauling would cost $30.

"Yes, of course, they are expensive yet, more expensive than they will be later, just like automobiles. This one cost me $2,800. An automobile? Oh, yes, I own an automobile, too."

Seven miles down the Republican River from St. Francis another motor was found. This one belongs to Jerry Lyons, who owns 1,900 acres.

"Coal costs $9 a ton here," said Mr. Lyons, "and with the engineer, fireman, water and coal haulers I found a steamer too expensive. What we farmers want is more crop with less expense, and we want to work without being too dependent on hired help. I've lived here twenty years. They are using motors in North Dakota some, but they're a new thing. I talked with a man from there who said they started one motor plowing on one section of ground and sixty horses and twelve men on an adjoining section, keeping track of the expense. The breaking done with teams cost $2.85 an acre; that with the motor 65 cents.

"Yes, I expect to harvest with it, but I'll do my fall plowing of the ground at the same time, hitching my binder far enough behind the eight plows to drop the bound bundles on the plowed ground behind the plows. Then when I'm through harvesting I'm through plowing.

"What is the comparative cost of teams and a motor? My experience is that with a gasoline farm motor I can do all farming operations at one-fourth the cost with which the same work can be done with men and teams or a steamer.

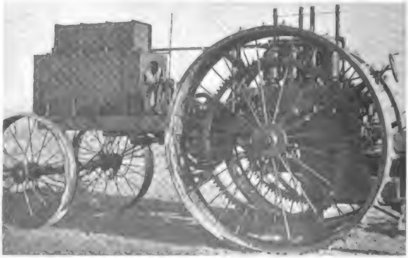
"I measured my land, and I measured my gasoline, and I broke this heavy river bottom sod—with mold-board plows, mind you, not disc plows—4 and 5 inches deep, with 1½ gallons of gasoline to the acre. My neighbors breaking the same kind of sod with horses find that it takes three or four good horses on one plow, and they average about an acre a day, which agrees with my figures that it costs me with teams $3 an acre to break river bottom sod. I can get gasoline at 16 to 17 cents a gallon. You can figure it out for yourself—25 to 30 cents an acre. In that heavy ground we break 15 to 20 acres a day with the motor, using eight mold-board plows and one man on the engine and one man to handle the plows, doing as much as fifteen to twenty men and fifty to sixty horses by the team method."

Commercial Notes.

The Board of Public Safety of Springfield, Ohio, is considering the plan of purchasing automobiles for the police and fire department chiefs.

Five members of the fire department committee of the New Bedford, Mass., city council, last week made a trip to Bridgeport, Conn., to make delivery of and drive home the new motor chemical fire engine built there for the New Bedford department.

J. C. Curtis, general manager of the C., B. and Q. Railroad office in Huntington, Ind., has petitioned the council of that city for a franchise to operate a motor transit service in the city streets. Four large cars will be operated over regular routes, and the promoters offered to make any necessary improvements in the streets.



Motor Agricultural Tractor in Use in Western Kansas.

LEGISLATIVE and LEGAL

Official Inspection of Taximeters.

By Xenophon P. Huddy, LL. B.

For some time there have been in operation public vehicles with instruments called "taximeters" attached, that compute the fare to be paid by those carried, according to the distance traveled and the time for which the vehicle is engaged. Presumably these instruments are fairly accurate, although there is no safeguard against "short measure" other than that which may be found in the criminal statutes. A taximeter may be too fast or too slow. If the instrument is too fast then the customer pays too much money for the service according to the contract existing between the carrier and the passenger. If the taximeter is too slow, then the advantage is on the side of the passenger. Who is to determine and who is to know whether these public carriers who are using instruments to measure the fare are making correct charges for transportation?

The taximeter is a new instrument and may be said to be used for the purpose of measuring distance. It may rightfully be called a measure, since its purpose is to measure the distance traveled by a taxicab, upon which measured distance the compensation is to be computed according to the scheduled rates of the operating company. I believe that no one will dispute that the taximeter is in the common and ordinary acceptance of the term a measure of distance, if you please, of linear feet, yards or miles. It is a yardstick in a certain sense. The idea that the taximeter constitutes a measure may strike some as novel, but upon reflection the character of this instrument as a measure will readily be appreciated.

The United States Government has established certain units of measurement. The States of the United States have by legislation also fixed certain units of measure. There are a standard yard, a standard pound for weight, and so on. Realizing that the public is more or less dependent upon the accuracy of the instruments used by various dealers, statutory regulations have been enacted requiring scales and various measures to be inspected annually, or otherwise to be compared with the standard, accurate units, and to be sealed with the seal of the Government by an official sealer, whose duty it is to see that measures are accurate. In New York, for example, there are State, country, city and town sealers. Sometimes the duty to test scales and measures is imposed upon municipal corporations. The various inspectors and sealers are compelled to give bonds for the faithful discharge of their duties and to perform their work in accordance with the legal requirements of the statutes. The public have a right to the protection which these laws afford.

When one hails a taxicab with the object of engaging it he offers to purchase a ride according to the established tariff as indicated by a *correct* taximeter. He does not agree to pay for a ride according to the reading of an incorrect instrument, no matter whether the inaccuracy is due to mere mistake or actual fraud. The taxicab company sells and the passenger buys a ride. The situation is similar in the case of a person going into a store and buying a pound of butter or so many tons of coal, in which latter cases the scales by which the commodities are weighed must be inspected and sealed every so often by the public sealer. Taximeters are not now inspected, nor are they sealed. There is no supervision over them whatsoever. But should there not be? The Public Service Commission of New York has recently taken jurisdiction over gas meters, and has caused several thousands of these instruments to be inspected.

It is the duty of inspectors and sealers to inspect and seal all measures, to have a correct standard unit, and to test the various measuring machines or appliances used in dealing with the public. Thus far the public officials charged with this work have failed to perform the duties of their offices with respect to taximeters. It may require some mechanical knowledge to properly inspect a taximeter, and the official may be compelled to have on hand in his office a correct instrument for purposes of testing and comparison. Of course, taximeter manufacturers and taxicab concerns may make some opposition to placing their instruments under the jurisdiction of the authorities having control over weights and measures. Nevertheless, it is a right belonging to the public which should be enforced. In New York undoubtedly the Public Service Commision has jurisdiction over this matter.

In case it can be shown that a taximeter is out of order no charge can be made for the service, since the measure is false. If a taximeter is intentionally used which is known to be incorrect, then under the old common law the user may be indicted for using a false measure. Under the statutes of the various States this is also made a crime. To neglect or to refuse to have a measure sealed ordinarily entails a statutory penalty, and to use a measuring instrument which has not been sealed in many jurisdictions constitutes a misdemeanor. It is more than probable that the taximeters used on taxicabs in the cities come within at least the spirit of the provisions of the weights and measures laws.

There may be some question as to whether a taximeter is included within the present New York ordinance, which provides for measures of *things* sold. A ride is not looked upon as a chattel, consequently it may not, ordinarily, be called "a thing"; however, by a broader construction the term may include "anything tangible or *intangible*," in which latter case a ride which is purchased is included.

I have written this article merely as a discussion of the question and as suggestive rather than from a partisan standpoint.

What the New Jersey Test Case Is to Establish.

We recently referred to the case to test the constitutionality of the Frelinghuysen automobile law brought by the Associated Automobile Clubs of New Jersey, and which will be conducted by ex-Governor Griggs. The associated counsel, a New York lawyer, has given out the following statement of the objects aimed at in the case:

> The intent is first to establish the principle that every citizen of the United States has a right to travel through a State in any kind of a vehicle, subject only to reasonable police regulation and not subject to a specific burden or tax, as is now exacted by the State of New Jersey.
>
> Second, it is intended to settle the question whether the present mode of licensing resident autoombilists is in accordance with the constitution of the State of New Jersey, when it states that all taxation shall be based on the standard of "true value."
>
> These two great fundamental principles are the proposed points or differences to be established, and in fighting for these principles we are assured that there is every prospect of success.

Parts Maker Sues Automobile Manufacturer.

Harvey L. Hooke, receiver for the Muncie Auto Parts Company, Muncie, Ind., on October 10 filed a declaration in the Federal court at Peoria, Ill., against the Bartholomew Company, of the latter place. The Parts Company claim that the Bartholomew Company gave them three promissory notes on the 17th of October, 1907, for $2,000 each, the first one for sixty days from date, the second to be paid January 1, 1908, and the third for ninety days from date, all to draw interest at 6 per cent., and also that the Bartholomew Company owed them $8,548.50 on account for merchandise, etc.

Charlotte, N. C., to Legislate Against Garages.

When some time ago the Southern Automobile Company, of Charlotte, N. C., rented rooms under the Auditorium for a garage and salesroom complaint was made to the board of aldermen that such an establishment was to be allowed under a public building. The matter has been considerably agitated locally, and the following ordinance is to be voted on by the city council this week:

> Be it Ordered by the Board of Aldermen of the City of Charlotte:
>
> Sec. 1. That no garage, or place where automobiles are kept, repaired or replenished with gasoline or other inflammable oils or liquids shall be established, conducted or maintained within the fire limits of the city of Charlotte; provided this section shall not apply to persons keeping not more than two automobiles for their own individual use.
>
> Sec. 2. Any person, firm or corporation proven guilty of violating any provision of this ordinance,

shall, upon conviction, be subject to a penalty of $50 for each day of such violation.

Sec. 3. This ordinance shall go into effect the 15th day of November, A. D. 1908.

Legal Notes.

Alderman Otis, of St. Paul, Minn., plans to have introduced at the next session of the legislature a bill requiring all automobiles operated in the State to carry uniform number plates.

Judge Babst, of Bucyrus, Ohio, has handed down a decision in the Drolesbaugh test case, pronouncing the Ohio licensing law constitutional. The case will be carried to a higher court.

Mayor D. S. Rose, of Milwaukee, has recommended to the chief of police that a motorcycle squad be added to the police service. Two plain clothes men have been supplied with motorcycles.

Oliver A. Quaile, president of the New York State A. A., who was arrested at Glens Falls, N. Y., in June last for speeding, and was convicted and fined, succeeded in getting the conviction set aside, and was exonerated on appeal on October 9.

The Cincinnati Professional Chauffeurs' Association in a petition to Mayor Markbreit has declared itself in favor of a traffic ordinance similar to that in force in New York City, which compels heavily laden vehicles to keep near the sidewalks, leaving the centre of the street free to lighter vehicles.

The little town of Hazelton, Ind., incensed over the speed of automobiles going through the place, has passed an ordinance limiting the speed to 8 miles an hour. In addition it is made compulsory on the part of drivers to sound their horns at least twenty times a minute while passing through the town. No automobiles are owned in Hazelton.

Without any special effort to pass the bill, the special session of the Indiana Legislature adjourned without repealing the 3 mile gravel road law. Under the law about $8,000,000 worth of road work has been done during the last two years, and although farmers complained of it, the Legislature thought best not to do anything to injure the good roads movement.

The test case of the New Jersey Automobile and Motor Club to test the constitutionality of the Frelinghuysen automobile law was commenced on October 6, when Frederick J. Kane, of Woodhaven, L. I., was arrested by prearrangement at Paterson, N. J., for operating an automobile without a New Jersey license. The case will be conducted for the club by former Attorney General John W. Griggs.

The common council of Fond du Lac, Wis., has passed an ordinance requiring all garages to be made fireproof, present buildings rebuilt, and new ones according to the new code. It was at first decided to condemn all garages in the business district, but protests were made. The ordinance is the result of the recent $250,000 conflagration, the origin of which is said to have been in the Crescent Auto & Garage Company's building.

The Corporation Counsel of the District of Columbia has been asked by the District Commissioners for an opinion as to whether the permit clerk of the engineer department is authorized under the law to issue more than one license plate and to register the same if the ownership of the motor vehicle has not changed, but when the original plate has been lost; also, if after the original plate has been recovered by the owner after the issuance of the second tag, the fee for the latter should be refunded.

M. R. Nyman, vice president of the Thomas automobile service in Chicago, was arrested recently on a charge of grand larceny made by the Coey Automobile Livery, of which Nyman was formerly manager. It is alleged in the complaint that Nyman appropriated to his own use $443 collected for the Coey concern. Nyman had previously caused the arrest of William E. Walsh, cashier for the Coey Livery, on the same charge, but when Walsh was placed on trial the charge was dismissed at the instance of the Coey Company and a warrant for Nyman's arrest issued.

The Massachusetts Highway Commission has revoked the license of Frank B. Comins, of Sharon, Mass. Comins recently endeavored to pass J. P. Allen on a curve in Newbury, when the two cars suddenly came upon J. L. Hale, of Newburyport, in another automobile coming in the opposite direction. A collision occurred, and the case was brought before the highway commission, who revoked Mr. Comins' license. Mr. Comins claimed that Mr. Allen was monopolizing the road. The latter's side of the case was not heard, as he is not a resident of Massachusetts and refused to appear before the commission.

Motorcycle Firms Trade Combine.

The bicycle and motorcycle department of the Light Manufacturing and Foundry Company, Pottstown, Pa., has been consolidated with the Merkel Motor Company, of Milwaukee. The new firm will be known as the Merkel Light Motor Company. It will occupy four floors of the brick building at the corner of Fourth and Hanover streets, Pottstown. Besides manufacturing bicycles and motorcycles, motors for railroad inspection cars, such as are used by section foremen and employees of railroads, will be made. Some of the employees of the Merkle plant have removed to Pottstown and some machinery has also been shipped there.

C. Herbert Moore, mayor of Spokane, wants a pair of automobiles to facilitate the work of the fire chief and board of public works and city engineer. In a letter to the council he requests that body to appropriate funds for the purpose of purchasing machines for the use of these officials.

Electric Vehicle Company Business to Be Continued Four Months.

Halsey M. Barrett and Henry W. Nuckols, receivers of the Electrical Vehicle Company, of Hartford, Conn., have been authorized by an order of Judge Shumway to continue the business of the company for another period of four months. The court also approves the semi-annual report submitted by the receivers.

The Cleveland Endurance Contests.

At Cleveland, Ohio, a three days' endurance contest was held last week, under the auspices of the local automobile club. It was run under substantially the same rules as the recent Chicago endurance contest, an examination of the cars following the runs. Following is the final score:

Car.	Driver.	Score.
Maxwell,	C. G. Bleasdale	1000
Thomas,	George Sperry	1000
Franklin,	C. S. Carris	1000
Garford,	E. E. Ernest	1000
Garford,	C. R. Wedler	946
Stoddard-Dayton,	H. S. Moore	922
Chalmers "30,"	J. H. Stickney	791
Chalmers "40,"	Sam Emerson	791
Jackson,	Grant Johnson	791

New International Race Rules.

The committee of the recognized national automobile clubs, in convention at Paris on October 19, adopted new racing rules, according to which the weight of the racing cars must hereafter not be less than 900 kilograms (1,980 pounds), and the cylinder bore of a four cylinder motor not more than 130 millimetres (5⅛ inches appr.). Under the Ostend rules now in force the limits are 1,100 kilograms (2,420 pounds) and 155 millimetres (6⅛ inches), respectively.

St. Louis Show Date.

The St. Louis Automobile Manufacturers' and Dealers' Association held a meeting at the Washington Hotel on October 7 and decided on February 15-20 as the date for next winter's show. Two propositions were considered, viz., a five and a six day show, and a majority of the votes was cast for the six day show. At the same meeting the following officers were elected: President, O. L. Halsey; vice president, E. J. Moon; treasurer, Samuel Primm; secretary, Robert E. Lee.

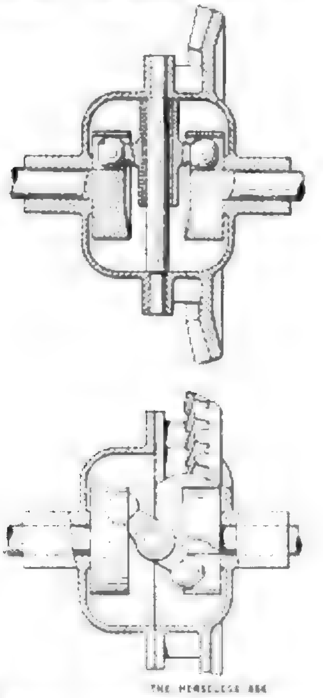
Alcohol Fuel Tests.

A representative of THE HORSELESS AGE recently had a ride in a special taxicab built by the H. H. Franklin Manufacturing Company. Alcohol was used as fuel in a regular Franklin motor suitably altered as to compression and carburetion. It appeared from the performance of this car that alcohol is an excellent fuel for motor car purposes. The motor is powerful, flexible and "sweet." Some difficulty in starting is the objection which remains to be overcome.

OUR FOREIGN EXCHANGES

A New Gearless Differential.

A novel and ingenious differential device, entirely dispensing with toothed gears, is illustrated in a recent issue of the *Automotor Journal*. It is the invention of Reginald Donkin, whose address is not given. As will be seen from the two views herewith, the side gears of the ordinary differential are replaced by circular discs, and diametrically through the centre of the housing extends a stud or shaft, on which a hub is arranged to slide, this hub carrying two laterally extending arms with ball ends. The balls are located in cylindrical holes in the discs at a certain distance from the centre. By looking at the drawings it will easily be seen that when the casing is held stationary and one of the differential shafts is turned in one direction, the connecting member between the two discs will have a combined sliding and rocking motion, and the second differential shaft will be rotated in the opposite direction to the first. The differential is here shown more or less in diagrammatic form, and if made as shown the balls would only have a line contact with the disc. In order to insure long life it would be necessary to provide sockets for the balls, of cylindrical form on the outside, and this arrangement has been adopted in a gear on this principle actually constructed. A number of variations in form embodying the same principle are possible, and in one form constructed the discs at the ends of the differential shaft are in the form of eccentrics with their outer surfaces rounded, and the connecting member is in the form of a cylindrical shell, into the ends of which the two eccentrics fit.

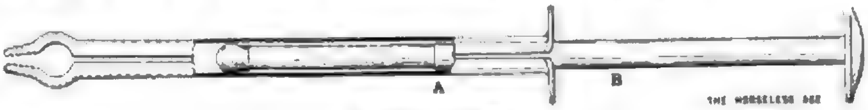


Donkin Gearless Differential.

It is stated that a device based on this general principle has been used for the office of a reversing gear in the United States, and it can be easily seen that if the power is applied to one of the side shafts the other side shaft will be turned in the same direction if the two are locked together, and in the opposite direction if they are freed and the casing is held stationary. Mr. Donkin believes, however, that he is the first to apply this mechanism to the purpose of a differential on a motor car.

Lamp Lighter.

A novelty of distinct utility has made its appearance in France in the form of a match lighter and holder with which the match can be ignited and held within the lamp out of reach of the wind, thus preventing the annoying and exasperating failures to light the lamp on a windy night. The sketch of the device is practically self explanatory, and is very simple. The body A is a light metal stamping, one end of which is corrugated to provide a frictional surface to ignite the match, and also to hold it, and the other end is flared to provide a grip for the fingers. A plunger B fits into the tube, and is provided with a button head. In operation the match is slipped into the tube, and the plunger inserted. The instrument is then grasped in the hand, and the end inserted inside the lamp. The lamp can be fitted with a small aperture covered by a slide, or else the door can be opened a quarter of an inch. The thumb then depresses the plunger, which pushes the head of the match through the corrugated ends, thus igniting it.



Match Igniter.

Statistics of the German Automobile Industry.

The German Department of the Interior some time ago took up the collection of data regarding the growth and present status of the German automobile industry, in which it was assisted by the several trade organizations. Question blanks were sent out to the various manufacturers, and by them filled in and returned to the department. The work of compiling these statistics has now come to an end. The statistics cover only the period up to 1906. They show a rapid growth both of the number of workmen employed in the industry and of the value of the products. Owing to the fact that many of the largest automobile manufacturers in Germany are also engaged in other lines, such as the manufacture of bicycles, typewriters, sewing machines and machine tools, the task of obtaining separate figures for automobile production, etc., involved some difficulty. The following figures, which are provisional, show the rapid growth of the industry since the begining of the century:

	1901.	1903.	1906.
Number of workmen employed	1,589	3,289	10,347
Wages paid in millions of marks	1.81	3.82	13.32
Value of products in millions of marks	5.66	14.11	51.04

Long Stroke Motors.

The manner in which freaks are developed by races and racing formulæ is well shown by the abnormal cylinder proportions of the cars which competed in the recent voiturette race in France. The bore for a single cylinder car was limited to 100 mm. (substantially 4 inches). The two Sizaire-Naudin cars, which secured first and second places respectively, had single cylinder motors of 4 inch bore and 10 inch stroke. They are claimed to develop 24 horse power at 1,800 r. p. m. At this speed they show the enormous piston speed of 3,000 feet per minute, and the mean pressure, figuring on a mechanical efficiency of 80 per cent., works out to 82 pounds per square inch. The vibration of such an engine must be very strong, as the reciprocating parts weigh considerably more than in a short stroke 4 inch engine, and as the linear speed is three times as great the inertia effects must be at least ten times as great. The De Dion motors used in this race had a 4 inch bore and a 6.4 inch stroke and are said to develop 17 piston speed at 1,900 r. p. m. The piston speed of this motor is therefore about 2,000 feet per minute, and the mean effective pressure, on the basis of 80 per cent. mechanical efficiency, figures out to 86 pounds per square inch. The car which secured third place, a Lion, had a stroke of 8 inches for a bore of 4 inches, but no data as to its output have come to our notice. The first five cars classed themselves in the order of length of stroke, which indicates that the power does increase the length of stroke.

There are now five motor cabs in service in Christiania, Norway, and as the demand for them is so brisk that they can very rarely be found at the cab stands, it is the intention to shortly put on a number of additional vehicles.

The Club of Vienna Motorists has been formed in Vienna, and its statutes have been approved by the Government. The club is founded on a "civilian" basis and intends to promote the motor movement by the organization of excursions, tours, contests, etc., as well as through lectures. The headquarters of the new club are Hotel Meissl & Schadn, Wien I, Neuer Markt.

MINOR MENTION

The Overland Automobile Company, of Indianapolis, have recently purchased the Marion factory of that city.

The Triumph Automobile Tire Company, of Homestead, Pa., has been incorporated in West Virginia with a capital stock of $1,000,000.

The W. D. Spring Cushion Tire Company, recently organized with its principal office at New York, has decided to locate in Hartford, Conn.

The Auto Import Company, 1786 Broadway, New York, who imported Rochet-Schneider cars, have dissolved. Benjamin Eisberg was president.

The Oakland Motor Car Company, of Pontiac, Mich., have recently brought out a new four cylinder model of 40 horse power, which is to sell at $1,600.

The Cuyahoga Motor Car Company, of Cleveland, Ohio, will shortly engage in the manufacture of automobiles. A model car is now being constructed.

The Boston Automobile Dealers' Association will hold its annual outing and dinner on October 21 at the Ashland Country Club in South Framingham.

The Brighton Beach track, near New York city, where quite a number of automobile races have been held in the past, is now being laid out in building lots.

The Auto Parts Equipment Company, of Cleveland, Ohio, have discontinued their salesroom on Euclid avenue. Their city trade will be handled from the downtown office.

The Moshammey Company, of Cleveland, Ohio, will shortly begin the manufacture of a new style of "water trap." In this device, after sufficient water is separated from the gasoline to fill the receptacle, the drain is automatically opened, and remains open until the chamber is emptied.

A company for the manufacture of automobile motors is being organized at Detroit, and will occupy the factory formerly occupied by the E. R. Thomas Detroit Company at Harper avenue and Dequindrie street. Louis Mendelsohn and Mr. Herreshoff of yacht fame are said to be interested.

The plant of the Verstraete-Fyfe Company, manufacturers of parts and accessories, Burlington, Wis., was damaged $20,000 by fire last week. Special arrangements have been made, however, for immediate resumption in temporary quarters and the business will be little inconvenienced.

The Interstate Automobile Company, of Muncie, Ind., composed of Thomas Hart, George and William Ball, T. F. Rose, J. M. Maring, and others, recently purchased a plot of 40 acres, and have now begun the construction of a brick, steel and glass factory building, 140x440 feet. They expect to start operations in this building by the first of next year.

It is reported that the John A. Roebling Company, of Trenton, N. J., have made a contract with W. H. Sharp to manufacture the car which Sharp constructed and drove in the recent Long Island sweepstakes races.

The Board of Freeholders of Atlantic County, N. J., met at Hammonton on October 14 and inspected and accepted the new road from that point, which will open a new automobile thoroughfare to New York city.

The registrations in Iowa reached 7,524 on October 9, which is double the number registered at the beginning of the year. This indicates that in Iowa at least the automobile business has been prosperous during the past season.

The Kirkham Motor Company, of Bath, N. Y., has secured the contract for supplying engines for the Pullman automobiles for 1909. The Kirkham Company has furnished the motors for the Pullman cars for the last two years.

Plans are on foot with a view to removing the Stanley automobile plant from Mooreland, Ind., to Troy, Ohio, and combining the business with the Troy Buggy Company. James Stanley, of Mooreland, is president of the Stanley Automobile Company.

The House & Rohle Carriage Company, manufacturers of carriages and automobiles, St. Louis, Mo., have secured a permit for the erection of a one story brick and stone factory building at 3958 to 3962 Laclede avenue.

The Shunk Plow Company, Bucyrus, Ohio, are placing on the market a motor buggy equipped with a 12 horse power Roberts two cycle engine and a Ross steering gear. The change speed gear is of the planetary type and is carried, together with the differential gear, at the centre of the rear axle.

The report for September of the Pope Motor Car Company receivers shows sales for the month of $39,611.01, and that the balance in Toledo banks was increased by $19,364.16. The factory pay roll was $3,264.17. The cash balance on September 1 was $214,250.18 and at the close of the month $233,614.34.

According to the report of the Electric Vehicle Company receivers for September, the receipts for the month, including a balance of $218,417 on hand September 1, amounted to $239,116. The cash disbursements amounted to $30,927, including as the largest items $17,262 for the pay roll and $9,371 for purchases. The balance on hand October 1 amounted to $208,188.

While the chauffeur of A. B. Longacre, of Pittsburg, Pa., was working on his employer's car a pool of gasoline formed beneath the car and was accidentally ignited. In order to save the garage from being destroyed by fire the chauffeur started the car and rapidly backed it out of the building, but in his excitement he drove it against a stable at the back of the garage and set fire to this stable. The total damage done amounted to $2,500.

The contract for the new three story building to be erected for the Peerless Motor Car Company has been let to the D. C. Griese & Walker Company.

The plant of the Auto Body Trimming Company, 338 and 340 Ellicott street, Buffalo, N. Y., was damaged to the extent of about $5,000 by a fire of unknown origin on October 6.

Washington A. Roebling, 2d, Trenton, N. J., plans to build ten four cylinder cars, with motors of 7 inch bore and 6 inch stroke, after designs by M. Etienne Planchard, a French engineer. The car is to be known as the Roebling-Planchard and to be rated at 140 horse power.

At the annual meeting of the stockholders of the Matheson Motor Car Company, held at Wilkes-Barre, Pa., last week, John C. Bridgeman, of Wilkes-Barre, and E. S. Fretz, of Pottstown, were elected directors to fill the vacancies caused by the withdrawal of the Palmers of New York.

The Rider-Lewis Motor Car Company have decided to locate in Anderson, Ind., in the northwestern portion of the city near the table factory. It is planned to erect two buildings, a factory building, 60x450 feet, with L extensions 36x80 feet, at each end, and a two story 30x45 feet office building.

R. G. Kelsey, of New York, who was to drive in an automobile race at Cleveland last week, was arrested there on instructions received from the Chicago police, being charged by the Haynes Automobile Company, of Chicago, with converting one of that company's automobiles to his own use. Offers of bail were made, but could not be accepted.

The sale of the Waverley automobile plant at Indianapolis, Ind., by the Pope Motor Car Company to the recently organized Waverley Company, was recorded in Indianapolis on October 10. The Waverley Company paid over to the clerk of the Federal court $200,000. It is stated that the Waverley Company expects to give employment to about 500 men.

John Albin, of Oyster Bay, N. Y., whose son Byron had his skull fractured by a piece of machinery thrown from the Buick car which participated in the sweepstake races on Long Island last week, has brought suit for damages against the Buick Automobile Company, Nassau County and the American Automobile Association. Nassau County is protected against any losses by a bond of $25,000 filed by the Long Island Motor Parkway Association.

M. R. Nyman, vice president of the Thomas Flyer Automobile service in Chicago, whose arrest on a charge of larceny preferred by the Coey Automobile Livery Company we noticed last week, was released by the court because of insufficient evidence to hold him. Nyman was accused of having failed to turn over to the Coey Company a certain sum of money collected for the latter. He admits that he collected the money, but alleges that he turned it over to William E. Walsh, cashier for the Coey Company.

The Four Traction Automobile Company, Mankato, Minn., have leased the Kleinschmidt Building, on North Fourth street.

The Kensington Y. M. C. A., 1854 Frankford avenue, Philadelphia, will open an automobile school on October 21. Wm. Vees will be chief instructor.

L. E. Younie, formerly with the Pacific Commercial Car Company, Tacoma, Wash. has taken the agency there for the Michelin tires, and is now located at 111 South Tenth street.

The Dayton Airless Automobile Tire Company, of Dayton, Ohio, have opened an office at Baum and Whitfield streets, Pitsburg, Pa., in charge of H. E. Henderson and Wm. McLay.

President S. W. Luitweiler, of the Luitweiler Pumping Engine Company, Los Angeles, Cal., builders of motor propelled fire apparatus, are considering to remove to Rochester, N. Y.

We are informed that the Ajax-Grieb Rubber Company have secured the order for tires for the Maxwell 1909 product. It provides for 20,000 tires, costing over half a million dollars, to be delivered before July 1, 1909.

The Smith Motor Car Company, selling agents for the Smith Automobile Company, both of Topeka, Kan., met on October 7 and re-elected their old directors, as follows: L. Anton Smith, C. H. Alexander, E. B. Kellam, Geo. W. Hackney and W. J. V. Deacon.

Business men of Sandusky, Ohio, have subscribed to the required amount of stock of the Roberts Motor Company, of Clyde, Ohio, and the business of the latter company will probably be moved to Sandusky in the near future, where it will be located in the Vincent Valve Company plant.

The Chalmers-Detroit Company inform us that they had received up to Ocober 5 953 bona fide orders from customers, while the list of inquiries for 1909 cars had run to 10,486. The entire 1909 output of 3,100 cars was sold to dealers before August 1. Over 500 1909 cars have already been delivered.

The Detroit Automobile Dealers' Association will hold its second annual endurance contest on November 5, 6 and 7. The start each day will be at the Hotel Tuller, and the daily routes will be Detroit-Saginaw and back, Detroit-Adrian-Jackson-Detroit and Detroit-Lansing and back. At the conclusion of the runs a technical examination of the cars will be made.

Scranton, Pa., will soon have two independent taxicab services, if the plans announced mature. The Scranton Garage and Motor Car Company will begin to operate two Thomas cabs within a few days and add to their equipment as fast as the patronage warrants. Now the Lackawanna Automobile and Taxicab Company has been formed in that city, which expects to begin operations December 1, and to have the service fully established by January 1.

Club Notes.

The fall series of family evenings at the Chicago A. C. began last Friday with a kinetoscope exhibition of automobile subjects.

A movement is said to be on foot in Indianapolis for the consolidation of the Indiana A. C. and the Indianapolis Automobile Trade Association.

The New Jersey Automobile and Motor Club, on October 15, held a house warming at its new quarters at Park place and East Park street, Newark, N. J.

The North Jersey A. C., Paterson, N. J., have extended an invitation to the Hackensack A. C. to affiliate with them. A joint committee of the two clubs will discuss the matter and arrange the terms.

The Montana A. A. has been organized in Helena, Mont., with the following officers: Creighton Largey, Butte, president; John Berkin, Butte, first vice president; Louis Penwell, Helena, second vice president.

The Cheyenne (Wyo.) Industrial Club has appointed a committee to arrange for the organization of the first automobile club in Wyoming. The club will have an initial membership of about ninety Cheyenne motorists.

The Louisville (Ky.) A. C. has decided to erect its own club house, and has appointed a committee to investigate various proposed sites. The committee is composed of Robert Morris, Albert Reutlinger, A. R. Howe, Lee Miles and E. H. Neill. A stock company will be formed to finance the undertaking.

At the regular monthly meeting of the New Jersey Automobile and Motor Club, held at Newark on October 12, counsel for E. R. Thomas, whose hearing before the club was set for October 15, pleaded that Mr. Thomas would be unable to personally appear before the club on that date, and asked for a postponement of the hearing. The governors of the club agreed to a postponement until November 2.

The Automobile Club of America has received from the International Motor Boat Association, specifically known as "The International Association of Yachting Automobile," which comprises in its membership the principal national motor boat clubs, yacht clubs and automobile clubs of France, Germany, Great Britain, Italy and Monaco, a dispatch notifying it that it has been selected by the association as its sole representative in America, which selection carries with it the sole governing authority in all international motor boat races or competitions held in the United States.

Business Troubles.

A petition in bankruptcy was filed on October 11 against the R. O. Williams Automobile Company, Columbus, Ohio. Among the creditors are the Electric Storage Battery Company and the Columbus Tool and Supply Company, the latter's claim of $566.46 being the largest of all.

The creditors of Charles A. Duerr & Co., Inc., at a meeting held on October 14 decided that the receiver, Lindsay Russell, should continue the business for sixty days.

Harry E. Price has been appointed receiver for the J. A. Orlando Auto Company, Columbus, Ohio, on a petition filed by Jess M. Morrison, who owns a one-third interest in the partnership, and who accuses his partner, James A. Orlando, of having converted some of the assets of the company to his own use.

Involuntary proceedings in bankruptcy were brought against the General Motor Car Company, of San Francisco, on October 9. The petitioners and their claims are the Union Oil Company, of Oleum, Contra Costa County, $2,159.94; W. M. Klinger, San Francisco, $674.27, and Arthur Joel, of San Francisco, $396.42.

J. T. Morrison, of Carthage, Mo., has started a motor parcel delivery service with a 14 horse power, two cylinder, air cooled, chain driven car, specially built for the service.

Trade Personals.

Arthur H. Denison has opened the Buffalo Automobile School at 59 Franklin street, Buffalo, N. Y. Both day and evening classes will be held.

Harry Cummings has been appointed sales manager of the American Automobile Co., handling Stoddard-Dayton and Reo cars in Tacoma, Wash.

H. C. Merrill, formerly with the Kansas City agent of the Moon, has been engaged by the Moon Motor Car Co. factory as touring salesman.

Harold Stillman, an automobile salesman, who had been connected with several agencies in Philadelphia, died at Hartford, Conn., on October 12 of typhoid fever.

George Von Rottweiler, until recently engineer of the Fort Pitt Manufacturing Co., New Kensington, Pa., is reported to be forming another company in that city, to be known as the Mercedes Motor Manufacturing Co., to turn out a car to be known as the "Vanderbilt."

F. B. Read, who has been connected with the Springfield Metal Body Co., for several years past, has severed that connection, and has accepted a position as assistant manager of the wholesale end of the H. J. Koehler Co., 1649 Broadway, New York, who handle the E. M. F. 30.

Trade Literature Received.

J. H. Sager Co., Rochester, N. Y.—Circular of the Sager "Easy" springs.

The Cameron Car Co., Beverly, Mass.—Catalouge of 1909 Cameron cars.

The Winton Motor Carriage Co., Cleveland, Ohio.—Catalogue of the Winton Six.

The Autocar Co., Ardmore, Pa.—Catalogue of the new Autocar utility car chassis.

Maxwell-Briscoe Motor Co., Tarrytown, N. Y.—Circular of the Maxwell Junior runabout.

Resilient Wheel Co., 96 Fulton street, New York.—Circular of the Overman resilient wheel.

Saks & Co., Broadway and Thirty-third to Thirty-fourth street.—Catalogue of motorists' apparel.

E. R. Thomas Motor Co., Buffalo, N. Y.—Folder containing specifications and cuts of the Thomas 1909 line.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis.—Circular of the company's battery charging panel Type E.

Stewart & Clark Manufacturing Co., 502-520 Diversey Boulevard, Chicago, Ill.—Catalogue of the 1909 line of Stewart speedometers.

Sterling Alternating Ignition Co., Binghamton, N. Y.—Catalogue of the Sterling alternating master vibrator and the Sterling double contact timer.

Garage Notes.

J. G. Rankin will open a garage and repair shop at Hibbing, Minn.

A garage is being built by Mooreland & Duholm on Main street, Austin, Minn.

Work has been begun on a new garage at Oneida Castle, Oneida, N. Y. It will be owned and operated by the Schubert interests of Oneida.

J. N. Boyce, New Haven, Conn., has filed plans for a one story, 37x80 feet, brick garage, to be erected at 911-913 State street, at a cost of about $5,000.

Charles Miller is negotiating for the purchase of the garage of the Hazleton Garage Co., at the corner of Wyoming and Green streets, Washington, D. C.

The White Garage, of Los Angeles, Cal., will move about December 1 to a new building, 120x168 feet, and two stories high, on Olive street, between Eighth and Ninth.

Plans have been drawn for a $25,000 garage for the Jones Automobile Exchange, Wichita, Kans. The building will be of brick, 50x140 feet and two stories high.

J. O. Caldwell, Jr., formerly of Boston, has opened a garage and automobile supply store at 145 Third avenue, North, Nashville, Tenn. He will also handle the Regal cars.

E. P Moriarty & Co., Kansas City, Mo., will shortly begin the erection of a three story garage at 1610 Grand avenue, in that city. An old two story brick building on the site was torn down last week.

C. F. Roemer and T. C. Miller will establish an automobile garage and supply store in Marshalltown, Ia. The former will continue to devote most of his time to the agricultural implement business.

The petition of the property owners of Fond du Lac, Wis., that the garage on Fourth street be condemned, owing to the fire risk, has been referred to the police and fire commission of the city council.

The old power house of the Chattanooga Railways Co., West Seventh street, will be remodeled to serve as a garage for the Joyce Automobile Co., Chattanooga, Tenn. A sum of $1,500 will be spent for improvements.

C. W. Lindsay and H. A. Wetmore, Sioux City, Ia., have formed a partnership and will open a garage before January 1. They will handle the Thomas car in western Iowa, eastern Nebraska, South Dakota and Minnesota.

The Matheson car will be handled in the District of Columbia and the States of Maryland and Virginia by the Matheson Company, of Maryland, J. J. Mason, president. A salesroom and garage at 1002 Morton street, Baltimore, Md., has been secured.

Plans have been completed for a new garage on Broadway, between Twelfth and Thirteenth avenues, Nashville, Tenn. The building will have 75 feet front on Broadway and be 175 feet deep. It will be completed in about forty-five days, at a cost of about $7,500.

A co-operative company has been formed between motorists of Rockford, Ill., who expect to erect a garage on Seventh street in that city. The following officers have been elected: Dr. E. Lofgren, president; Dr. E. W. Parks, secretary, and Swan O. Widell, treasurer.

The Somerset Automobile Co. has been organized at Somerset, Pa., to handle several lines of automobiles. The officers of the company are: J. Watson Frease, president; J. B. Holderbaum, vice president; J. Picking, secretary and treasurer; William Hoffman, manager, and John Arisman, mechanic.

The Mutual Motor Car Co., consisting of a number of motorists of Pittsburg, Pa., have bought for $50,000 the property of the Colonial Auto Co., consisting of a two story brick, stone and iron fireproof building at 5518-5520 Walnut street, East End. The intention is to restrict the use of the garage to stockholders in the company.

Wm. J. Doughty and Oscar Eckberg, Grand Rapids, Mich., have gone into partnership and bought the Deane Brothers & Shedd garage at 160-162 North Iona street, of that city, which they will conduct under the style of the Central Auto Garage. They have the agency for the Franklin car.

V. E. Roscher, Riverside, Cal., has purchased the interest of his partner, B. H. Ormand, in their garage on Tenth street.

A garage for the Meteor Automobile Co., is to be built by Mrs. M. B. Petersen at Third and Harrison streets, Davenport, Ia.

State Senator H. C. Lintott, Nashua, N. H., has taken a five years' lease of a garage in the Commercial Inn property of the Greeley estate, and expects to occupy it about January 1.

The Schwartzburg-Bond Co. has opened a garage at 176-178 Thirteenth street, Milwaukee. The company will do a general livery business, handle second hand cars, storage and general repair work.

The William R. Ruess Automobile Co. will open a garage and salesroom at 1028-1032 South Main street, Los Angeles, Cal., on November 1, and will handle Pope-Hartford and Tribune cars in southern California.

The Olds Motor Works, of Lansing, Mich., have leased a portion of the building at 5922-5924 Baum street, Pittsburg, for a local branch, which will be placed in charge of J. Vandergrift Hall. Another story will be added to this building.

The H. L. Keats Automobile Co., of Portland, one of the largest concerns in the automobile business on the coast, contemplates erecting an up to date brick and cement garage on Broadway and Pike streets, Seattle, in the near future.

The Western Carolina Automobile Co. has opened a garage at 61 South Main street, Ashville, N. C., and will handle the Cadillac car. The officers of the company are J. H. Lange, president; A. H. McCormick, secretary, and Waxler Smathers, treasurer.

The Levy & Hipple Motor Co., now located at 390 Wabash avenue, Chicago, has leased the property at 1467-1469 Wabash avenue, a plot 42x161 feet, on which it will erect a three story garage building. The building will have a front of white tile and glass and cost in the neighborhood of $25,000.

The Crescent Automobile Co. has been organized at Chattanooga, Tenn., with J. A. Wardlaw, as president; C. N. Woodworth, vice president; L. M. Strong, treasurer, and Jos. J. O'Rourke, secretary and general manager. The company handles the White steamer, and has opened a garage at 18-22 William street.

The Barclay Auto Co., Minneapolis, Minn., at a recent meeting, decided to reorganize by taking George S. Burch into the company, and to increase the capital stock from $25,000 to $50,000. Officers were elected as follows: J. J. Barclay, president and general manager; George S. Burch, vice president, and Harry A. Peterson, secretary and treasurer.

H. A. Paxton, Sandusky avenue, Bucyrus, Ohio, is building a 68x40 feet addition to his garage, which will give him when completed a single story cement block building 150x40, entirely fireproof. The addition will be completed by November 15. Mr. Paxton makes a specialty of tire repairs and battery charging, and handles the Cadillac and Winton cars.

The State Automobile Co. has been organized at Indianapolis, Ind., with Jake Herft as president; John R. Schmidt as vice president, and Sol. Allman as secretary and treasurer. The company has leased the building at 415-419 Massachusetts avenue, and will conduct a general garage, repair and supply business. The full line of cars to be handled has not yet been decided upon.

New Incorporations.

Mitchell Automobile Co., Chicago, Ill.—Capital stock increased from $1,000 to $40,000.

Gove Automobile Co., Milwaukee, Wis.—Capital, $5,000. Incorporators, Richard Gove, E. G. Gove and G. J. Carroll.

White Tire Co., New York, N. Y.—Capital, $250,000. Directors, Leonard L. Stein, Leo L. Dobkin and Nathan Coleman.

Automobile Livery Co., Birmingham, Ala.—Capital, $5,000. The officers are H. T. Shoup, president; N. O. Tyler, vice president; H. Lee Brown, treasurer, and A. J. Morgan, secretary.

State Automobile Co., Indianapolis, Ind.—Capital, $25,000. Directors, Jacob Herff, Sol Allman and J. R. Schmidt.

Non-Fluid Oil Co., New York, N. Y.—Capital, $50,000. Directors, Thomas A. Matthews, Walter F. Kimball and Frederick J. Barnes.

Triumph Automobile Tire Co., Homestead, Pa.—Capital, $1,000,000. Incorporators, H. E. Keyes, C. O. Derr and W. O. Johnson.

Best Automobile Co., Indianapolis, Ind.—Capital, $20,000. Directors, Edgar Updyke, William N. Gates and Edward E. Gates.

Southern Tier Motor Co., Elmira, N. Y.—Capital, $25,000. Directors, Guy W. Shoemaker, Charles S. Latten, Harry H. Crandall.

Bingham-Jordan Automobile Co., Minneapolis, Minn.—Capital, $50,000. Incorporators, George Bingham, Eva Bingham and T. C. Jordan.

Auto Livery Co., New Orleans, La.—Capital, $7,500. Incorporators, Ginder Abbott, Palmer Abbott, E. J. Hewling and Joseph Woodward.

Standard Auto and Transit Co., Mansfield, Ohio.—Capital, $10,000. Incorporators, Bert Lane, J. C. McNutt, F. C. Poling, E. K. Lane and E. B. Polin.

Preston Fabric Co., Buffalo, N. Y.—Capital, $100,000. Directors, Christian Weap, Morris R. Evans, James F. Preston, Philip Weap, Jr., and Alonzo S. Collins.

Derain Motor Co., Cleveland, Ohio.—Capital, $30,000. Incorporators, J. T. Murphy, D. F. Sherbondy, W. S. Mitchell, M. A. Copeland and Charles F. Lang.

Los Angeles Automobile Livery and Sightseeing Co., Los Angeles, Cal.—Capital, $75,000. Incorporators, Frank C. Woodward, O. E. Freeman, G. W. DeLape and E. S. Williams.

Champion Tire Co., Syracuse, N. Y.—Capital, $100,000. Incorporators, I. C. Reed, E. Olin Kinne, John R. Clancy, George B. Becker and S. D. Schlacter. To manufacture the Champion auto tire cover.

New Agencies.

Newark, N. J.—J. H. Koehler, E-M-F.

Detroit, Mich.—C. B. Fear, Gyroscope.

La Crosse, Wis.—Alfred James, Franklin.

Kansas City, Mo.—W. S. Helm, Gyroscope.

Hutchinson, Minn.—W. W. Sivright, Ford.

Reading, Pa.—Graham Automobile Co., Acme.

Brooklyn, N. Y.—W. S. Williamson, Gyroscope.

Youngstown, Ohio.—Standard Auto Garage Co., Franklin.

Charlotte, N. C.—Southern Automobile Co., Maxwell.

Salina, Kan.—Ollinger-Center Motor Car Co., Oldsmobile.

Tacoma, Wash.—Pacific Commercial Car Co., Chalmers-Detroit.

Tacoma, Wash.—E. S. Dimmock, Seventh and Pacific avenues, Studebaker.

Reading, Pa.—Reading Automobile Co., 26-28 South Fifth street, Franklin.

Baltimore, Md.—Mar-Del Mobile Co., Charles street and Mount Royal avenue, Franklin.

Coming Events.

October 17—Hill Climb, Avon Mountain, A. C. of Hartford (Conn.).

October 24—Vanderbilt Cup Race, Long Island.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 27 to March 3—Hartford, Conn., Annual Show, Automobile Dealers' Association.

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Stresses in Universal Joints.

By David Landau and Asher Golden.

A recent editorial in The Horseless Age pointed out that considerable improvement was being made in universal joints. That this is true cannot be questioned even by the most casual observer. We believe that further improvement may be rendered possible by a knowledge of the nature and extent of the stresses to which universal joints are subjected, particularly where the power to be transmitted is great, as in automobile practice.

Besides the determination of strength, it is also necessary to consider the bearing areas, so that proper provision may be made for wear. This is of as much importance as determining the stresses, since a certain part of a machine may be of sufficient proportions to resist all the possible stresses imposed and yet show enough wear in a reasonably short time to make replacements an absolute necessity. The factors entering into the discussion of the strength of universal joints are many and sometimes very complicated. The most important, however, are considerations of torque, speed and angularity of the shafts.

We will limit ourselves in this article to the consideration of the stresses in the joints of the Hooke type and its modifications. For automobile purposes the following types have come into extensive use: Fork and cross arms (original Hooke joint), pin and block, and spherical or globular. There are other types, such as the diaphragm, which need not be considered here, since they are not true universal joints.

Owing to the kinematical properties of the universal joint, it is easily determined that when a single universal joint is used in the transmission of power between two shafts not in the same straight line there are variations in the angular speed of the driving and driven shafts at certain intervals in every revolution.*

The difference of angular speed tends to set up additional stresses in the joints unless the angle between the shafts is very small, in which case these stresses may be neglected, as will be shown later.

To determine the stresses in the various parts of the joint it is necessary to know the extent of the variation of angular speed, in addition to the driving force, which produces pure torsional stresses.

The twisting moment, T, due to the transmission of a given horse power at a constant speed, is given by the following equation:

$$T = \frac{12 \times 33000 \times H P}{2 \pi N} \text{ (pounds-inches)} \quad (1)$$

where N is the number of revolutions per minute.

If this twisting moment or torque were to be transmitted through a single shaft or two shafts in the same straight line, it would be the determining factor in the calculation of the stresses in the shaft or shafts, and the total pressure, P, at the point H, distant r inches from the centre of the shaft, Fig. 1, would be

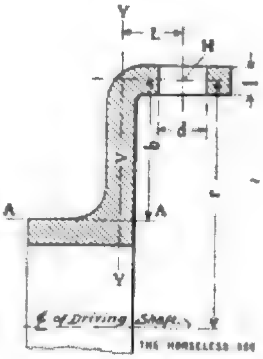

Fig. 1.

$$P = \frac{T}{r} \quad (2)$$

However, since we are to transmit the torque between two shafts inclined to each other, it is necessary to consider some function of the angle θ between the two shafts. The pressure P then becomes:

$$P = \frac{T}{r \cos \theta} \quad (3)$$

This is the total pressure on all trunnions; if we call n the number of trunnions, then the pressure at each is

$$p = \frac{T}{n r \cos \theta} \quad (4)$$

Equation (3) may be derived from the following considerations:

Let w = angular velocity of the driving shaft.
w' = angular velocity of the driven shaft.
θ = angle between the driving and driven shafts.
ϕ = angle through which the driving shaft has turned.

Then it can be shown that

$$\frac{w}{w'} = \frac{\cos \theta}{1 - \sin^2 \phi \sin^2 \theta}$$

and solving for w', we have

$$w' = \frac{w(1 - \sin^2\phi \sin^2 \theta)}{\cos \theta} \quad (5)$$

In this discussion we are concerned with the maximum value of the torque, so that it is necessary to find that condition which will make w' a minimum. For any particular case, it is evident that w and θ are constant; then we have by differentiating twice with respect to ϕ,

$$\frac{dw'}{d\phi} = -\frac{w \sin^2 \theta \sin 2\phi}{\cos \theta} \quad (6)$$

$$\frac{d^2 w'}{d\phi^2} = -\frac{2 w \sin^2 \theta \cos 2\phi}{\cos \theta} \quad (7)$$

Equating (6) to zero we find two values of ϕ which will satisfy the equation, namely, 0 and $\pi/2$. Equating (7) to zero and substituting in it the values 0 and $\pi/2$ we find that the latter will make equation (7) positive. Now, by substituting this value of ϕ in equation (5), the value of w' is a minimum. Making the substitution, we have

$$w' = w \cos \theta \quad (8)$$

We can now find the maximum torque due to the angularity of the shafts by substituting in equation (1) for $2\pi N = w$, the value of w', which is equal to $2\pi N \cos \theta$. We then have:

$$T_{max} = \frac{12 \times 33000 \times H P}{2 \pi N \cos \theta}$$

$$= \frac{T}{\cos \theta} \quad (9)$$

The reciprocal relation—that is, the condition for minimum torque—may be found from equation (5) by substituting for ϕ the value which makes the right hand member of equation (7) negative. This value is 0. We then have

$$w' = \frac{w}{\cos \theta}$$

However, beyond the fact that this relation and that given in (9) enable us to find the limits of angular velocity and torque it has no further interest for us at present. We are here concerned with the maximum turning effort, from which we are to determine the maximum fibre stresses.

To illustrate the preceding discussion by a concrete case we will take an example from practice, which will show the differences of torque between driving in a straight line and the additional torque due to the angularity of the two shafts. The case is that of a 35 horse power car in which the following conditions obtain:

Horse power	35
R. P. M of shafts	300
Acute angle between shafts	10°

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* For a fuller discussion of this point see Jones, "Machine Design;" or Kennedy, "Kinematics of Machinery."

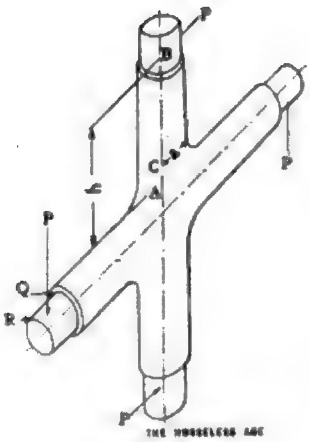


Fig. 2.

Assuming that the shafts are driving in a straight line, we find the torque to be, from equation (1),

$$T = \frac{12 \times 33000 \times 35}{2 \times 3.1416 \times 300} = 7,340 \text{ pounds-inches}$$

Now, considering the angularity, we find from (9) the maximum torque:

$$T_{max} = \frac{12 \times 33000 \times 35}{2 \times 3.1416 \times 300 \times .9848} = 7,450$$

pounds-inches.

The angle 10° may be considered as an extreme case; it is seen, therefore, that the additional stress due to angularity is very small, and in the case considered is only 1½ per cent. more than the straight shaft torque—an amount which may be easily neglected in ordinary cases.

We will now consider the stresses in the simple Hooke joint, taking the arms of the fork first and then the cross arms. Taking the torque as acting at a distance r inches from the axis of the shaft, the maximum pressure at the centre of the trunnion bearing, Fig. 2, is $P = \frac{T}{2\,r\,\cos\theta}$; the unit bearing pressure is $B = \frac{T}{2\,r\,d\,l\,\cos\theta}$ (pounds per square inch), whre d is the diameter of the bearing and l is its length, both expressed in inches. The factor 2 in the denominator is substituted for n.

The vertical arm V is subjected to combined bending and torsional stresses imposed by the load P. We may consider the half fork as a cantilever loaded at the centre of the trunnion and fixed at the line AA. We then have a force tending to bend the vertical arms around the line AA and a force tending to twist the arm around the vertical axis YY. The maximum bending moment is P b and the twisting moment is P L.

Now, let Z = the section modulus of the section under maximum stress (combined stresses);

f_b = the normal stress on the extreme fibre of this section due to bending;

f_t = shearing stress due to torsion;

f_e = equivalent stress at the section AA;

then we have

$$f_b = \frac{P\,b}{Z} \qquad \text{.......... (10)}$$

$$f_t = \frac{P\,L}{2\,Z} \qquad \text{.......... (11)}$$

The equivalent stress at the section AA is

$$f_e = \frac{P}{2\,Z}\left(\frac{m-1}{m} + \frac{m+1}{m}\sqrt{L^2+b^2}\right) \text{..(12)}$$

where m is Poisson's ratio. For automobile steels, m may be taken to have the average value 3.33. Substituting this value of m in equation (12), we have the much simplified formula:

$$f_e = \frac{P}{2\,Z}\left(.7 + 1.3\sqrt{L^2+b^2}\right) \text{....(13)}$$

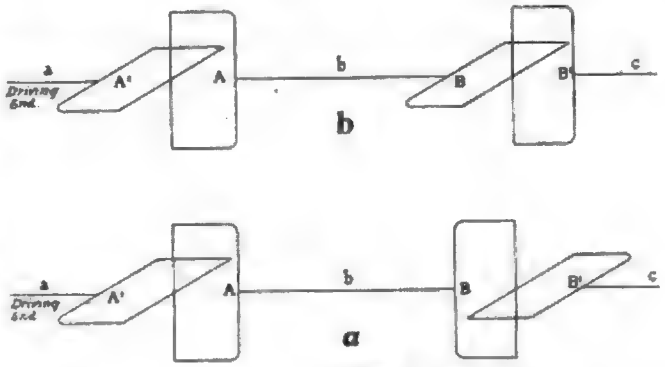
For the purpose of illustrating the above formulæ, we will take the figures given in the numerical example above. In addition we also have the following dimensions:

$b = 1$ inch.
L = 1.5 inches.
$r = 2$ inches.

Then the total bearing pressure on the bearing surface H is

$$\frac{1}{2} \times \frac{7340}{2 \times .9848} = 1,860 \text{ pounds.}$$

This is the load which produces bending and twisting in each arm of the fork.



Figs. 3a and 3b.

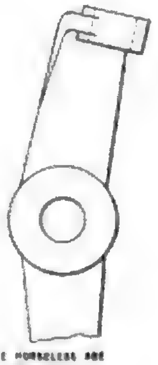


Fig. 4.

The bending moment at the section AA is

$$P\,b = 1860 \times 1 = 1,860 \text{ pounds-inches.}$$

The twisting moment is

$$P\,L = 1860 \times 1.5 = 2,790 \text{ pounds-inches.}$$

$$f_b = \frac{1860}{Z}$$

$$f_t = \frac{2790}{2\,Z} = \frac{1395}{Z}$$

$$f_e = \frac{1860}{2\,Z}\left(.7 + 1.3\sqrt{1.5^2+1^2}\right)$$

$$= \frac{2240}{Z}$$

It is seen from the foregoing that the twisting moment is greater than the bending moment, but since any section is twice as strong in torsion as in bending, the bending stresses will be greater, so that it is necessary to design the arm of a form in which it will be most able to resist bending stresses, which tend to bend the arms of the fork, as shown in Fig. 4. A suitable section for this purpose is that shown in Fig. 5. The section modulus of such a section is approximately

$$\frac{B(H^3 + b\,B^3)}{6\,H}$$

In the case considered, Fig. 5, H is 1⅝ inches, B is ¼ inch and b is 1 inch. Substituting these numbers in the formula for the section modulus, we have

$$Z = \frac{.25(1.625^3 + 1 \times .25^3)}{6 \times 1.625} = .1115$$

This is the section modulus at the section of maximum stress. Substituting this value for Z in the equation $f_e = 2240/Z$, we have

$$f_e = \frac{2240}{.1115} = 19,300 \text{ pounds per square inch.}$$

The material of which this joint is made is cast steel having an ultimate strength of 85,000 pounds per square inch. To make the arm equally strong throughout it is seen that we can now find suitable proportions for the section AB, distant y inch from the centre of the bearing. The section AB being subjected to bending only the bending moment at this section will be Py and the section modulus of the section at this point is found from

$$Z' = \frac{P\,y}{f_e} \qquad \text{.......... (14)}$$

From this we can determine the required section by experiment.

The stresses found above are the same for both forks of the same joint.

STRESSES IN CROSS ARMS.

Each member of the cross arm may be regarded as a cantilever loaded at the point B, Fig. 2, and fixed at A. These arms are subjected to a twisting force which depends on the coefficient of friction between the

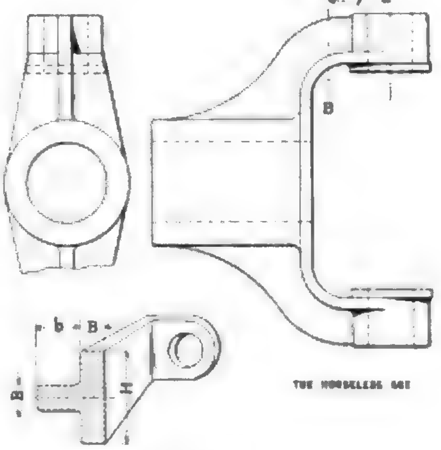


Fig. 5.

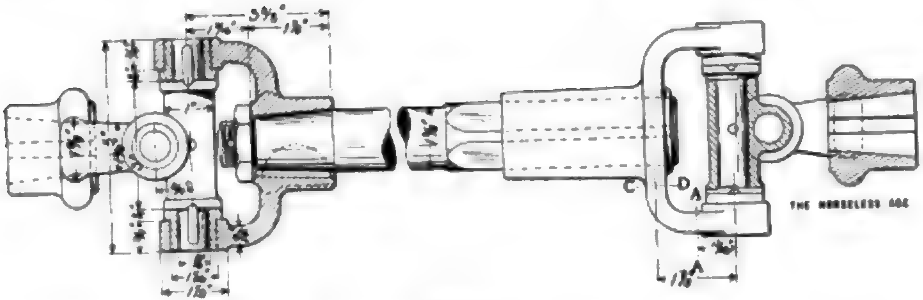


FIG. 6.

bearing surfaces, and a bending force due to the load P. The twisting force is, however, very small and may safely be neglected. The maximum bending moment is P*h*, and the stress in the trunnion is

$$f = \frac{4\,P\,h}{\pi\,a^3} \quad \ldots\ldots\ldots\ldots\ldots\ldots (15)$$

where *a* is the radius of the cross arm at C; the unit stress is

$$\frac{4\,P\,h}{\pi^2\,a^3} \quad \ldots\ldots\ldots\ldots\ldots\ldots (16)$$

Each half arm is under shear and the value of this shear, in pounds, is that of the load P at the points between A and B. The unit shearing stress is the same at all points between Q and R, but failure will occur, if at all, through the plane Q, since the shearing action takes place in this plane.

It is now of interest to determine the change of stress which takes place when two universal joints are used. If we assume the axes of the shafts, *a*, *b* and *c* (Figs. 3*a* and 3*b*), to be in the same straight line, the angular velocities of the shafts will be the same at all points in a single revolution, so that there is no variation of torque between the points *a* and *c* no matter how the arms A, A', B and B' are disposed. If, however, there exists an angular relation greater than zero between the shafts *a* and *b*, then there is a variation of torque which is a function of the angle θ, as was pointed out above.

Now let us assume, as in Fig. 3*a*, that the forks A and B are in the same plane and that the acute angle between the shafts *b* and *c* is also θ; then the fork B' stands in precisely the same relation to the fork B as A' to A; that is, equal variations in angular velocity occur at the same instants, so that the torque in *c* is the same as that in *a*, and the stresses in both joints are the same. If, as in Fig. 3*b*, the forks A and B are perpendicular to each other, then similar variations of angular velocity occur between the shafts *a* and *c* at intervals 90° apart; there is then an additional increase of torque as we pass from *b* to *c*, and the stresses in the right hand joint are greater than the stresses in the left hand joint. In this case when the angular velocity of the fork A is a maximum that of the fork B is a minimum, and vice versa.

The maximum torque at the right hand joint is then found from equation (9), and is

$$T^1_{max} = \frac{T_{max}}{\cos\theta} = \frac{T}{\cos^2\theta} \quad \ldots\ldots\ldots\ldots (17)$$

As an additional illustration, we will determine the stresses and bearing pressures in the joints shown in Fig. 6. The couplings and shafts of this joint were designed to transmit 35 horse power at 300 r. p. m. This joint has been on the market for some time, and the makers have found it to serve its purpose. The forks are of cast steel, having an ultimate strength of 58,000 pounds per square inch. All dimensions necessary for the purpose of calculation are shown in the sketch.

The maximum pressure on each trunnion is 1,700 pounds; the trunnions are 11/16 inch in diameter, and the section modulus of this section is .0316. The bending moment at the point A is

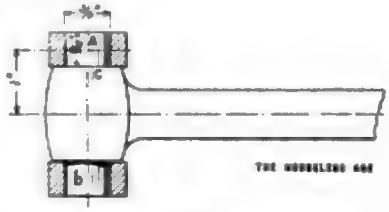


FIG. 7.

1,700 × .625 = 1,060 pounds-inches,

and the fibre stress at this section is

$$\frac{1060}{.0316} = 33,500 \text{ pounds per square inch.}$$

The projected area of the bearing is .6875 square inch, and the unit bearing pressure is

$$\frac{1700}{.6875} = 2,470 \text{ pounds per square inch.}$$

This pressure is not excessive considering the small angular movement and the low surface speeds at the bearings.

We will now consider the stresses in the fork. The section modulus of the section AA is approximately .075. This section is 13/16 inch from the centre of the trunnion, so that the bending moment at this section is 1,700 × 13/16 = 1,380 pounds-inches; hence the fibre stress at this point will be 18,400 pounds per square inch.

The section CD is subjected to twisting and bending. Its section modulus is .168. The twisting moment at the section CD, which is distant 1⅞ inches from the point of application of the load, will be 3,190 pounds-inches; the bending moment at this section, which is distant 1 inch from the point of application of the load, is 1,700 pounds-inches. The maximum equivalent fibre stress is

$$f_e = \frac{1700}{1 \times .168}\left(.7 + 1.3\sqrt{1.875^2 + 1^2}\right)$$

$$= 17,600 \text{ pounds per square inch.}$$

If we assume that the ultimate strength is practically the elastic limit, then the factor of safety is 3.3. The shaft which transmits the power is 1⅛ inches in diameter, and its elastic limit is probably in the neighborhood of 100,000 pounds per square inch. The twisting moment to which the shaft is subjected is 7,353 pounds-inches; the section modulus of the section is .255; hence the fibre stress is 28,800 pounds per square inch. Its factor of safety is 3.7—practically the same as that of the universal—a fortunate combination! If, however, the shaft had been heat treated, it is possible that its strength would have been considerably increased, in which case the strength of the universal joint would be the criterion of the strength of the driving system.

PIN AND BLOCK JOINTS.

The pin and block joint shown in Fig. 7 was designed for a light, high powered runabout. The maximum torque of the propeller shaft was found to be 8,440 pounds-inches when driving in a straight line, and 8,570 pounds-inches for an assumed maximum angularity of the shafts of 10°. The maximum pressure on each of the pins *a* and *b* is 4,285 pounds. The pressure is distributed over a projected area of 9/16 × ¾ inch = .4225 square inch. Therefore the unit bearing pressure is 10,150 pounds. It is well to bear in mind, however, that these surfaces are a high grade of chrome nickel steel, case hardened. Particular attention is called to this point as showing one of the results of racing car design.

The bending moment at the point C is 1,206 pounds-inches; the pin is of chrome nickel steel, heat treated, having an elastic limit of about 225,000 pounds per square inch; diameter of pin, ¾ inch. The section modulus of this pin is .04143. The fibre stress is, therefore, 29,200 pounds per square inch. This pin is subjected to pure shear equal to the load at the point *a*. The area

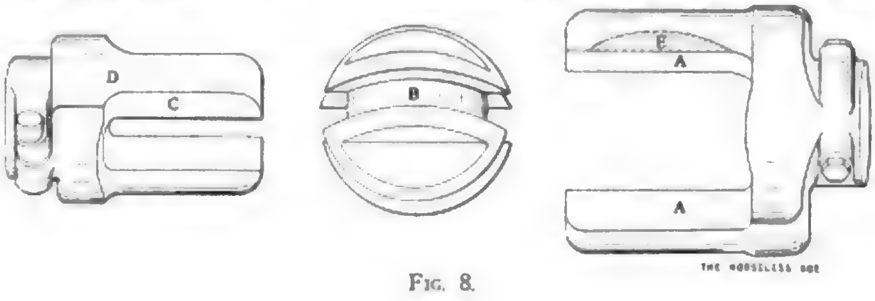


FIG. 8.

of this pin is .4225 square inch; hence the maximum shearing stress is 4285/.4225 = 10,100 pounds per square inch.

It is seen that the determination of the stresses in the pins of the pin and block type of joint is a comparatively simple matter.

Owing to the comparatively limited space which universal joints have to occupy, the excessive bearing pressures above noted are of common occurrence. One maker, however, in order to eliminate the effects of excessive pressure between bearings and trunnions, has replaced the plain bearing by a radial ball bearing. This is very commendable, but we venture to say that many manufacturers would reject the idea owing to the high initial cost of the ball bearing. Since the motion of these parts is very slight it seems not impossible that a very small and light type of ball bearing could be adopted. Further improvement in the direction of lessening the effects of excessive bearing pressures may be had by enclosing the moving parts and supplying them with a suitable lubricant.

SPHERICAL OR GLOBULAR JOINT.

From the foregoing it is evident that once we have succeeded in determining the stresses in one form of simple Hooke joint, it should not be a difficult matter to treat other forms. Let us take as an example the joint shown in Fig. 8. The ball B is shown removed from the forks.

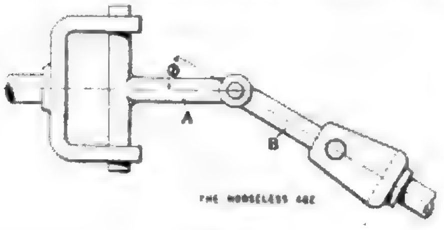


FIG. 9.

If T is the maximum torque to be transmitted, the pressure on each arm is $\frac{T}{2r}$, where r is the distance from the centre of the ball to the centre of the arm. The arms A A, as in the cases considered above, are subjected to a bending moment and a twisting moment, so that here it is also necessary to find the equivalent fibre stress due to combined bending and torsion. We may consider the arm as a cantilever fixed at D and loaded at the point C; the maximum bending moment is then $\frac{Ty}{2r}$ and the twisting moment is $\frac{TL}{2r}$.

It is unnecessary to determine the stresses in the ball, since it is strong enough in any event to resist all loads imposed on it.

The pressure on the arm is distributed over the shaded area E. If the area of this segment be a, then the unit bearing pressure is $\frac{T}{2ra}$.

The Renault ball joint is almost similar to that discussed above and may be treated in the same way.

CROSS ARMS NOT IN THE SAME PLANE.

A point worthy of consideration is the effect of disposing the cross arms so that they revolve in different planes. By way of illustration we will take an exaggerated case as shown in Fig. 9. It is evident from the illustration that the longer we make the arms A and B the shorter will be the driven shaft and the greater the angle θ. This results in greater variations of angular velocity and increased stresses. This applies to any case in which the cross arms are not in the same plane, as in Fig. 6. In addition, where the cross arms are tubular and the pins are driven in, the load imposed on the pin tends to rupture the tube longitudinally.

Two Cycle Experiments—III.

By Herbert Frey.

The following is a description of experiments which suggested themselves to the writer while he carried on the experiments described in this article in The Horseless Age of January 22 and 29, 1908.

There is no doubt that a large amount of thought and money is being expended in research along the line of two cycle motors with fuel injection, as is evidenced by the numerous inquiries in the trade papers and letters to those who publish results of their personal experiments. It is rather surprising that more has not been done with gas injection systems. By this I mean the vaporizing or breaking up of the fuel and pumping this gas or saturated mixture in measured quantities to the cylinders during (or at the end of) the power stroke. This would seem to be a simpler solution of the fuel injection idea than to attempt to pump the minute quantities of liquid fuel, with the attendant troubles due to delayed vaporization in the working cylinder.

THE GAS INJECTION SYSTEM.

That this system does not entail any great complication may be seen from Fig. 1, which shows a conventional two cycle cylinder having an extra port P to admit gas (saturated mixture) from the pump O, which also constitutes the measuring device, and may be made to feed any number of cylinders by interposing a distributing valve and timing the pump in relation to the power impulses.

The pump draws its supply direct from the vaporizer or "saturator" at (or slightly above) atmospheric pressure, and the volume delivered by the pump is controlled by varying the piston stroke. In this connection it may be well to call attention to the ease with which the exhaust heat may be utilized for raising the heavier fuels to such a temperature that saturation takes place even in the ordinary type of carburetor, especially when pains are taken to keep the entire influx of mixture at a high temperature by jacketing the entire intake line.

The objection of a heated gas supply does not apply here, as the mixture enters the cylinders under pump pressure, after the exhaust is closed, and the increase in temperature does not, therefore, cut down hte air charge.

The writer's experiments with this system have not been carried far enough to give conclusive data on its efficiency, as compared with the liquid fuel system, but they seem to show that much better regulation and vaporization may be expected. It is hoped that other experimenters will give this system as much experimental study as is now being accorded the liquid fuel feeding devices. Both light and heavy grades of fuel may be used, as there will be no trouble from vaporization at the injection nozzle and the resulting banking up of pressure in the fuel supply tubes, as occurs when the use of gasoline is attempted in the liquid fuel injection system.

Fig. 2 shows a modification of the idea in which acetylene gas from a "Prest-O-Lite" tank is fed to the cylinders through a port opened by the piston at the end of the power stroke, thus doing away with valves under combustion pressures, which were found to give trouble owing to their small size. The tubes for the gas will be seen to enter the cylinders just to the right of the bypass cover plates.

The gauge in the foreground shows the pressure of the scavenging air, supplied in this instance by an external pump and also admitted at the end of the stroke and directed by the regular deflector plate.

AN EXHAUST EJECTOR.

Fig. 3 shows a section of an ejector for causing the exhaust of one cylinder (in a multi-cylinder motor) to draw in the charge of another. A, B and C are the exhaust pipes from the motor, and D is the main tube having the injector tubes a, b and c. To the writer's knowledge this is the first "series" injector tried, and no doubt it can be so designed as to give good results on a constant speed motor, but so far as tried it proved

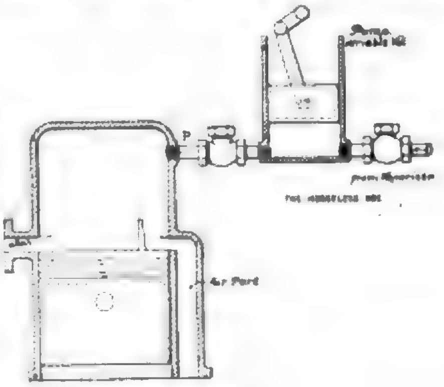


FIG. 1.

useless for automobile work. The principle embodied should prove especially applicable to air scavenged motors, for in that case there would be no tendency to draw out mixture through the exhaust port.

PISTON TOP AND RINGS.

It does not seem to be appreciated that unless the top edge of the piston is a close fit in the cylinder the upper edge of the top ring detrmines the opening and closing of the exhaust port (which means the beginning of compression) and not the top edge of the piston. When it is realized that the terminal pressure may be as high as 80 pounds per square inch when the exhaust opens, it will be seen that there is an appreciable difference in the timing if it is the ring that acts as cut-off. The inlet is not affected so much, as the pressures involved are much lower. Obviously compression cannot commence until the exhaust port has been passed, and if the metal is one-quarter of an inch above the upper ring it causes a delay of one-quarter of an inch in the piston travel in closing.

It is the writer's practice to so grind this upper edge that after expansion it fits close and acts as the cut-off edge. The practice of turning the piston down one-thirty-second above the upper ring seems wrong, as it subjects the rings to severe service.

Two five-eighths of an inch rings at the upper end seem to work as well as a greater number of narrower ones, if the initial fitting is good, and they allow of the use of unbridged ports, as this width is greater than the length usually allowed for the intake port, and so leaves only the exhaust port to be considered in connection with the spring of the rings.

The amount of spring to allow on a piston ring has been a much mooted question some claiming that a ring that just touches the cylinder walls is as tight as one having three-eighths of an inch spring. Theoretically this would seem correct, but in practice one-eighth of an inch spring is about the minimum to allow in a ring of the usual size. There is no doubt that the banked up oil at the edge of the rings adds materially to the tightness of the piston, and for this reason a large number of narrow rings are advocated by many builders.

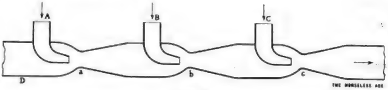


FIG. 3.

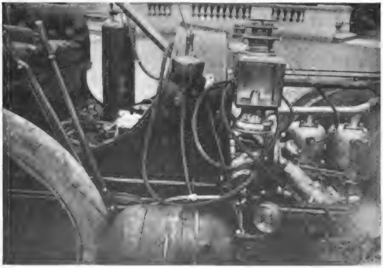


FIG. 2.

Business Use of Automobiles in Rhode Island.

Rhode Island, the smallest State in the Union, with a land area of 1,067 square miles, and a population of about 520,000, has about 4,000 motor vehicles registered within its limits. Under the recently passed automobile law all machines have been re-registered within the past three months, and the figures given out by the Board of Public Roads show therefore almost exactly the number of cars owned in the State.

Taking the above figures as a basis, and figuring an ordinary family as consisting of four persons, it will be seen that there is one automobile for every 130 persons, or for every forty families. As the percentage of runabouts to other motor vehicles is approximately 1 to 2, or one-third of the total number, it will be seen that there is one runabout for every 420 persons or 120 families in the State. On the basis of the area, there are four machines to a square mile. This appears to be a low figure, but when it is considered that the population of the State is half in Providence it is not so bad. The figures of the 1905 census in Providence show a population of 198,635. This is now about 200,000.

The State ranks among the first for good roads, and under the new law a revenue of between $45,000 and $55,000 annually will be collected and expended on road building and repairing.

In Rhode Island physicians use the runabout more than any other one class of business men, and as a general thing find them more satisfactory than horses. This fact is shown by the number who own and operate such cars. In Providence about 70 per cent. of the doctors have runabouts. The average for the entire State, on account of the great uncultivated districts, is somewhat less than 60 per cent. As a general thing physicians find the runabout as cheap as if not cheaper than horses. There are the exceptional cases where a "green" operator finds difficulty.

The builders and contractors of Rhode Island have within the past three or four years adopted the runabout to a great extent in their business, and reports from them show that they are as a rule very much satisfied in their choice between the horse and the automobile. Real estate agents and auctioneers also use runabouts freely in going from location to location in their business. In fact the congestion of the downtown streets of Providence became so great recently, owing (in the opinion of the board of police commissioners) to the increased number of automobiles, that special streets had to be assigned where persons might leave their machines while at business.

Exchange place and Market square, both in the centre of the city, are now practical outdoor garages during the day time. Cars are left standing there during the day under adequate police watching, and so far no reports have been made about troublesome boys or thieves. It is not an uncommon sight to find twenty machines at any hour "anchored" in Exchange place. At the time these free out of door garages were allowed the police commission also put into force new traffic rules. The local State automobile club had for many months been asking for regulation of the traffic, which request, backed by the mayor, was finally heeded.

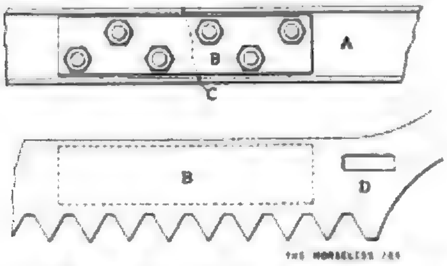
The physical construction of the State, as one automobile owner recently pointed out, makes a machine valuable to a man who has to go over the entire State. Narragansett Bay splits the State practically in halves for about 30 miles up from the ocean, and there is a noticeable lack of cross ferries. From Newport to Narragansett Pier, on opposite sides of the bay, a ferry has been established primarily to accommodate the automobilists.

Maintenance and Repairs

Repairing a Frame Break.

A young engineer, who was about to return from a dam upon whose construction he was engaged, noticed just before starting that a crack had developed in the lower flange of the right longitudinal frame member of his car, but as the distance to the city was only 35 miles he decided to risk the frame holding together until he arrived there and could obtain another car, or at least some conveyance until the frame member could be replaced. However, before the trip back to the city was completed the car was forced off the road by a large cement wagon, and as a result the break in the frame member was complete. Getting back to the city with the car was out of the question, and it was necessary to make a repair to the frame even before the car could be towed with safety. The engineer accordingly started off to a farmhouse, where he stopped and asked for a team to take him to the city, some 25 miles. No horses were then about the stable, being out plowing, etc., but at 6 o'clock that night the farmer thought he could hitch up and take the engineer in. An old reaper was lying in the barn, its parts coated with rust. The engineer immediately looked over the reaper, and finally noted that the cutter frame was in good condition, and after a little bargaining obtained that part of the machine. At 6 o'clock that night a team was hitched up, and after a piece of fence had been lashed to the frame to keep the broken ends together the car was towed back to the construction works, the cutter frame being taken along in the wagon. Progress was slow, the outfit not arriving at the works until half-past 9.

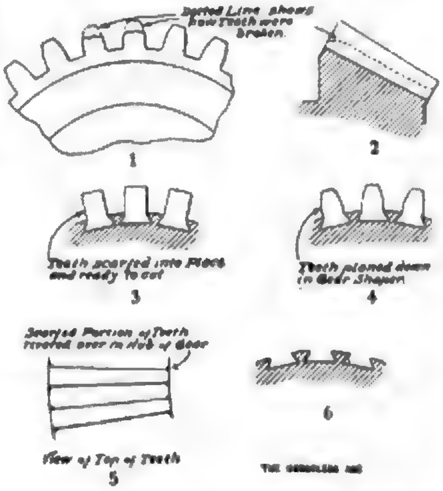
The next morning the engineer and an assistant went to work and cut out a portion of the cutter frame until it was of the correct size to fit the car frame between the flanges. The frame was now drilled and the piece taken from the cutter drilled to match. The piece was fitted in place and six bolts were put in and locknutted. The repair, which is shown in the accompanying figure, held for several months until the construction work on the dam was finished, when a new frame was put in the car. A A is the pressed steel frame of the car, viewed from the inside, C being the crack or break in the frame. The portion B, shown by the dotted lines, was cut from the cutter frame and bolted to the car frame, as shown in the upper figure.



Replacing Broken Teeth in a Main Driving Pinion.

By G. S. Granlund.

Some time ago the writer was shown a main driving pinion for a steam car with two teeth broken off, as shown in Figs. 1 and 2. The owner was just on the point of going to the manufacturers for a new pinion when he held up the broken gear and asked my opinion. I told him that two teeth could be scarfed into the hub and the pinion could be made almost as strong as when it was new. I took it to a small machine shop (not an automobile repair shop), after having first made drawings of what was wanted. The pinion being case hardened, it had to be softened. After that two slots were milled in the hub, as shown in Fig. 6. Two pieces of 35 per cent. carbon steel were machined so as to fit these slots with a driving fit, and provision was made to rivet over the ends, as shown in Fig. 5. The hub was then placed in the gear shaper and the two pieces of steel were shaped to the correct contour of five pitch teeth. The pinion was then case hardened. The total cost of this operation was $4, as against $20 for a new pinion. The car has been running two months and the pinion works as smoothly and silently as a new one.


Dotted Line shows how Teeth were broken.
1
2
Teeth scarfed into Place and ready to cut
3
Teeth planed down in Gear Shaper
4
Scarfed Portion of Teeth riveted over in Hub of Gear
View of Top of Teeth
5
6
THE HORSELESS AGE

Prop Up the Axle When Removing a Wheel.

When one of the wheels of a car is to be removed it is not sufficient to jack up that end of the axle, but a soap box or other support of sufficient strength should be placed under the axle to carry the weight if the jack should be knocked over. If the brakes should not be set a very slight push in the fore and aft direction will suffice to upset the average jack, and even if they were set, as they should be, the car might easily be pushed sideways sufficiently—if the wheel opposite to that removed stood on a greasy spot—to knock the jack off its base and cause the axle stub to drop to the floor, either bending or breaking the axle. Such an accident is usually a matter of considerable expense, and it is therefore important to observe the above mentioned precaution.

A High Wheeler and a Country Doctor.

By Dr. Z. Fuller.

I have used my auto one year as a practical road vehicle in my profession of a country doctor on the roads of western Iowa, winter and summer, under all conditions of roads, except the very worst mud and the deepest snow. Even these I have successfully negotiated, but I prefer then to go with a livery team. I had previously driven with horses over the same roads for nearly twenty years.

I very much prefer the machine, because I can do my trips in half the time. I do it cheaper and it's much more pleasant. There are other reasons, but these seem to me enough. I drive my machine myself, and, of course, I had to learn to do this. I also had to learn to care for it for the most part myself, to figure out what was the matter when things went wrong, and to apply the remedy. This means that I had to learn to be an engineer and considerable of a machinist, too. Most of this I had to learn on the road, often in mud and snow, sometimes in storms and the darkness of night. And I had to learn all these new things after I was fifty years old, which was no small matter, as old dogs do not easily learn new tricks. Of course I had trouble, particularly at first. Yet I would gladly go through all of it again if necessary.

Nearly all my trouble was due to ignorance. Now that I know my machine I have almost no trouble at all. When I start out I am just as confident that I will get back home again, and on time, as though I went with a team. I have no fear of being caught out in storms and mud, as I drive a high wheeler.

I chose a high wheeler largely because of the solid rubber tires, which I believed would do best in mud and snow, and would be least troublesome; also because of the high road clearance—a good 15 inches. Experience has proved the wisdom of this judgment. My total tire expense has been $2.50 for mending and replacing one which came loose, and the tires seem good for another year. Vibration does not seem to have injured the machine, as everything above the running gear rests on four large elliptic springs. This makes the car easy riding.

Mine is not a fast machine. I commonly drive at about a 12 mile speed over ordinary country roads, and can easily make 15 miles where roads are good. This is fast enough for me; I haven't the speed mania. The manufacturers say the machine is good for 30 miles. Maybe it is; but I don't want to ride that fast over country roads. The fact that I have had no accidents, endangering others or myself, is doubtless chiefly due to these modest notions about speed.

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Are Automobile Racing Tracks Profitable?

When the Long Island Motor Parkway was first proposed we ventured the opinion that the enterprise would not be a paying one. This opinion was based on the fact that the circling round of a number of fast automobiles is in itself not a sufficient attraction to constantly draw the large crowds necessary for the support of such an undertaking. The large attendance at all of the Vanderbilt Cup races might appear to controvert this opinion, but it really does not. There are two features to such a race which account for the large attendance and which could not be counted on if races were held every week, or even every month. The first of these is the danger to which the cars and drivers are exposed, and there is absolutely no doubt that a great many who journey a considerable distance and bear up with various hardships to see the race do so with the expectation of seeing some serious smashup, perhaps a fatal accident. This is proved by the manner in which the crowds congregate at the reputed dangerous spots. On a private track, where races were held continually, either the conditions of safety would have to be such that the chances of fatal accidents would be almost eliminated, in which case the contingent which goes to a race to see accidents would stay away, or, if serious accidents were frequent, owners of cars would soon refrain from entering them.

The other factor which creates interest in the race among a large class is its international character. The fact that cars and drivers of various nationalities are pitted against each other appeals to the spirit of patriotism. However, if these races became more frequent it would not be long before the patriotic grand stand crowds came to realize that those entering cars in these races and those driving them are not animated by patriotic considerations at all, but that it is simply a matter of business with them.

The unprofitableness of a motor track under certain conditions is well illustrated by the Brooklands (England) enterprise, the comparative failure of which is referred to in an article in this issue. This track, located near the largest city in the world, was constructed at great expense to meet as nearly as possible all theoretical requirement of a track on which the highest speeds could be indulged in with safety. The establishment proved another seven days' wonder. For a time the vast scale on which the track was laid out, the extremely steep banking at the curves and other features were spiritedly commented on in the press; and several early meetings were well attended. The attraction of novelty soon vanished, however, and the races failed to draw the crowds. The reputed safety of the track has also been disproved by several fatal accidents, and what will probably seal its fate is the recent decision of a prominent British manufacturer, who has been well represented at every meet on the track held so far, to discontinue participating in dangerous races.

The construction of motordromes or special motor racing tracks has been a perennial topic in the press since motor racing first began, and schemes innumerable have been proposed and fallen through. The Brooklands track is so far the only one which has been completed, and the experience of its owners should prove a lesson to others who may be tempted to invest in similar schemes. The plight of the Brooklands corporation has come to the surface at the right moment to prevent the waste of large sums on several other contemplated tracks. It is now most likely that the proposed German track in the Taunus will not be built, though at one time its construction seemed certain.

The Agent's Influence on Progress in Design.

Very few persons realize what an important part the agent and salesman have played and still play in determining even the technical characteristics of the cars offered in the market. While the agent and his salesmen perform the function of reporting to the manufacturer the state of public opinion regarding his product, they are at the same time the most effective influences in molding that public opinion, for the reason that they are in constant contact with the automobile buying class and are expert if not highly enlightened talkers. This body of automobile dealers exercises a strong conservative influence upon technical development. If an innovation is offered by one or two manufacturers, it is likely to meet with the active opposition of the representatives of all other makes of cars, and its bad points are sure to be dwelt upon in conversation. Not infrequently, sad as it may seem, fanciful objections are trumped up against it. For example, air cooled cars have been very largely driven out of the market chiefly, it is believed, by the adverse publicity given them by the agents representing water cooled machines, who are very much more numerous than the agents for air coolers. A customer making the rounds of the agencies hearing a dozen or more salesmen condemn air cooling for every one who explains its advantages is very likely to be convinced that the majority is right, forgetting that all statements he has heard may be regarded as *ex parte*.

Another highly meritorious development of a radical nature, which has suffered from the opposition of agents and their salesmen, is the two cycle motor. Two cycle cars are few and four cycle cars are many, and the agents of the latter are not paid to say kind words about two cycle engines. The result is that the two cycle car has been so continually "knocked" that it is only very lately that it has been able to make substantial headway.

The influence of the agent is to keep things as they are. With him "whatever is is right" (if it is embodied in his own car). He is not an idealist, looking for something better, but an intensely practical vendor of the automobile as it is. In this attitude he is simply performing his appropriate function, which should not be belittled.

On the other hand, the designer is by nature an idealist, always searching for something better, and hence something new; but woe to the constructor who embodies a decided innovation in his new model, for his agent's influence will be "as a voice crying in the wilderness" compared with the babel of the voices of salesmen who represent cars of the "accepted" model. The innovation in design must possess extraordinary merit if it is to make anything but a poor showing as regards sales, no matter how superior its merit.

Although the agent body has thus wielded an important influence in hindering the development of new technical ideas, some of them of great merit, it should not be forgotten that the same conservative spirit has acted to eliminate freak designs from the market and to produce a standardization of type. The car which differs from so called standard practice has few voices raised in its praise among the agent community and many to decry its distinctive features, and the features in which it differs from the "consecrated commonplace" are likely soon to be dropped.

The struggle between the designer, with his new conceptions, and the agent and his salesmen, with their advocacy of the merit of what is, is of perennial interest and a vital formative influence in the industry. The public, however, is beginning to think for itself, and has, of course, in the final event, the power of acceptance or rejection of all technical changes offered.

The Safety of the Automobile.

Some figures regarding the number of automobile claims paid and the number of automobiles in use in this country each year from 1904 to 1907, inclusive, have recently been made public by a New York accident insurance company, and the conclusion has been drawn therefrom that in proportion to the number of cars in use the accidents have become fewer, and the automobile has, therefore, become a relatively safer vehicle. The published figures are as follows:

Year.	Number Auto Claims Paid.	Cars in General Use.	Total Policies.
1904	91	30,000	63,576
1905	108	50,000	66,536
1906	155	78,000	71,270
1907	246	120,000	80,100

While these figures are probably correct so far as they go—the number of cars in general use must, of course, be an approximation—they are rather inconclusive. It is, of course, definitely stated that the number of automobile claims paid by this particular company increased in the ratio of nearly 1 to 3 from 1904 to 1907, but the inference drawn from this, that the number of all automobile accidents in the country increased in the same proportion, is unwarranted. In the first place, not all motorists carry accident insurance, and those who do are not all insured in the same company. The argument put forth might have some weight if it were shown that the number of automobile accident policies issued by this company increased approximately in proportion to the number of cars in general use. The total number of all kinds of policies issued by the company has no bearing on the case. If the experience of the company be thoroughly representative, and if its auto accident policies increased in direct proportion to the number of cars in use, then the figures show that the actual number of accidents to insured motorists increased 170 per cent. during the period considered, while the relative frequency of accidents decreased 31 per cent.

The automobile has always been a relatively safe vehicle when in the hands of a skilled and cautious driver—safer than the horse. Some of the developments of recent years have tended to increase its safety, while others have tended to reduce it. The brakes and the steering gear, the two main parts of the car affecting its safety, have undoubtedly been made more reliable during this period. Besides, numerous antiskid devices have been brought out and are now very extensively used in "sloppy" weather, largely eliminating this potent cause of accidents. Another thing that has undoubtedly tended to reduce the number of auto casualties is the fact that the proportion of experienced to inexperienced drivers is constantly increasing. Finally the public has become accustomed to automobiles, looks for them when crossing much frequented roads and has become better able to judge their speed of approach.

Opposed to these factors tending to reduce the frequency of accidents stands one potent counter influence—the speed craze. It was during the period from 1904 to 1907 that the big, powerful touring car and roadster were developed to their limit. At the beginning of this period an ability of one horse power per 100 pounds of car weight was considered ample; at the end double this ability was found in a great proportion of cars. It is an indisputable fact that the public was much more agitated concerning automobile accidents in 1907 than in 1904, though this is probably more a measure of the actual number of accidents than of the relative number. The public considers the total number of casualties, not the number per thousand cars. If there had been a decrease of over 30 per cent. in the relative number of accidents it would be timely for the insurance companies to reduce the premiums, but we have not heard of any such move as yet.

The well built automobile is inherently a very safe vehicle. Accidents that can be traced to defects in material or construction—if inability to withstand the strains of lawful speeds is made the criterion of such defects—are very rare. When the speed craze dies out, when automobiles are used mainly for business purposes, and when it is more generally recognized that the driver must always confine his attention to the car and the road before him, accidents will become so rare as to stamp the automobile the very safest of road vehicles.

Weather Affects Touring.

The almost unprecedented drought with which a large section of the country has been afflicted during the past two months has had a prejudicial effect upon the sale of cars for fall touring. Many roads which are usually in good condition at this season of the year have been so dusty that travel over them was not enjoyable. In consequence there has been very much less country riding than in previous seasons, and not only the sale of cars but of accessories has suffered in consequence.

Had weather conditions been favorable it is likely that there would have been as many touring parties as in former years. For while many who formerly toured because it was "the thing" would not have appeared upon the road this fall, numerous new recruits would have taken their places, and there will always be a class who go from a sincere love of the out of doors.

Coming Events.

November 5 to 7—Endurance Contest of the Detroit Automobile Dealers' Association.

February 15 to 20—St. Louis Show.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 27 to March 3—Hartford, Conn., Annual Show, Automobile Dealers' Association.

The Influence of Brooklands Racing Track Upon Design.

By Roy Lindsay.

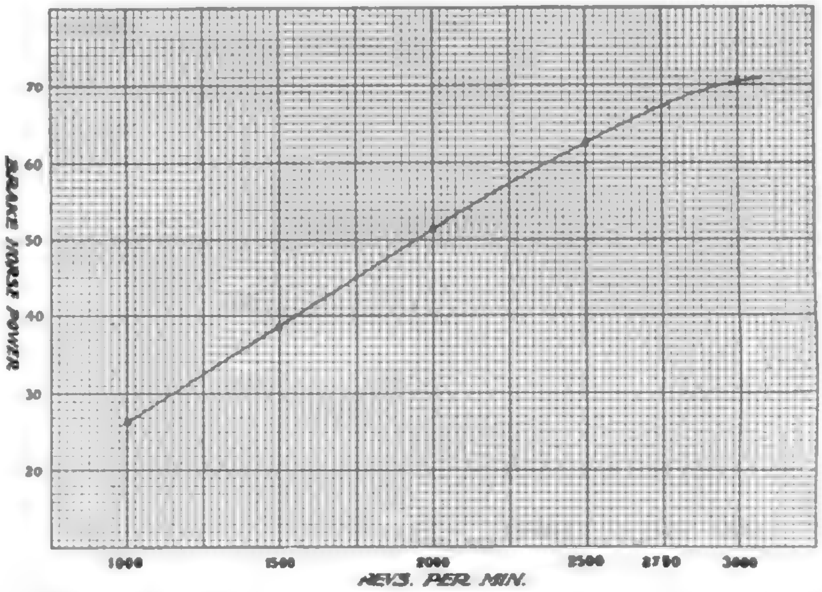
Right from its first issue this journal has consistently deprecated every form of road racing, a policy that all who have the welfare of the industry at heart must cordially indorse. The writer is in thorough agreement with the editorial views on this matter, yet asserts the opinion that knowledge of obscure points both of construction and design can be enormously increased by comparison of performances made by machines upon a properly constructed racing track. When the Brooklands, London, track was mooted I held the opinion—and the events of the past year have given me no cause to think otherwise—that as a financial enterprise the track was foredoomed to failure. At every meeting since the track was opened the attendance of the public has been meagre in the extreme; on no occasion have more than 5,000 persons been present, and at some half that number would have been a liberal estimate. The 20 miles distance of the track from London, the difficulty of access except by one railway that refuses to give cheap fares, the prohibitive prices of admission (since considerably lowered) and the huge size of the track itself have each contributed toward the comparative failure. Nor do manufacturers or owners of cars appear anxious to obtain advertisement and prizes by competing. The announcement made by the owner of the track that the meeting advertised to be held on September 12 was canceled owing to the paucity of entries is a pretty sure indication of the closing down of the track in the very near future, so far as its spectacular attractions are concerned. The most fervid opponent of track racing cannot but admit that in its conception and completion the undertaking was of colossal magnitude—and its owner—for it is only a "one man show"—has sunk over $750,000 upon his pet idea. The very vastness of the track has been the great mistake made in its design, for a spectator stationed at any point within its 2½ miles circuit loses all sense of proportion in watching the races, cars traveling at 80 miles per hour seeming to be only proceeding at the pace of a fast trotting horse.

AS A TESTING GROUND.

From the standpoint of the experimenter the admission must be frankly made that, as a testing ground, the track has been of inestimable advantage, and for this reason alone the likely closing of the establishment will be more than regrettable. Wide awake manufacturers have learned lessons which could not have been learned by any other means.

Many of the cars that first used the track were fitted with specially large fans behind the radiators, the impression prevailing that on account of running for 5 or 10 miles with wide open throttle, water could not be circulated fast enough to secure efficient cooling, but a few trials soon convinced the experimenters that fans were needless, and in fact a drawback rather than an aid, at speeds of over 50 miles per hour, the temperature being lowered too considerably with the fan running. With a properly designed radiator one maker, who had hitherto derided the claims made by the supporters of thermo-siphon circulation, went so far as to disconnect the pump, and in his first trial without it, that lasted for some 10 miles, became enthusiastic over the advantages of natural circulation, but his ardor evaporated with the water when he found it had disappeared in steam on a second trial of double the distance, with the consequence of seized pistons. The trouble was due more to non-appreciation of the principles underlying the motion of cold and hot liquid, as, in discarding the pump, he had simply completed the water circuit by a piece of rubber tubing, retaining the original small bore copper inlet and outlet pipes. When these latter were changed for pipes of more than double the diameter, the trouble disappeared and another convert was obtained for simplicity of construction. But over longer distances it was found impossible to prevent pre-ignition, and this brings me to an important phase of the subject that does not appear to have received in America the attention it deserves. I refer to increased engine speed and increase of power without enlarging the cylinder bore of any particular engine. The earliest engines made in the De Dion-Bouton factory, as fitted to motor tricycles, had, according to notions prevailing up to a few months ago, a comparatively small bore with about equal stroke and only obtained the power developed by being run at speeds approximating to 2,000 revolutions per minute. These manufacturers have consistently followed the practice they originated, and their 14 horse power, four cylinder engine of today (the largest yet turned out by them for pleasure vehicles) cannot be run much below 1,100 revolutions at partial throttle opening, otherwise the power suddenly falls away. Other European constructors contented themselves with fewer revolutions and a lower piston speed, nobody venturing to obtain power by an increased stroke because the theory was generally held that if the stroke were increased to more than 20 per cent. above the bore the piston speed must inevitably be decreased. The limitation of cylinder diameter in the principal European racing events this past season compelled the designers to seek for some means of increase of power without much increase in weight.

Right at the beginning it was evident that increased engine speed without an increased charge of gas at each power stroke would leave things much as they were. Although we may some day resort to pumping gas under pressure into the cylinders, nobody has yet seriously exploited the notion, and it is quite possible the extra fitments and weight that would be required might be more than counterbalanced by great increase of power. Recourse was therefore had to an increase in the length of stroke. One or two experimenters in the direction of long stroke engines who went to the expense of new crank shafts, connecting rods and base chambers learned that the torque certainly was increased, but the engine speed was reduced, one effect just about balancing the other. And then occurred one of those simultaneous expressions of thought in concrete form from quite a number of quarters, which have been fre-



Typical Power Curve Obtained as Result of Tests on Brooklands Track.

Arrol-Johnston four cylinder engine, 4 inch bore, 5 inch stroke; diameter of valves, 2½ inches compression, 82 pounds; gear ratio of engine to road wheels, 3.05 to 1 on direct top, 4.6 to 1 on second, 9.85 to 1 on first.

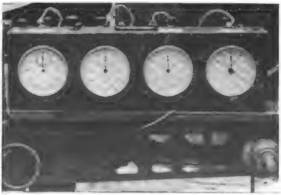
quent among engineers: "Why not try long stroke with high compression?" Within a few days of each other at least four factories were trying out engines so designed at Brooklands. The results obtained from this combination, in the case of at least three manufacturers, were so extraordinary that, unless verified by some impartial authority, no outside person would have given any credence to statements of the brake horse power shown on 30 minute runs on the test bench. The desirable verification was obtainable at Brooklands, as will be shown in the following paragraph.

During the winter of 1907 the committee charged with the supervision of racing matters on the track (including the Earl of Lonsdale, Lord Montague and Colonel Holden, the last named in charge of the Government gun department at Woolwich Arsenal) announced what were termed "class" races on level terms for machines with certain defined cylinder bores. These were for 26 horse power, 40 horse power, 60 horse power and 90 horse power. The first of these classes only concerns the subject matter of this article. Called nominally 26 horse power, the class is limited to four cylinder engines of 4 inches bore or engines with any number of cylinders having equivalent bore. One manufacturer, to whom credit ought to be given for being usually the first to grasp opportunities, secured the winning place in the first of the series of 26 horse power races by such a large margin as to arouse general doubt concerning either the time announced or the engine dimensions. The automatic electrical timing devices, the invention of Colonel Holden, had previously been proved capable of permanently recording to less than the five-hundredth part of a second, and those ignorant of possible improvements in automobile construction intimated that "a larger engine has been used." The man against whom these aspersions were directed is very smart, but about the last person in the world who would foolishly risk a big reputation just for the sake of winning one race. However, to prove that the rumors were unfounded, the cylinders were dismounted within the track precincts, measured by qualified officials and declared a decimal fraction inside 4 inches. Thereafter an official measurer was appointed, whose sole duty it is to verify the bore of every engine competing in every race; once measured, cylinders and crank cases are stamped and sealed, and if presented for any succeeding race with seals intact it is accepted; but if seals are broken the cylinders have to be remeasured before or immediately after the race. This verification of cylinder dimensions is one of the most important regulations instituted at Brooklands, and in conjunction with the automatic timing, automatic weighing and exact distances, insures the absolute correctness of the result of any event. Manufacturers admit unreservedly that in building special engines for the 26 horse power class racing at Brooklands track and in a few months' testing out on the track itself they learned more of the possibilities lying dormant among the problems of the internal combustion engine than in all their previous experiences. The water circulation point, referred to earlier, was one of the knotty problems when very high compression was attempted, and pre-ignition proved such a stumbling block as to doubt the efficacy of the idea. Burned out spark plugs and quickly pitted exhaust valves were not the least of the troubles. Altering the castings so as to provide increased jacketing space around valve chests and combustion chambers was but a partial remedy, but this difficulty was finally and entirely overcome by placing separate small water cooled heads right

ON TOP OF THE EXHAUST VALVE CHEST,

by-pass pipes off the main water circulating pipes maintaining a constant flow. Designers of air cooled engines long ago realized the necessity of cooling not alone the exhaust valve chests but also the caps and the cages when overhead types of valves were employed. With water cooled engines having a normal compression of 75 to 80 pounds no special difficulties present themselves. This is considered about the safe working limit for cars for sale to the public.

Electrical Contact Maker on Front Wheel Hub.



Wheel Revolution Counters on Car Frame.

RECORD OF A HIGH COMPRESSION CAR.

With the chance of pre-ignition nearly a negligible quantity, compression was gradually raised to 90, 95, 100 and then to 105 pounds to the square inch, with better and better results on speed. "We knew all this before," declares the technical critic, "but nobody would be mad enough to risk using very high compression on a touring car." Well, even higher compression has quite lately been employed on the road, with such startling and unlooked for results that all previous theories based upon laboratory experiments are proved quite unreliable in the light of actual running on highways. A remarkable performance was achieved by the four cylinder, 20 horse power Vauxhall car during the recent Royal A. C. 2,000 miles reliability trial. Never out of sight of impartial officials for a second, night or day, this machine climbed all the very steep hills considerably faster than any other machine in its own class, was only beaten on one hill by a 60 horse power car, with over forty other machines competing, and traveled throughout without a single second's stop for any mechanical or other trouble. No adjustments were made, not a drop of water was filled into the radiator from start to finish, or a drop of oil added to that contained in the crank chamber and ordinary size oil tank at the start. This is absolutely a world's record and was created with an engine having long stroke and compression of 110 pounds above atmosphere. It so happens that the makers of this car do not believe in racing on the track or on the road, yet they frankly admit that had they not spent very many days on the Brooklands track in testing out all sorts of details they could never have achieved their remarkable success. To dare suggest 120 pounds compression for a road machine savors of the ridiculous, and would certainly never have been attempted if they had only to rely upon road tests where no regular comparison of results was obtainable. The writer has actually driven one of these machines having 130 pounds compression with only two millimetres clearance between the top of the pistons and combustion head; but although free from all signs of pre-ignition at half to three-quarter throttle opening for any distance, full throttle opening caused the engine to pound after a couple of miles. One hundred and ten pounds seems about the safe working limit unless some new ideas are developed in carburetion and cooling. Such high compression makes it a physical impossibility to "swing" an engine round and round when starting up from the cold, a sharp single pull at the starting handle being the only plan. Consequently carburetion needs to be of so sensitive a character that a true explosive mixture is certain at the first intake stroke of any of the four cylinders. The ordinary so called automatic carburetor with single spray nozzle and spring controlled auxiliary air supply altogether failed, compelling investigation of other carbureting devices. The desired requirement was realized with a triple jet carburetor, having a sliding piston throttle wherein graduated air ports are given further opening as each jet is exposed, and by the provision of an extra air lever on the steering column for cutting off all but a minimum at quarter throttle opening when starting up. This multiple jet carburetor also gave the expected greater economy in fuel consumption than the single jet type.

Still another point was evolved in the course of the Vauxhall experiments. Thermo-siphon circulation is used, through a gilled tube radiator of somewhat abnormal dimensions in respect to the length of the tubing, that acted exceedingly well on the track, without need of a fan behind. But with very long hills to climb in the course of the reliability trial no risks of failure could be taken, and therefore a fan was fitted. During the third day of the trial the fan belt snapped at the fastening, and for the balance of the distance covered, about 1,550 miles out of the total 2,000, the engine ran without this aid to cooling. The track experiments were thus so amply confirmed by road experience that it is the intention to market the 1909 model of this car without a fan. Another manufacturer—of the Standard car—has discarded fans for some months past, and only fits them when cars are specifically ordered for hot climates in India and South Africa.

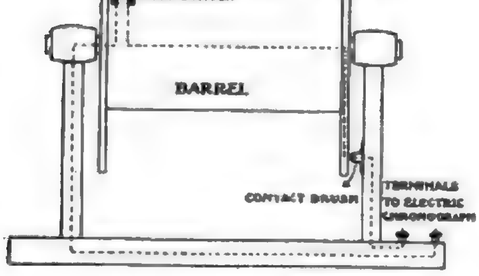
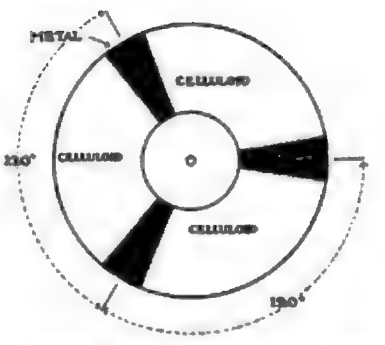


Diagram of Electrical Connections of Acceleration Testing Machine at Brooklands.

EDGE'S EXPERIMENTS.

Any discussion concerning the Brooklands track would be incomplete without mention of S. F. Edge, who more than any man in England has from the first realized all that is to be gained from the study and comparison of the running of various powered cars. Apart from the free advertisement of winning races (as witness Edge's twenty-four hours' world's record, which is still some 400 miles in front of the recent American record put up at Brighton Beach track), he has consistently tried out each new detail of Napier cars on the track as well as on the road before having the same embodied in standard machines. Many of the results so obtained are too valuable to be given freely to the world, but some others have provided definite facts on subjects that were previously of a very hazy character. We were all acquainted with the retarding action of wind upon speed, but just how much windage was created by a car traveling at a particular speed was problematical and could only be approximated by abstruse mathematical calculations. Edge tackled the problem from the practical standpoint, and at the conclusion of a long series of costly tests was able to prove conclusively that a foot of extra height in a body from the ground line involved expenditure of more engine power at a certain definite speeds than had previously been supposed was the case. Edge also carried out a series of weight tests that quite upset all theories and simultaneously had the effect of revising the methods of handicapping for the race at Brooklands. Prior to these weight tests it had been the rule to load up weight according to rated power, a 50 horse power chassis having to carry much more than a 40 horse power chassis. But when Edge demonstrated that, beyond the initial starting effort, an addition of as much as 1,000 pounds made no appreciable difference in speed on the level to a 40 horse power chassis, the handicapping was altered to time allowances instead of weight. Another series of tests, at present being conducted by Edge, relate to the "slip" of the road wheels on the ground, the object being to ascertain whether the distribution of the wieght of engine, etc., on the chassis makes any considerable difference in holding down front and rear wheels. "Slip" causes abnormal wear of tire treads, for on every occasion when unevenness or a bump in the road jumps the wheel, the speed of rotation temporarily increases and then decreases to the speed of the other three wheels by friction with the road, the resulting action on the tire tread being similar to that of an exterior applied brake shoe. Mervyn O'Gorman, the well known English expert, in a paper read before the Royal A. C. last winter, advanced the opinion that slip is responsible for more wear of tires than is due to the pure rolling action of a wheel, and that on a truly vibrationless surface the life of covers would probably be extended to five or six times their present length. But as automobile designers have to deal with imperfect road conditions, attention must be devoted to some rearrangement of the transmission and rear axle, whereby slip can be partially neutralized. Mere loading of weight on to the rear axle is not the remedy, and although larger diameter wheels and wider cross section of tires may conduce to smoother running, the problem can only be approached with the aid of recording instruments specially devised for the purpose.



Side Diagram of Acceleration Testing Machine, Showing Contact Cheek.

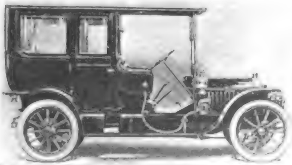
ACCELERATION TESTS.

Colonel Holden has just invented an "acceleration" testing device that was tried for the first time at Brooklands on August 30, and it promises to be of considerable service to manufacturers in discovering newer and better systems of change speed gear. It is used in conjunction with the costly and very elaborate time recording clock, also the invention of Colonel Holden, that is probably the finest thing of its kind in existence. This clock is not wound up in the ordinary way, the pendulum being pushed forward at every other swing by an impulse from a powerful electro magnet, and the permanent record of performances is secured on long reels of paper by electrically actuated pens, the car under test itself automatically controlling the devices when passing over certain parts of the track. The accelerator recorder consists of a wide drum, exactly one yard in diameter, upon which is wound some 220 yards of light but exceedingly strong cord. At one side of the drum are three insulated brass segments, against which are pressed three brass arms exactly one foot apart. The two wires from the recorder are led down to a couple of binding posts on the instrument; the three brass arms are in series in the circuit which passes through the shaft upon which the drum freely revolves at a point midway along the bed of the drum; a simple plug switch is inserted to which one end of the cord is attached, the other end of the cord being hitched on to the most convenient point at the rear of the car. Just before the test is made the car is backed close up to the drum that rests on the ground, and the official in the timing room switches the recorder into circuit, the paper strip simultaneously being caused to unwind and pass over a series of rollers under the recording pens, the rate of movement of the paper being regulated by an electrical governor controlled from the clock. The car is started, unwinds the cord off the drum, and the drum, being quite free on its shaft, starts to revolve, each revolution being communicated to the recording pens by the brass contact arms, and when 220 yards has been completed the string itself pulls the plug from the drum and breaks the circuit. As the recording pens make a mark on the paper strip at every half second, each mark represents a distance of 18 inches traveled by the car in that time, and with the aid of a special ruling machine and a magnifying vernier the successive increases of the car's speed can be calculated. When the figures are plotted out as a curve, one can read off the exact distance and time when the change gear is manipulated, all the tests so far made showing that the speed of the car either remains constant or actually decreases for at least a couple of seconds when the change speed lever is moved into a higher gear. The scope of the acceleration test is of far wider application than to pleasure car design. Railway companies, endeavoring to compete with the ubiquitous electric trolley car for suburban traffic, are seeking to evolve something more flexible and cheaper than the cumbrous train of steam hauled carriages, and the "rail motor coach," as it is termed in England, consisting of one long vehicle propelled by its own engine, seems destined to achieve success. Railway engineers have hitherto been chary of installing internal combustion engines, even of power as high as 400 horse power, because so much time is wasted in reaching a speed of 30 miles per hour between suburban stations closely adjacent; the one or two coaches that have been built experimentally, wherein a gasoline engine drives a dynamo, which in turn transmits to a set of electric motors, means such appalling power losses that, although the desired acceleration is obtained, the cost of the work is prohibitive. With a proper acceleration testing device there is better chance for improving the accelerating powers of the cars.

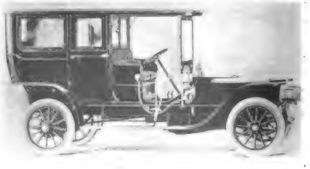
If any further evidence were wanted to substantiate the facts outlined above it can be found in the result of the 4 inch race decided in the Isle of Man at the end of September. Confined to chasses with four cylinder engines not exceeding a bore of 4 inches, with a minimum total weight, including fuel, water, oil, driver and mechanic, of 1,600 pounds, this race was won by a so called "Hutton" car, which was actually constructed throughout in the Napier factory to Napier designs and entered for the race by S. F. Edge. [If so, why was it called a Hutton car? As a precaution in case of defeat?—Ed.] In what is known as the 26 horse power class at Brooklands track this particular machine has always performed well and has been timed officially to travel at the rate of 80¼ miles per hour. The only alterations made in this chassis for the 4 inch race were a different ratio of gears and larger tires, otherwise it was run in the road race in the same condition as on the track. The technical details, other than the bore, have been rigidly guarded, but it is known that the stroke is 7½ inches compression 95 pounds above atmosphere, and at that the valves have a very large area and an unusual arrangement of inlet gas piping. The inference that because a car does well on the track it must also do equally well on the road would be misleading, but in the case of the Napier-Hutton there can be no doubt that the lessons learned at Brooklands materially conduced to success. Many other lines of investigation, such as best length of wheel base and best width of track wheel to provide stability, correct tire pressure for given loads, suitable shape and size of springs, height of car platform from the road, etc., can only be properly secured under the definite conditions prevailing at places similar to Brooklands track.

Enclosed Cars.

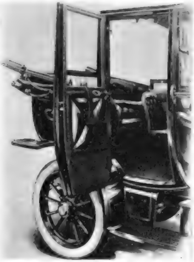
When automobiles first came into use they were seldom driven in stormy weather. Their use was limited to pleasure trips on pleasant days, when no special protection was needed, except, perhaps, a canopy or Cape hood top to protect the user from the rays of the sun or from an unexpected shower. As a consequence open tonneau and side entrance bodies became almost universal. Later, however, when automobiles became more reliable and people realized their practicability, they came to be used all the year around, except when the weather conditions were very adverse. The use of the open car in early spring and winter means that the user must expose himself to rain and cold. The Cape top with side curtains of course affords a fairly good protection from rain, but it is not comfortable, and the user must dress very heavily if he does not want to suffer from the cold. As the average person does not care to bundle himself up in a lot of clothes this type of car is not exactly what is wanted for winter driving, and the manufacturers therefore evolved the enclosed type of car, the limousine. This type affords perfect protection from the weather, is generally well ventilated, thus eliminating that stuffiness which is so common with horse drawn coaches; but it is open to the possible objection that it cannot be opened sufficiently in warm weather to give the same freedom as the open touring car. It possesses the one great advantage over the touring car that to its occupants the dust evil is practically eliminated. To give greater serviceability the year round the landaulet body has been introduced, which possesses all the advantages of the limousine, with the further advantage that the rear top portion can be folded back, giving all the freedom and air of a touring car, with protection from the dust. The limousine and landaulet types of body have steadily gained in favor, until now a large portion of all cars in use are so equipped. The modern enclosed car is a delightfully comfortable conveyance, and a great amount of time and money has been spent in bringing it to its present state of perfection. In cold weather a radiator, set in a fireproof pocket in the floor and heated



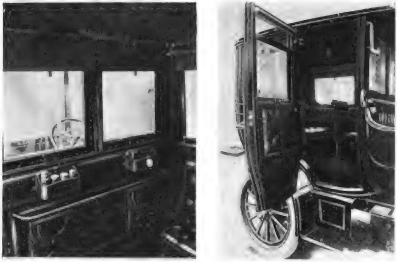
Peerless Model 19, Four Cylinder Limousine.



Franklin 1909 Model H Limousine.



Interior of Peerless Landaulet.



Interior of Peerless Limousine.

by the exhaust gases from the engine, heats the interior to any desired temperature, and is regulated by a valve. A great deal of attention has been paid to the cushions and upholstering, with the result that the seats are exceedingly comfortable, especially with adjustable foot rests. The accessories are many, and depend upon the purse and taste of the purchaser. They vary from the regulation card holder to the collapsing washstand used for touring. The regular equipment consists generally of a neat card and engagement book holder, with a clock set in the front. Beside this may be another small holder for a mirror, brush and comb, bottle of smelling salts, etc., while large pockets are set into the upholstery either in front or on the door panels. A speaking tube is always installed for instructing the driver, and in some cases an electric signaling board is provided in addition. For night riding the interior is usually lighted by one or more small electric lamps, thus adding greatly to the comfort.

There is, however, another side to the use of closed cars aside from the comfort they provide. To persons who are not accustomed to be out in all weathers they are a real necessity, as the danger of exposure when driving in open cars is not to be denied. Limousines, and especially landaulets, are eminently suitable for business men going to the office, children going to school, and women to do their shopping, making calls and going to the theatre. The sudden change from the usually too high temperature of the home, the office or the place of amusement, to the cold outside is a real source of danger, and a number of prominent persons have died from pneumonia said to have been contracted on automobile trips. Of course, professional drivers and others who are constantly out in the open air run very little risk from exposure in open cars, but the situation is entirely different with respect to persons accustomed to an indoor life. People of today are prone to be careless of their health despite the fact that they are really less able to withstand exposure than their ancestors.

The year 1909 will show many examples of the highest development of the body builders' art, and we illustrate herewith views of a few well known American cars. These cuts speak for themselves as to the comfort afforded the user by the modern automobile. These cars can be used the year round by lowering the windows of the limousine or throwing back the upper top portion of the landaulet. Some cars have even the driver's seat enclosed, which certainly seems a humane step, for it is a cold proposition to sit exposed for hours at a time even if he is warmly clad.

THE FRANKLIN CLOSED CARS.

The Franklin enclosed cars are made in five models, viz., an 18 horse power, two passenger, interior driven brougham; a four and a six cylinder model, both rated at 18 horse power; a 28 horse power model, and a 42 horse power, six cylinder model. The last named model is fitted with the limousine type of body and seats seven people. The chasses of these models are of the same construction as those used for the touring cars, except that they are strengthened and increased in length to accommodate the increased weight. The bodies are of aluminum and wood construction, and are finished in the same standard royal blue as their touring cars. The upholstery is in heavy broadcloth and leather, of a color to match the finish of the bodies.

THE PEERLESS CLOSED CARS.

The two Peerless models are somewhat larger and of higher power than last year's, but are substantially the same. They are fitted with either limousine or landaulet bodies, with two folding seats, which can be easily removed, making a very roomy car for five people. As will be seen from the cuts, a great deal of attention has been given toward the comfort of the passengers. The seats are large and comfortable and the upholstery is of a high grade, of a color to match the finish of the bodies. Two holders secured to the front panels hold an engagement book, hand mirror, clock and other smaller necessities. Two electric lamps of four candle power, set in the ceiling, light the interior.

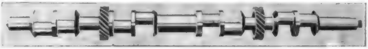
French Show of Agricultural Motors.

The first show of agricultural motors took place recently at Bourges, in France, under the auspices of the A. C. du Centre. Unfortunately, the exhibition did not receive very much support from the manufacturers of that type of vehicle. Although agricultural machines and apparatus were represented in great numbers, only a small number of automobile firms took part. The Lorraine-Dietrich firm exhibited, in addition to several stationary motors, a combined truck and tractor for transporting and hauling agricultural machines. Panhard-Levassor and Renault Frères exhibited stationary motors, and the Bayard-Clement firm showed a number of gasoline-electric generator sets. Among the largest exhibits were those of the International Harvester Company and of the Pilter firm, who exhibited motors, trucks, tractors and also ordinary agricultural machinery and appliances. The show drew a very large attendance, and the greatest interest centred in the practical trials connected with it. Thus, no less than 2,000 persons attended a trial in the use of tractors for hauling reaping machines, of which one, a Pilter, made three rounds of the field in twenty minutes, while the other (International) required twenty-six minutes. Considerable speed was also developed in plowing with motor tractors. Although the exhibition was not a complete success, it is hoped that it will give a considerable impetus to the agricultural motor industry.

The English Daimler Company Adopts the Knight Engine.

The whole of the British automobile industry has within the past few weeks been staggered by the startling announcement of the English Daimler Company that, commencing with the 1909 models to be exhibited at the Olympia Show in November, all their pleasure chasses will be equipped with engines manufactured under the joint patents of Charles Y. Knight and L. B. Kilbourne. In its general design the engine is similar to that hitherto known in America as the "Silent Knight," and manufactured by the patentees in Chicago. The news is the more astonishing because the Daimler Motor Car Company (1904), Limited, the reconstructed successors of the original Daimler Company, are not a small firm with only a limited output, as they occupy a position in Britain corresponding to that of the G. N. Pierce Company, Locomobile Company and Packard Motor Car Company in America. The factory covers a larger extent of ground than any other in the country, and while not perhaps employing the largest number of work people, its competitors are forced to admit that it has certainly the largest sale of large machines. In fact, the standing and reputation of this firm is so well established that its annual announcement of future policy just prior to the show is invariably looked upon as a pointer for fhe coming year's business by those firms not possessing the same financial resources or influence. Hence, to boldly declare the complete abandonment of the type of engine devised by Gottlieb Daimler in favor of the Knight engine compels more general attention than would have been the case if a dozen smaller firms had co-operated for the same object. A few favored individuals were aware that one or two experimental engines were in course of construction at Coventry, but it was never supposed that a revolutionary policy of the nature indicated above would be thrown at the industry like an anarchist's bomb.

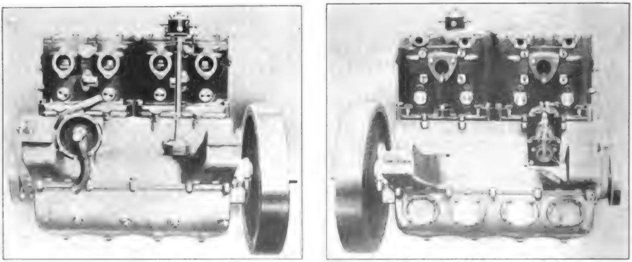
Unable to obtain the financial support needed for the proper exploitation of his ideas in the States, Mr. Knight brought a four cylinder touring car over to England in the summer of 1907, and demonstrated it to quite a number of manufacturers. His claims for silence of working were not confirmed on the trial runs, and as this was mainly the basis upon which he had originally designed the engine, his proposals were courteously rejected by all except Percy G. Martin, the general manager of the Daimler factory. Seeing greater possibilities in the patents than Knight himself, Martin had the engine taken out of the chassis and placed on the testing block, where it developed 34 horse power, the bore being 114 millimetres and the stroke 128 millimetres. With a few minute alterations the same engine was made to give 40 horse power, and in the belief that something better than this could be developed by their own technical and manufacturing staff, the Daimler Company concluded negotiations with Knight and his partner which were satisfactory to both parties.



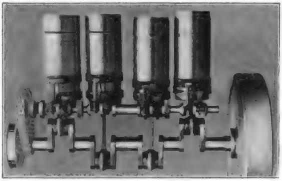
Eccentric Shaft Made in Two Pieces.

MAGNITUDE OF THE TRANSACTION.

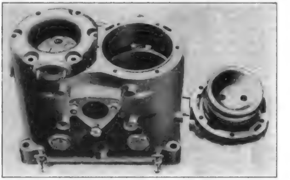
The arrangements made, which were only quite recently completed, are as follows: The Daimler Company secures the sole license to manufacture in Great Britain; the Italian Daimler Company (the majority of whose shares are controlled by the English Company) for Italy; Panhard and Levassor for France; the German Daimler Company (makers of the Mercedes) for Germany, and the Minerva Company for Belgium. Each of the respective licensees is free to sell in any part of the world, including the territory of the licensed countries, but is prohibited from granting any subsidiary licenses. Negotiations are in hand for Sweden and Russia, and when these are settled no others will be issued. It is also probable that the American rights will be purchased by the Daimler Company. So far have the plans been perfected that the English Daimler Company will have at the show in November complete chasses of 22 horse power, 38 horse power and 48 horse power, and the Minerva Company will also exhibit a complete 38 horse power from their Antwerp factory. Further than this, an engine of different construction to that for pleasure vehicles is under way at Coventry for a new type of omnibus; a marine engine is being designed; a very big model of about 400 horse power will be put in hand for railways, and there is a rumor cncerning an air cooled type for aeroplanes. The manufacturers already mentioned are of such worldwide renown that no sort of tall talk or wide claims would have been accepted for a moment, and that Mr. Knight has convinced the experienced technical staff at each factory sufficiently demonstrates the capabilities of the engine. As regards the Panhard factory, Knight superintended the construction of an engine there which has been subjected to tests of the most searching character for nearly six months. To say that the adoption of the Knight engine in such influential quarters will revolutionize the industry is too sweeping an assertion, but that it will



Exhaust Port Side. Knight Engine, Complete. Inlet Port Side.



Internal Working Parts.



Forty-five Degree View of a Pair of Cylinders, Showing One Head Detached.

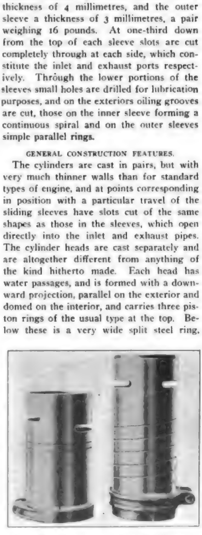
set other inventors on the track of hitherto neglected fields of development there can be no doubt. The fact must be emphasized that the English Daimler Company have ceased to manufacture engines having spring controlled mushroom valves, will make and sell only the Knight type for pleasure cars, and are busy putting 300 engines through the shops at the moment this article appears.

CHANGES FROM ORIGINAL DESIGN.

The engine has been called "valveless," but this is hardly correct, because whether designated valves, ports or slides, the functions performed by valves are obtained. In its original form the cylinder head was shaped with a very high dome with acutely angled sides, the pistons had very long strokes, the crank shaft was offset and the supplementary crank shaft was driven by spur wheels. Since the Daimler staff have had the matter in hand the design of the various parts has been materially modified, and the alterations have been so extensive that, save for the underlying principles, it can be truthfully called a new design. The main feature of the Knight patents is the abolition of the cam shaft, tappet rods, valves, valve springs and valve chests, substituting for these a supplementary crank shaft (which the inventor prefers to term an "eccentric" shaft), a non-stretching chain to drive this off the main crank shaft at half speed, eight exceedingly short subsidiary connecting rods and eight sliding sleeves, one pair for each cylinder. The main crank shaft is suspended from the upper half of the crank chamber in five long bearings, and carries four connecting rods attached to four pistons, each having four rings, all this portion of the engine following standard construction. The eccentric shaft is situated in the same position relative to the crank shaft as is the usual type of cam shaft, and in addition to operating the sliding sleeves also actuates the water circulation pump, high tension magneto and vertical shaft contact maker for coil accumulator ignition, through the medium of a couple of skew gears. The pistons move with a 5 inch stroke inside concentric shells or sleeves, completely open at top and bottom. These are the inner sleeves, and sliding upon them are outer sleeves of similar construction but slightly shorter in length. Each sleeve is machined up from an iron casting, with an integral collar near the base for attaching the short actuating rods that are given an up and down motion by the eccentric shaft. The inner sleeve has a thickness of 4 millimetres, and the outer sleeve a thickness of 3 millimetres, a pair weighing 16 pounds. At one-third down from the top of each sleeve slots are cut completely through at each side, which constitute the inlet and exhaust ports respectively. Through the lower portions of the sleeves small holes are drilled for lubrication purposes, and on the exteriors oiling grooves are cut, those on the inner sleeve forming a continuous spiral and on the outer sleeves simple parallel rings.

GENERAL CONSTRUCTION FEATURES.

The cylinders are cast in pairs, but with very much thinner walls than for standard types of engine, and at points corresponding in position with a particular travel of the sliding sleeves have slots cut of the same shapes as those in the sleeves, which open directly into the inlet and exhaust pipes. The cylinder heads are cast separately and are altogether different from anything of the kind hitherto made. Each head has water passages, and is formed with a downward projection, parallel on the exterior and domed on the interior, and carries three piston rings of the usual type at the top. Below these is a very wide split steel ring, which is surrounded by another wide ring, split into two equal halves. Above the tops of the rings a recess is formed right around the head, in which the sleeves can slide at the upward limit of their stroke. The action of the engine is simple enough, and can be followed by the aid of the accompanying transverse sectional elevation. When the piston starts to descend at the intake stroke the inner sleeve A and the outer sleeve B are made to simultaneously slide over each other by means of the integral collars X X, connecting rods C D and eccentric shaft W until the ports H in the two sleeves coincide with the port I in the outer cylinder, which is connected up to the carburetor by the inlet pipe. On the compression stroke the ports H are carried up by the sleeves, and slide against the wide rings J K, consequently closing the inlet port I of the cylinder, and the sleeves remain in this position until nearly the end of the firing stroke. The exhaust ports F in the sleeves then commence to travel toward each other, until, as the piston is ascending, the slots coincide for their full width with the full width of the exhaust port G in the outer cylinder. The faced joint between the detachable head and the cylinder is marked by Y, and the water outlet from head to radiator is shown at E. An important point, that must not be overlooked, is that the faced joint of the detachable head is never subjected to gas pressure because the inner sleeve is continually in close contact with all the compression rings around the peculiar cup-like projection of the head, and has only to withstand the comparatively small pressure maintained by the water circulating pump.



The Two Concentric Sleeves.

OFFSET CRANK ABOLISHED.

So much for the main details of the engine itself, and now something must be said concerning realized result. The original American built engine, with a bore of 114 millimetres and a stroke of 128 millimetres, could only develop 34 horse power on the test bench. Knight had tried innumerable alterations in the widths and lengths of both the inlet and exhaust ports without appreciable result, and it was found impossible to run at a speed much beyond 1,150 revolutions per minute. If that speed were exceeded, pounding and knocking at once commenced, and at about 1,260 to 1,300 revolutions the jarring was so intense that the engine threatened to rack itself to pieces. The defect was presumed to be some inherent peculiarity of the design, and until dismantled in the Daimler shops nobody was able to account for the peculiar state of affairs. Knight, when finally settling his drawings for the Chicago built engines, had been led away by the craze then prevailing in some of the leading European factories for offsetting the crank shaft, and, thinking that what was good enough for cars with big reputations ought to be good enough for him, the shaft was set *desaxé* a little over a quarter inch from the true centre line. The Daimler Company had tried the same thing nearly four years ago, and had promptly discarded the notion, fortunately before a single engine so constructed had been sold to the public. The same pounding effect had been quickly located and the cause traced to the offset crank shaft, and came as a revelation to Knight, who for three years had been experimenting in every direction but the right one to remove the trouble. It is a very interesting fact that Minerva engines have had offset crank shafts for quite a long time, and excellently as they are built have never developed power commensurate with their size; only when starting out to build the Knight engine in accordance with the design formulated on the results secured by the Daimler Company at Coventry did they also learn where the loss of power occurred.

POWER RESULTS.

Three sizes of engine will be sold in 1909, viz., a nominal 22 horse power, a nominal 38 horse power and a nominal 48 horse power, the middle size being the one that will be most vigorously pushed. According to Royal A. C. rating, this engine, having a bore of 124 millimetres and a stroke of 130 millimetres, is 38 horse power at a speed of 1,000 revolutions per minute; but the mean of a large number of tests made in Paris and Coventry proves it to develop 50 horse power at 1,000 revolutions, 61 horse power at 1,200 revolutions, 72 horse power at 1,500 revolutions, and something approaching 85 horse power at 2,000 revolutions per minute. These results are so remarkable that doubt might be expressed concerning their correctness were they not vouched for by the skilled power testers of the various factories mentioned in an earlier paragraph. Nor is the engine deficient in flexibility when propelling a fully equipped, five seated touring car on the road. On direct third gear (the fourth gear is indirect on Daimler cars) the speed can be varied from 5 miles to 52 miles per hour without clutch manipulation, and the writer, who was recently favored with an extensive drive, must confess astonishment at the really extraordinary manner at which speed can be accelerated from a crawl to over 40 miles an hour in about 600 yards distance. Grades of 12 per cent. can be negotiated, irrespective of length, at never less than 35 miles per hour. In respect to silence, no difference can be detected as compared with the very best of modern engines having mushroom valves up to a speed of 20 miles per hour. It is when the throttle is opened more widely that the Knight really scores, the metallic rattle that seems inseparable from any machine travelling beyond 30 miles per hour being entirely absent, the only noise that can be distinguished being a swish, swish, swish, not unlike the characteristic and not unpleasant hum of a steamer when exhausting to the atmosphere.

SPLASH LUBRICATION USED.

All sorts of lubrication methods and devices have been tried and discarded in favor of the simple splash system. Forced lubrication would at first sight appear to be essential, but it was found that oil was carried up and deposited just inside the gas inlet port of the outer cylinder, thereby upsetting carburation and occasionally sending small amounts down into the carburetor on the compression stroke. The sleeves have so little clearance between themselves and the outer cylinder wall that the natural capillary attraction of the oil particles is sufficient to provide for any possible contingency. It is claimed that because the hot gas is never in actual contact with the cylinder (except at the edge of the port on the exhaust stroke), and the consequent benefit of employing a very much thinner casting, heat is more quickly conveyed to the water jacket and dissipated in the radiator. It is further claimed that as a consequence "seizing" is impossible from overheating so long as the water is circulating, and that with only a minimum of oil in the crank chamber the water can never boil. These claims are bold and are based upon factory experience, but when machines get into the hands of the ordinary user we shall be better able to judge whether the results agree.

The Situation in New England.

From the standpoint of actual sales the automobile situation in New England is extremely unsatisfactory. The sales of large cars, which were never very numerous in that portion of the country, have become even fewer recently, owing to the fact that the majority of those who are able to afford such cars are already supplied and are no longer in the market. The possible number of new purchasers being small, and automobile builders still continuing to turn out the same number of cars for the New England market, it follows that competition is very keen, or, as one dealer expressed it, "it has got even beyond the throat-cutting stage." The $500 to $1,000 class of car seems to sell in greatest numbers, a popular two cylinder opposed motor runabout being the leader, with two makes of four cylinder runabouts coming next in order. The pseudo-touring car—a medium powered chassis designed mainly for runabout purposes, but fitted with a touring body—seems to have decreased in numbers but slightly from last year. Such cars are used chiefly for going about the city and making occasional trips for short distances into the country, but are never used for extensive country touring. Doctors and other professional men seem to be the greatest buyers of automobiles through this section, which accounts for the number of runabouts. Taxicabs are only seen in Boston, where they are fairly well patronized, although the majority of Bostonians habitually use the street cars, while quite a number have their own automobiles.

There are quite a number of commercial vehicles in use, chiefly owned and operated by factories, mills, etc. The majority of these are of from 2 to 3 tons capacity, and the Knox make is predominant. A number of American Locomotive trucks are also seen. The fire departments of Springfield, Bridgeport and Boston have special automobiles for the use of fire chiefs and for conveying squads of firemen; the former two cities also have motor driven chemical engines. Other cities are taking up the question of motor propelled fire equipment.

The garage situation, generally speaking, is unsatisfactory. In the larger cities the garages are numerous, and practically no garage has a sufficient number of customers to entirely fill its storage floors with cars. Quite a number of cars have been put into dead storage. Accessories do not sell very well; lamps and robes meet the largest demand, while horns, clocks, speedometers, etc., have a smaller market, despite the numerous cuts in prices that have been made. The garages in the smaller towns depend largely upon the patronage of local owners, made up of doctors, contractors and business men, runabouts or 10-12 horse power cars fitted with side entrance bodies being the types of cars most extensively used in such localities.

The automobile factories are running with half force, though men are being taken on weekly. Production is carried on at about half capacity, but as the new year approaches the companies expect better times and hope to turn out machines to the full capacity of their factories. A similar situation exists with regard to the makers of parts and accessories, although in a few cases these have suspended work entirely. The large manufacturing firms which have taken up the manufacture of automobile parts as a side line, in one or two cases have abandoned the work entirely, while others have cut down force, expecting to resume manufacturing with full force after the first of the year.

The attitude of all branches of the trade in New England is an optimistic one. The recent financial stringency seems to have affected all alike, and is thought to be responsible for the present situation. A good Western trade is depended upon largely by the manufacturers to recoup the losses sustained during the period of the stringency. The chief cause of complaint on all sides is the difficulty in making collections and in obtaining loans. The new year, it is hoped, will restore the trade in general to its former prosperous state.

Autogenous Welding and Its Application to Automobile Repairs.

By Henry Cave, A. M. I. M. E.

Autogenous welding is best defined as the process of uniting metals by heat alone, without the application of pressure and without the use of a flux or another metal. The absence of pressure or hammer blows distinguishes it from the ordinary welding processes, and the non-use of fluxes from brazing and soldering.

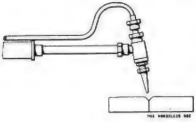


Fig. 1.

The most common apparatus for this purpose is one in which the heat is produced by burning acetylene with pure oxygen, in a hand torch (Fig. 1) giving a welding flame varying in size from about a sixteenth to a quarter of an inch in diameter, depending on the size of the tips, a number of which are supplied with each torch, and used as required by the size and thickness of the part to be welded.

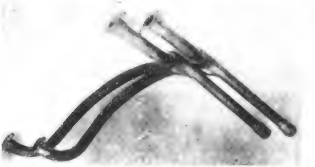


Fig. 2.

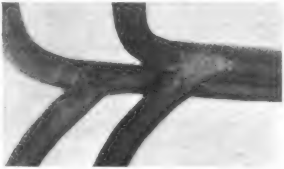


Fig. 3.

This flame has a temperature of about 6,300° Fahr., which is about the same as that of the electric arc, and upon its application to any metal—I might say to any substance—fusion very soon takes place, the extent of which is noted by the operator, who is guided accordingly in the movement of his torch. The metal at the point of fusion flows together and is practically "recast locally," metal being added where necessary from a rod of the same material as the part being welded.

This applies to all metals, including cast iron and aluminum. I mention these two metals particularly because they are not commonly considered to be weldable, and, therefore, serve the better to show the magnitude of this development, particularly when it is considered how brittle they are, and how subject to mishap.

Like the automobile, autogenous welding received its early development in France. At the end of last year (1907) there were over 800 plants in operation in that country. The whole success of the process depends upon the high temperature of the flame, which raises the temperature of the metal so rapidly that very little heat is diffused into the body of the part, so that most of it is available for fusion.

The number of heat units actually absorbed by the metal is a very small fraction of that required to bring the same part to a brazing heat with the ordinary gas or oil blowpipe, and very little, if any, warping takes place.

One of the first points to be understood, when considering the autogenous welding of any part, is that the flame has actually to come in contact with every drop of metal welded, and that it is impossible to weld in places where this cannot be done. For instance, if a small boss is required on a casting it is useless to cut out a disc of metal the size of the boss with the idea of welding it on. The correct way would be to add metal, drop by drop, until the required size is reached, and if the shape is of importance extra metal must be added and machined off to the correct size.

Metal up to one-eighth of an inch in thickness can be "butted," the heat passing down the opening being sufficient to insure its welding through. Above this thickness the sides must be beveled off, as shown by the dotted portion of Fig. 1, allowing the welding flame to penetrate to the bottom of the joint. The operator then notes the flow of the metal right from the bottom and fills up the groove accordingly.

In welding a crack in metal over one-eighth of an inch in thickness it is necessary to cut a groove or opening which will allow welding right through. These grooves will be noticed in some of the illustrations. The grooving is usually done by grinding, but sometimes by clipping, filing, milling or sawing.

When beveling a broken part care must be taken to leave sufficient of the original break to line up the parts with, it generally being desirable to leave three short sections on each fragment for this purpose.

After reading the above it will be realized that it is impossible to make a lap weld with this apparatus. Therefore, when it is required to weld such parts as are usually braced, as, for example, the joints of the exhaust manifold made from steel tubing, shown in Figs. 2 and 3, it will be necessary only to fit the two tubes so as to butt together, and they should not be flanged, as for brazing. The flanges and other fittings will only be welded at the edge, either out-

Fig. 4.

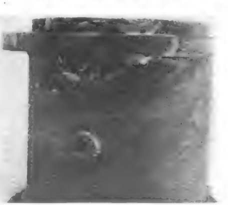


Fig. 5.

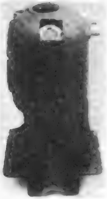


FIG. 6.

side, inside or both, as found most convenient, it being sufficient to weld around at one place, if the pipe is a good fit in the flange.

When a crack or break passes through a machined surface, as in the case of the cylinder, Figs. 4 and 5, which was broken through the failure of the connecting rod, and it is not necessary to eliminate all signs of the accident, it may be welded entirely from the outside. The machined surface will not then be damaged; but the line of the crack can always be seen on the inside. If it is necessary to eliminate all signs of the break, then the crack must be welded on the machined side as well, and metal added, which can be removed by hand or machine, as desired, the break then being indistinguishable.

In some cases when the part is broken out entirely the internal strain in the metal may cause the broken part to warp, and it will then have to be fitted as near as possible and metal added to make up for any defects.

It is sometimes impossible to get at both sides of a weld, as in the case of the two cycle cylinder, Figs. 6, 7 and 8, the deflector on the piston having been driven through the wall of the compression chamber. It was necessary to weld this from the outside, so a piece was cut out of the jacket wall, as shown in Fig. 5, thus making the inner wall accessible to the flame from the outside. A block of graphite, which stands the intense heat better than any other material, was fitted inside the cylinder. The weld was made on this, and then the hole in the jacket was filled in, as shown in Fig. 7. Upon removing the graphite the inside of the surface, which can be seen in Fig. 8, was found to be free from any projections that would cause pre-ignition. The outside, Fig. 7, could be trimmed off so it would look the same as before the accident.

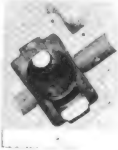


FIG. 8.

The illustrations give a good idea of the variety of work being carried out at the demonstration plant of the Autogenous Welding Equipment Company, Springfield, Mass., who handle the Davis-Bournonville oxy-acetylene welding equipment.

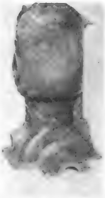


FIG. 7.

Fig. 9 shows the operation of welding an aluminum case.

A party on tour traveled over 100 miles by train to have the malleable iron hub shown in Fig. 10 made serviceable again, and the work was carried out to their entire satisfaction in a very short time. The damage to the two cylinders shown in Fig. 11, and successfully repaired, as shown in Fig. 12, does not reflect any discredit on the designer, as it was an experimental car, the parts being made light for special reasons.

It will be seen from these illustrations that autogenous welding can be extensively used, not only in the manufacture but in the repair of automobiles, it being possible to save the owners large sums, or, what is

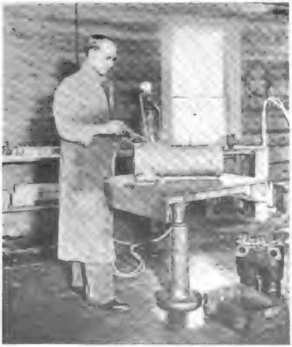
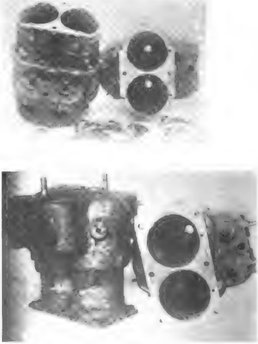


FIG. 9.



FIGS. 11 AND 12.

FIG. 10.

often more important, to get the cars back on the road in a minimum of time. In numerous cases early makes of cars have had to be retired owing to the supply of spare parts running out. This process will put many of them back on the road, as it makes them, to a certain extent, independent of such conditions.

Brake Experiments.

The Maxwell-Briscoe Motor Company recently made some tests of various brake lining materials near their factory at Tarrytown, N. Y., and have furnished us an account of these tests and the conclusions drawn from them. As to the location of the brakes, the company argue that the greatest strain to which the transmission of a car should be subjected is that obtaining when a car is brought from a standstill to full speed in the shortest possible time and distance. This, they say, requires about 300 feet. If, when the car is traveling at full speed, the brakes are jammed on, the car will come to a dead stop in about 75 feet, provided, of course, it has a proper braking equipment. This means that the rear wheels and every part between the brake and the wheels will be subjected to four times the strain in coming to a stop as in getting underway. Now, if the transmission is built to stand two, or even three, times the maximum strain exerted by the engine, it can be readily seen that grave danger exists when the transmission or any part of it lies between the brake and the rear wheels. From these experiments the deduction is drawn that the brake and the wheel must be constructed together. The Maxwell Company place both the foot and emergency brakes on the rear hubs.

The road tests were held near the company's factory on the morning of Wednesday, September 23. A smooth stretch of macadam road was selected with plenty of room for getting up speed, and a four cylinder Maxwell car with a passenger capacity of five persons chosen, equipped with the regular double external contracting rear hub brake, a photo of which is here shown. With passengers the car weighed about 2,850 pounds. The first trial was made with the brakes lined with the new asbestos preparation used by the company, and with the tonneau empty. The machine was speeded up to 30 miles an hour, and when the road mark crossed the driver's line of vision with the radiator, the brake was applied in full strength. The wheels immediately locked and the car came to a dead stop in 74 feet 10 inches, the distance measured from the line to the rear axle. In a second trial with the tonneau occupied the wheels again locked immediately and the car came to a dead stop 61 feet 6 inches from the line. When the brake was thrown the wheels locked immediately and silently; there was no loss of time, undesirable noise nor slippage.

The other materials for brake lining were found to lack several of the most desirable characteristics of the asbestos lining. It was found that when cast iron blocks were used the car traveled about 25 feet before the wheels locked, that during that time the friction gave rise to a disagreeable scraping noise, and that owing to the delay in the locking of the wheels the car traveled a considerable distance beyond the 61 feet of the asbestos. Hickory blocks were tried, but they, too, gave rise to the same disagreeable noise. It was found that they burned easily and that the car covered approximately 17 feet before the wheels locked. Hickory blocks boiled in paraffine showed improvement in the matter of noise and seemed to grip without the jerking experienced with the other two; they were found, too, to be more immune from combustion than the dry hickory—but they failed to lock the wheels until the car had traveled a little over 20 feet.

Red fibre, a papier maché product, was found to be better yet in the matter of noise, combustion and slippage, but the 12 feet found necessary to insure locking the wheels debarred it when measured according to the standard of the asbestos. Camel's hair was found most admirable; it was noiseless, it did not jerk, its life was long. But it, too, required about 12 feet in which to lock the wheels. Cork, too, was tried. With the exception of the asbestos it was the most desirable; its life is long, it was noiseless, it gripped nearly instantly, but the gripping was accompanied by a severe jerking.

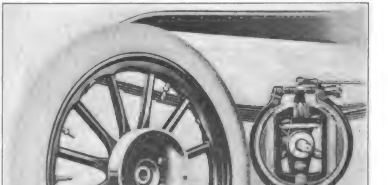
The company therefore considers that the different materials rank in the following order for general efficiency:

1. Asbestos.
2. Cork.
3. Red fibre; camel's hair.
4. Hickory blocks boiled in oil.
5. Hickory blocks dry.
6. Cast iron.

The company have decided to use the asbestos preparation in all their brake construction work, having found that it locks the wheels instantly, has long life and is combustion proof and noiseless.

A Curious Gear Box Lubricant.

A correspondent in *The Motor* claims that he has used the following gear box "lubricant" to good effect, and that the mixture rendered an otherwise noisy change gear quite silent. "I procured some peat moss litter and mixed this with a proportion of black soap, boiled oil and a little molasses, and after washing out the gear box with kerosene I dusted the gears with French chalk and filled the box with the above preparation. The result was astonishing, as the noise was entirely eliminated and the gears after 500 miles of running were in perfect condition, the preparation, owing to the introduction of the molasses, being continually on the move when the car was running, and no path being made as in the case of grease. I have no doubt sawdust would answer the same purpose as peat moss, but I consider the molasses absolutely necessary to get good results."

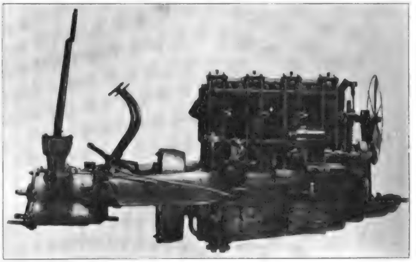


BRAKE CONSTRUCTION OF MAXWELL AUTOMOBILE, SHOWING ASBESTOS LINING.

NEW VEHICLES AND PARTS

The Model O Knox.

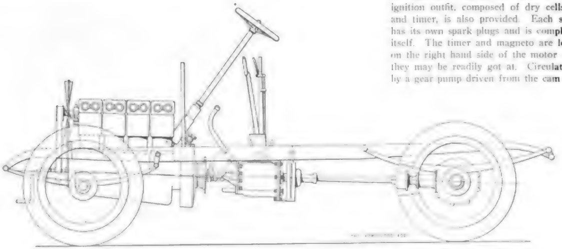
The Knox Automobile Company, of Springfield, Mass., are bringing out their Model "O" car, which succeeds the former Model L. The motor is of the four cylinder type, with individual cylinders, the bore being 4⅞ inches and the stroke 4¾ inches, giving 38 horse power by A. L. A. M. formula. The cylinders are similar in construction to those of Model L, each cylinder being made up of two distinct castings, the cylinder proper and the head. Each is fitted with a complete and entirely separate water jacket with very liberal water spaces. The jacket of the cylinder casting extends well down its length, but is entirely enclosed at the top, the water inlet being at the lowest point and the outlet at the front of the top at the right hand side. At the upper end of the cylinder casting is a counterbore leaving a shoulder upon which rests a copper-asbestos gasket. The bottom of the cylinder head seats upon this shoulder, and four studs projecting from the cylinder pass through holes in lugs integral with the head at the corners, thus securing the two parts together by means of four nuts. The head contains the inlet and exhaust valves and has its own water jacket also. Connection is made with the cylinler water jacket by means of a flat U pipe, there being no water jacket between the cylinder and the head. The valves are operated from a single cam shaft, located on the right side of the motor. The valve push rods, like those of Model L, terminate in cup shaped sockets and the outer ends of the valve rockers with which they engage are ball shaped. Oil is placed in sockets to prevent wear at these points. The valve push rods work through glands at their lower ends, these glands being provided with asbestos-graphite gaskets soaked in oil, thus providing for lubrication. Adjustment for variation in length due to wear is made by the usual lock nut and screw on each rod.



Knox Power Unit Model O.

The crank shaft is a drop forging of nickel steel and is 1⅞ inches in diameter. Five bearings are provided, the forward and intermediate bearings being 2½ inches and the flywheel end bearing being 4 inches long. Parsons white bronze is used for the connecting rod as well as for the crank shaft bearings. The connecting rods are nickel steel drop forgings, of I beam section, the big ends being fastened with four bolts with double lock nuts. This arrangement tends to make the bearings wear evenly and not more at the ends than the centre, as when a single bolt is used. The aluminum crank case construction used on all four cylinder Knox cars is retained, the parts being made larger and stronger for the increased power of the motor. The lower half of the crank case is of aluminum and acts only as a reservoir, the crank shaft bearings being in the upper half. Two square doors are provided for access to the bearings, or foi cleaning out the casing. The crank case is fitted with a sump at its rear end into which the oil drains, and a pump driven from a downwardly projecting shaft draws the oil from this sump and forces it through passages in the crank case proper to the various rotating bearings of the cam and crank shafts. In each connecting rod is drilled an oil passage, the opening of which registers once per revolution with a similar opening in the crank pin, so that the wrist pin is not only lubricated by the oil distributed centrifugally, but by direct pressure through the connecting rod. The cylinders are lubricated by the oil mist in the case, surplus oil falling back into the sump, and after passing through a strainer located therein is used again.

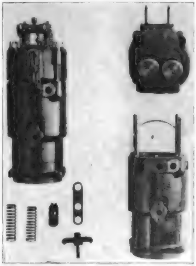
Ignition is by high tension Splitdorf magneto with unit coil on the dash. A reserve ignition outfit, composed of dry cells, coil and timer, is also provided. Each system has its own spark plugs and is complete in itself. The timer and magneto are located on the right hand side of the motor where they may be readily got at. Circulation is by a gear pump driven from the cam shaft,



Knox Model O Chassis, Showing Straight Line Drive.

the pump being located just ahead of the timer drive shaft. A honeycomb radiator is used, as in the Model L, a four bladed ring fan being used to assist the passage of the air through the cells. This fan is driven directly from the crank shaft by means of a flat belt and is located just back of the radiator.

The carburetor is of the float feed type, and is of Stromberg make, being built especially for these motors. Exhaust and inlet manifolds are held on by yoke pieces, the removal of four bolts releasing both manifolds.

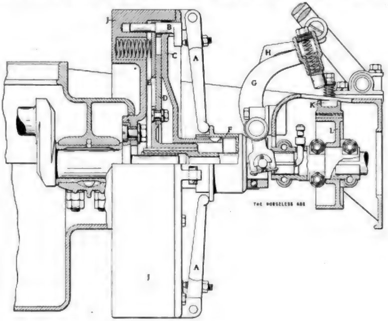


Knox Model O Cylinder.

The bridge construction used for the last two years by the Knox Company is retained, the parts being strengthened to meet the increased power of the motor. This construction is easily understood by referring to the accompanying illustrations. The change gear case is bolted to the rear end of this bridge, forming a rigid and practically "one piece" construction. The reader is referred to The Horseless Age for October 10, 1906, and for October 23, 1907, for descriptions of the bridge construction and other distinct features of the Knox cars. While all preceding Knox models used a cone clutch, the new car is fitted with a three plate clutch which is completely encased within the flywheel. Referring to the sectional cut of the clutch, J is the flywheel hollowed out at the rear to contain the ring E, the disc D and the cover C. Sixteen spiral springs fit into hollows in the flywheel and keep the ring E constantly against the disc D. The cover C has four bosses placed at equal intervals thereon. These bosses are hollowed out for the reception of the head ends of four plungers B. These plungers have two diameters, the larger diameter passing through C and the shoulder formed by the difference in diameters pressing against ring E. The smaller diameter of each plunger passes through E and enters into a correspondingly shaped hole in the flywheel. The flared ends of the plungers are acted upon by set screws fastened to pivoted arms A A A A, whose ends are ball shaped, a flange on a sliding shell F bearing against the ball ends of these arms for the purpose of operating the clutch. This shell works over the hub portion of the cover C and slide axially thereon by means of a series of Woodruff keys fitting into keyways in the shell. A wide ring, made up of a ball bearing and two collars, presses against the end of this shell, and is actuated from the clutch pedal through the medium of a lever H and a fork acting on two studs fitted to the ring. The disc D is fitted with cork inserts and is keyed to an extension piece which is squared at its rear end and there coupled to the line shaft of the change gear by means of a box coupling. The ring E and cover C are driven with the flywheel by means of the plungers B. The action of the clutch is as follows: When the clutch pedal is released the coiled springs in the flywheel force E rearward, pushing out the plungers E E E E, which in turn act on the levers A A A A and pushback shell F. At the same time the disc D is squeezed between E and C, and the drive is transmitted to the change gear line shaft through the disc extension piece and the box coupling. When the clutch pedal is operated the collar forces shell F forward, causing the arms A A A A to push in the plungers B B B B, forcing the ring E away from the disc D and compressing the spiral springs.

An ingenious clutch brake is used in connection with this clutch. L is a drum integral with the box coupling previously mentioned. A shoe K is pivoted to the bridge construction of the motor, and a hollow is cast in the top of this shoe. Keyed on the same shaft as the clutch lever H is another lever G fitted at its outer end with a hollow casing within which works a spring actuated plunger. When the clutch pedal is operated the lever G is moved downward, and its plunger entering the hollow part in the shoe K forces the shoe against the drum L, "damping" the clutch action. The spring permits of any desired pressure to be put on the shoe, the farther forward the clutch pedal being pushed the more the spring is compressed and the greater the pressure put on the shoe. When the clutch pedal is released the parts resume their onrmal positions.

The change gear is of the selective type, giving three speeds forward and one reverse. Two sliding trains are used, the first giving the direct drive and intermediate speed and the other giving the low speed and reverse. The gear case is fitted with end and top plates bolted on, the former allowing the entire contents of the case, gears, shaft, bearings, etc., to be withdrawn, while the latter allows inspection and lubrication of the gears. A smaller hand hole cover is bolted to the bottom of the case, allowing of purging, etc. The gears are of chrome nickel steel 1 inch face, separately cut and heat treated. The shafts are carried on double ball bearings on each end, one bearing taking thrust and the other the load. The drive is by propeller shaft fitted with two universal joints to the floating type rear axle. The rear universal joint is of the slip type, allowing for change in distance due to the vertical movement of the axle. The rear axle comprises the two half axles and the differential, all being encased in a heavy tube. The casing surrounding the differential and bevel gears is pinned to the axle tubes, and is fitted with an oval hand hole by which the differential may be examined. Hyatt roller bearings are used to carry the half axles, end thrust



Clutch Assembly.

being taken by ball bearings. The bevel pinion shaft runs in annular ball bearings. The outward ends of the axle tubes are fitted with supports for the brake actuating mechanism. Spiders on the ends of the half axles drive the wheels by means of dog clutches. The motor and change gear, shaft and pinion casing are so inclined in the car as to form a "straight line" drive, reducing wear in the universal joints and lessening the loss of power through the drive. The front axle is of heavy steel tubing, dropped in the centre to give clearance for the engine base. Steering knuckles are drop forged, the yokes being fitted to the axle ends skein fashion. The drag link is ahead of the axle and the steering arm is above the axle, preventing injury thereto by striking objects on the road, as is the case where the arm is below the axle. The steering gear is exactly like that used on former models, a quintuple threaded nut working on a similarly threaded shaft. Ball joints are used throughout the steering connections. The steering column is considerably raked, and is fitted with a large four armed hand wheel with rubber covered steel rim. Spark and throttle levers work over a quadrant on top of the wheel. Semi-elliptic springs are fitted all around, the rear springs being shackled at both ends. The rear springs take the drive and torque, in addition to suspending the frame. The wheels are of the artillery type, of second growth hickory, and 34x4 inch tires are fitted all around. The frame is of channel section pressed steel and is inswept just forward of the dash to give a greater steering lock. The wheel base is 114 inches and the tread standard.

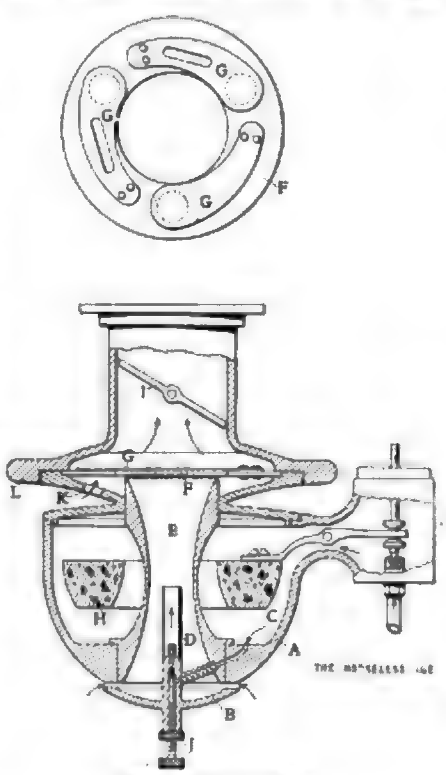
Two pedals are fitted on the footboards, the left hand one operating the clutch and the right hand pedal the contracting band operating on a large drum just in the rear of the change gear. A plunger between these two pedals acts as an accelerator, it being interconnected with the throttle lever on the steering wheel. Gear changes are made by a lever at the side of the car, the shifters, selectors, etc., operating within an aluminum casing bolted to the change gear casing. The internal expanding hub brakes are operated by a hand lever at the side of the car, an equalizer being fitted to give equal pull on both brakes. Provision is made for adjustment on both hub and transmission brakes and also on the clutch pedal linkage, to accommodate the difference in build of individual drivers. Gasoline is carried in a 16 gallon tank under the front seat, and an auxiliary tank is provided on the dash, both tanks being gravity fed. The car weigh 2,850 pounds with full equipment.

When used as a runabout the wheel base is reduced to 102 inches, but in other respects the chassis is the same.

The Bowers Junior Carburetor.

F. E. Bowers Company, of 42 Church street, New Haven, Conn., are bringing out the Bowers Junior carburetor for light automobile and marine motors, illustrations of which are here given. The base of the carburetor body A has a hole drilled through it, so that the Venturi tube E and combined air cup and jet B can be fitted therein. An extension of the body forms a small chamber, in which the needle valve works, and through a cap screwed into the top of this chamber the stem of the needle valve is seen projecting. The cork float H is fastened to a pivoted brass rocker piece having a fork at its other extremity, and this fork acts on one or the other of two collars on the needle valve stem, raising it or lowering it as the float is raised or lowered by the gasoline in the chamber.

The combined jet and cup B has a hollow extension from its upper end, which establishes communication between the jet and the float chamber by means of a canal, C. The jet is quite short, but is surrounded by a tube, D, whose top is on a level with that of the fuel in the float chamber. The jet is regulated by means of a needle valve, J, fitted with a lock nut for retaining it in place when once set. The cup of B acts as an air deflector, and also catches any overflow from from the jet, as when "priming." The makers claim that there is no gasoline wasted, as the air passing over that which has dropped into the cup combines to form an explosive mixture, which is aspirated along with the mixture formed in the Venturi tube above D. The float chamber cover forms the base of the throttle chamber L, and is pierced with holes, K, through which auxiliary air may be drawn in. The construction G—F fits into a ledge cut in the combined cover and base, and is kept in place by an interal rim on L. This construction is designed to admit auxiliary air, and consists of a circular ring, F, fitted with three holes. Each of these holes is covered by a thin metal spring flap, G, pinned at its other extremity to the ring F. Slots are cut through two of these flaps to vary the tension, while the third is left without a slot. The ring fits directly above the opening of the Venturi tube, allowing the mixture to pass inside of it, but drawing the auxiliary air around the mixture as it emerges, and incorporating this air with the mixture when the chamber "chokes down" to form the throttle chamber proper, in which works the butterfly valve I.



Bowers Carburetor.

The action of the carburetor is the same as that of any other jet carburetor, the mixture being formed in the space above the tube D. The suction of the piston draws this mixture upward, and also lifts one or more of the flaps, according to the speed of the motor. The action of these flaps is very rapid, and the makers hold that an over-rich mixture at high motor speeds is guarded against by the auxiliary air combining with the mixture in the throttle chamber and not passing the jet. The carburetor is light in weight, and is readily taken apart, the cover of the float chamber being screwed in place. The removal of the cap on the extension of the float chamber allows the needle valve to be readily taken out, while unscrewing L from its base releases the auxiliary air ring G F. With the exception of the screw holding the cork float to its rocker no screws are used in the carburetor.

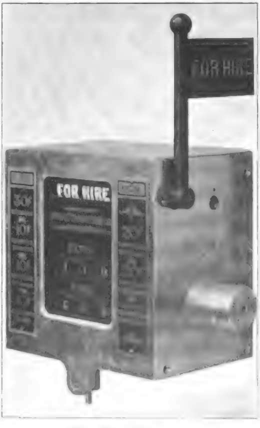
The B. & S. 15° Angle Autombile Wrenches.

The Billings & Spencer Company, of Hartford, Conn., are putting out a new set of 15° angle double end wrenches that are adapted to use on automobiles. These wrenches, seven in number, ranging from 7-16 inch milled opening to 1¼ inch, are put up in serviceable waterproof kit bags of duck or drill, and are furnished either semi-finished or full case hardened finish.

The Royal Taximeter.

We show herewith a photographic view of the Royal taximeter, made by the Royal Taximeter Company, of 140 Fifth avenue, New York, under the Sieman & Myers patents. The instrument is of very light construction, weighing but 7¼ pounds, without the flexible shafting, aluminum and brass being used for the gears throughout. It is cubical in shape, the dimensions being 7x6⅞x5 inches. Unlike the majority of taximeters in use, all operations save the registering of "extras" are performed on one shaft, with its connections to the "fare" and "total" dials. On the front of the instrument is a single mortise, within which is fitted a black face plate. Showing through a slot in the upper part of this plate is a "signal" which indicates whether the car is for hire or whether the mechanism is operating. At the centre are the openings or dials indicating the charge for "extras," and immediately below those for "fare." Upon the back there are four small mortises through which can be seen the totals for initial charges, "extras," miles run and for quarter miles. A milled knob is fitted to the back, and by turning this knob an "extra" charge is indicated on the dial at the front. A flag is seen at the right hand side of the instrument bearing the words "For Hire," and a milled knob is seen on the same side a little lower down. By turning this knob the flag is raised or lowered, and the clock and driving mechanism set in operation or returned to zero. An initial charge of 30 cents is always indicated on the fare dial, but the mechanism is not operative until the knob has been turned. To prevent any misunderstanding as to rates, etc., plates giving the charges and extras are fastened to the left and the right of the mortise on the front of the instrument.

The instrument is designed to be proof against tampering, a lug on the cover matching up with one on the base, a padlock securing the two, thus preventing lifting of the cover without opening the padlock or breaking the lug. In addition the cover is kept in place by eight screws, four on a side, and the heads of these screws are deeply countersunk and sealed so that any tampering can be detected. A brass extension casing fits over the flexible shaft, which is of the unit link type, to prevent its forcible withdrawal by unscrupulous drivers. The clock on the taximeter runs continuously and is wound by the insertion of a key into a small hole alongside the flag at the side of the instrument. The drive from the road wheels is either by spur gears or by snail gear and star pinion, as desired.



The Royal Taximeter.

New Bosch Ignition Terminal.

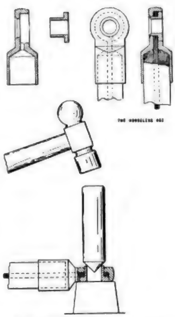
The firm of Robert Bosch, in Stuttgart, Germany, has recently brought out a new terminal for primary and secondary connection cables in which soldered joints are avoided. The shank of the connector is drilled out to take the insulation of the cable, and a small hole is drilled entirely through to the studhole. Through this hole stranded wire is passed, after having first been bared, and the end of the wire is then formed into a loop, which is lodged in a counterbore in the head portion of the connector, where it is secured by a hollow rivet, inserted as shown in the drawing.

Marion Plant Purchased by President Willys, of the Overland Automobile Company.

J. N. Willys, president of the Overland Automobile Company, has purchased 989 of the 1,000 shares of stock of the Marion Motor Car Company. The manufacture of the Marion car has been discontinued and the Marion factory will be used for making Overland engines and many of the smaller parts. The cars will be assembled and tested at the present Overland factory. Communications will be maintained between the two factories by the use of several motor trucks. With these additional facilities the Overland Company expects to turn out more than 2,000 cars during the season of 1909.

Milwaukee May Establish Its Own Garage.

The city of Milwaukee may open a municipal garage, to care for the municipally owned motor cars, which have been increasing to a respectable number this year. The latest applicant for a car is Mayor D. S. Rose, who says he is tired of paying money out of his own pocket for car hire to entertain guests, visiting executives, and the like. Chief Clancy, of the fire department, has a touring car; Superintendent Capenter, of the park board, has a runabout; Secretary Harbach, of the board of education, has been granted a machine; Chief Janssen, of the police department, is expecting his new car; the police patrol has a big patrol wagon, motor driven, and the board of public works has been promised a touring car for next spring. Although there was never a municipal livery stable, and although the cost of maintaining the motor cars is said to be less than in the days of the horse, it is believed that the city can save money by having a central garage for its cars.



Bosch Ignition Cable Terminal.

Motor Stagnation in Yucatan.

Vice Consul R. A. Williams writes concerning the automobile situation in Yucatan, Mexico, that there were 200 licensed automobiles in operation in the capital of that province about three and a half years ago, when prosperity reigned, but today the tax records show only thirty-five cars, the rest evidently being stored away or having been shipped to various parts of the republic to be sold. Aside from five or six machines of French make American cars are used exclusively, and seem to have given very satisfactory results. Repairs come very high in Yucatan and are mostly very poorly made, so that a car needing frequent trips to the repair shop soon becomes unpopular. The cost per month for maintaining an ordinary touring car seating four or five persons, including garage, fuel, lubricant, repairs and municipal taxes, amounts to about $90 gold. The tax is $6, gasoline from 39 to 44 cents per gallon wholesale, garage about $15 per month, and a set of tires, which will last about six months, about $100, all gold values.

Business Opportunities.

The Daily Consular Reports publish the following inquiries for motors, etc. Further particulars may be had by addressing the Bureau of Manufactures, Washington, D. C.:

An American consular officer in a European country reports that a firm in his district is willing to consider propositions for selling American motors, motor boats and accessories. Catalogues, prices lists and full descriptive publications are desired by the firm in question. In writing refer to No. 2,726.

COMMUNICATIONS

The Weaver Pathfinder Axle.

Editor Horseless Age:

I send you an explanation and diagram illustrating the action of and the reason why in the "Weaver Pathfinder Axle" (illustrated, described and misunderstood in your issue of October 7, 1908) the front wheels seek a position giving a straight course ahead, and tend to keep the course.

Referring to the enclosed diagram, the arm D when moved produces motion of the hub and wheel about an axis *x-y* through the inclined end of the axle. Draw the line O-W through the axis of the wheel until it meets *x-y* at O. Draw a vertical through the tire contact with the ground and mark where it intersects O-W at A. Next consider the point B which represents any point on the line O-W, but for illustration has been taken as the centre of the hub cap. It will be apparent that B, being on the element of a cone whose apex is O, will revolve to B in 180 degree movement about the axis *x-y*. This is the lowest point it will reach, and if B were kept a constant distance from the ground by a support, then the axle would be raised the distance O-B'. In this case, however, the wheel would lie in a horizontal plane and give no support for the axle, and the whole front of the machine would fall to the ground if the support were taken from under B when at B'.

This extreme case of limits is given to illustrate the action, but let it be understood that such a motion could never occur in practice, as even at extreme throw in steering the front wheels do not incline much from the vertical. Also stops are provided, so that the inclination of the wheels is restricted well within any dangerous amount.

Now consider the point A, which is over the contact of the tire with the ground and on the line O-W. As in the case of the point B, point A will move to A' during 180 degree movement around the axis *x-y* and the projection of the base circle of the cone is the ellipse drawn to the right of the hub cap. This ellipse represents the loci of the point A during a complete revolution of the hub and wheel around axis *x-y*.

In practice the extreme throw of the wheel gives from ⅛ inch to $\frac{5}{32}$ inch rise of the axle, but this is slightly reduced by the fact that the wheel then has an inclination, and the net measured rise is probably from $\frac{3}{32}$ inch to $\frac{5}{32}$ inch.

The weight of the front end of the car (about 1,200 pounds) acting through this vertical distance, or applied, if you will, to constantly decreasing lever arms, crowds the point A (displaced) back to the highest point of its loci, which is in the same vertical plane as the axis *x-y*. This has been found sufficient to restore the wheels to the straight forward position and to keep this relation when on a level track even when moving better than 40 miles per hour with hands free from the steering wheel. I know many at first will doubt this statement. I doubted the possibility of doing it until I drove the experimental car and actually did what under ordinary conditions would appear suicidal. An actual demonstration may be convincing, but personal experience in driving this car is what clinches the argument. I understand that the car is ready for any skillful driver who has more than idle curiosity to satisfy.

The characteristics of this steering gear are as follows: It comprises a regular inclined steering post and rod, on the lower end of which a small bevel gear meshes with two larger bevel gear sectors arranged on opposite sides of the small bevel. On turning the steering wheel the large bevel sectors move in opposite directions, and they carry on their shaft arms *so set* as to produce a greater angular movement of the inner front wheel than the outer when turning corners. This was worked out carefully and the effect is very satisfactory at the wheels, while the means are simple. It may be thus seen that the arrangement is *not* irreversible.

I have been operating my car of the ordinary steering type with irreversible worm and wheel steering control for five years, but have never had the confidence necessary to drive at high speed without firmly gripping the wheel. Again, after driving a full day with ordinary control my arms are tired from overwork in meeting road shocks and vibration; but with the Weaver Pathfinder axle, which is *not* an irreversible gear, little or none of the vibration reaches the arms of the driver. My explanation of this is that on the slightest displacement of the wheel axis from the position of highest locus or A the gravity effect appears and forces the wheel to the straight ahead position again. This effect constantly present at the front axle absorbs most of the road shocks and greatly relieves the steering arms and connections from strain.

I have driven a touring car 45 miles an hour over roads where it has been necessary to keep up a constant arm strain at the steering wheel to prevent it being torn from my grasp, and I can appreciate a new type of steering gear with which it is perfectly possible to drive at equal or greater speed with only a finger and thumb grip, one hand.

A boy of five can turn the front wheels, resting on the floor, hard to hard over when fully weighted. The control is most sensitive in straight ahead driving, requiring no work whatever to hold the machine straight. Yet the machine instantly responds to the slightest pressure on the wheel held between one finger and the thumb.

For sharp curves the force required at the steering wheel increases slightly and progressively as the wheel is turned more and more from the straight ahead position, but at no time does it require as much exertion as the usual type. This increase in force required gives a security against over-response in steering and inspires confidence in control. I have driven the car around corners at good speed; in fact, fast enough to slew the rear of the car badly, but have failed to notice the slightest slip at the front tires.

I write you this from no motive except my appreciation of an invention which, owing to its own merit, will ultimately supplant the present type of steering pivot. I sent you the first circular early in October for the same reason. I was extremely sorry to have the operation of the device misunderstood, and hope that the above information and sketch will clear up any difficulty in properly explaining it to your readers.

Francis E. Holleran, C. E.

[After looking carefully into the action of the Weaver axle we find that our first impression "that the axle is in its highest position when the wheels are in the straight ahead position, and is lowered as the wheels are turned from this position" is incorrect. Mr. Holleran's graphical demonstration was not convincing, however, as he assumed (but did not prove) that the lowering of the axle due to the inclination of the wheel is less than the lowering of the wheel centre with respect to the axle by its rotation in a plane inclined at 45 degrees. In order to satisfy ourselves of the action that actually

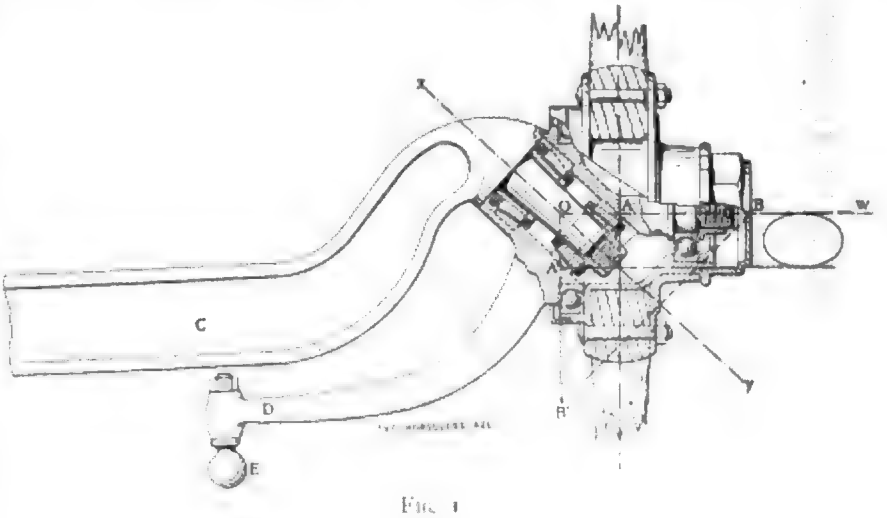


Fig. 1

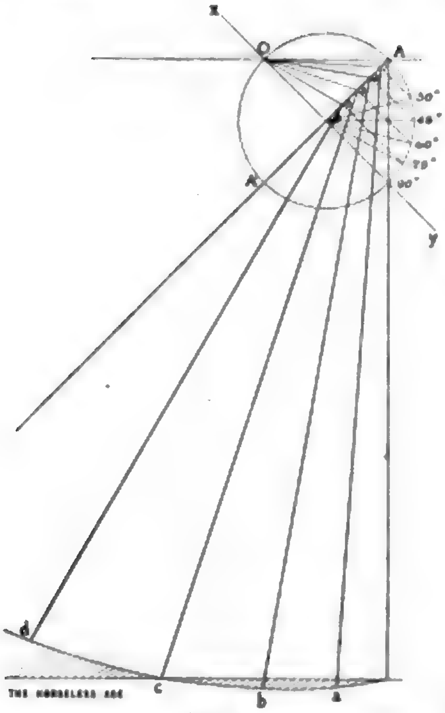


Fig. 2.

takes place we constructed the diagram Fig. 2. In this the wheel is represented as a circular disc with centre A. O is the point where the axis of the wheel intersects the axis of the pivot. As Mr. Holleran has explained, the line O-A forms an element of a conical surface described when the wheel hub is turned around the pivot. The point A then describes a circle perpendicular to the plane of the paper whose projection is the straight line A-A'. The circle described by A is shown in the drawing turned through an angle of 90 degrees. The point A is shown moved successively through 30, 45, 60, 75 and 90 degrees. By drawing lines parallel with *x-y* from these points to the line A-A' the projections of these points on the horizontal plane through the centre of the axle are found, which, of course, are the projections of the centre of the wheel. By connecting these points with the point O we obtain the projections of the wheel axis in the different positions.

Here it is well to remember a few geometrical relations. First, the largest dimension of the projected area of a circle is always equal to the diameter of the circle. Second, the largest dimension of the projection of a circle is always perpendicular to the projection of the axis of the circle. This latter proposition becomes self evident when one considers the plane of projection to pass through the centre of the circle.

Applying these two propositions to our case, we find that for any position of the point A the longest dimension of the projection of the wheel on a vertical plane through the centre of the axle is equal to the diameter of the wheel and is perpendicular to the corresponding projection of the axis O-A. Drawing perpendiculars to O-1, O-2, O-3, etc., and measuring off distances equal to the radius of the wheel from the points 1, 2, 3, etc., we obtain the points *a, b, c*, etc., which represent the lowest point of the wheel for an angular motion of 30 degrees, 45 degrees, 60 degrees, etc., from the straight ahead position, on the supposition that the point O (the axle) remains at the same height. In reality the lowest point of the wheel is fixed by the contact with the ground, and the point O (the axle) rises as the wheel is turned from the straight ahead position. The point O (axle) continues to rise at least till the wheel has been turned through an angle of 30 degrees around its pivot, with the proportion in the length of the wheel diameter to the length of the line O-A here selected. The line O-A has been purposesly chosen somewhat longer, relatively, than it actually is, in order to bring out the effect more clearly.—Ed.]

Wants Accessories Discussion.

Editor Horseless Age:

I have read with much interest the Runabout Number, which is of great practical value. I have frequently thought that if a symposium on various matters of interest to the practical user of the automobile could be published in your columns it might be of great interest to the readers of the paper.

The tire proposition is the one I have in mind at the present time. It is, of course, the weak point of the automobile. I have often seen articles commendatory of the solid tire, but have rarely noticed anyone saying anything against them, yet they do not seem to be coming into general use. The tire protector is another matter of great interest to me, and I presume also to other drivers. We get all kinds of recommendations for their use in the booklets supplied by the manufacturers, and one would think, from reading their literature, that about one-half the automobiles in America were equipped with them, but on a recent visit, stopping at all the principal cities between here (Western Canada) and New York, I did not see a single pair on a car. The leather tire is another interesting subject. I have before me a letter from the manufacturers of the —— leather tire, giving a guarantee of 10,000 miles, and also stating that their tire has all the resilience of the rubber tire, with the advantage of being puncture proof; yet apparently none of the writers in your Runabout Number has had the courage to invest in a set. Tire fillings could also come in for discussion. Shock absorbers, magnetos—the low tension kind particularly, that are being advertised so extensively to fit several popular makes of cars—could also be discussed. Personally I have been stung so often with accessories that I am beginning to look on them all with the cold eye of suspicion, and I think that if a regular discussion were to be opened in your paper much money would be saved to the unsuspicious buyer, and any really good accessory would get the benefit of satisfied users' exploitations. C. F. Smith.

Two Cycle Motor Proportions.

Editor Horseless Age:

I have read with increasing interest the "two cycle engine" articles appearing in The Horseless Age during the last two years. The diversity of opinion among the various writers, however, is so great that it is difficult to come to a conclusion as to what is at present good practice in a particular case.

As I am planning to rebuild a two cycle, two cylinder, 5 by 5 inch, 750 r. p. m. marine engine in order to conduct further experiments on "ignition," I venture to ask whether the following would be considered good general design:

1. Combination of crank case inlet check valve and third port, connected to the same carburetor manifold.
2. Exhaust port, 3½ by ⅞ inches, divided in two parts with ½ inch bridge.
3. Cylinder inlet port, 3½ by ½ inches, in two parts; transfer passage about 50 per cent. larger.
4. Third port, 3½ by ½ inches, in two parts.
5. Crank case compression, about 6 pounds.
6. Compression space, 30.4 cubic inches, or 31 per cent. of the *effective* stroke volume, 5 inches diameter by (5—⅞ inches exhaust port) stroke.
7. Deflection plate, 1¼ inches from cylinder inlet, straight across piston head, and 1⅛ inches high.
8. Crank shaft offset, 1 inch and 1¾ inches in diameter.
9. Maximum power to be obtained at about 800 revolutions per minute.

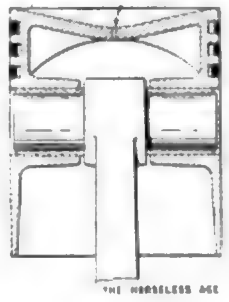
F. W. Springer.

[We do not see anything abnormal in these dimensions. The ports are quite liberal in size and the engine will probably be not very economical of fuel, but it should develop considerable power. We would expect about 25 horse power at 800 revolutions per minute.—Ed.]

Suggestion for Getting Rid of Superfluous Oil in the Cylinder.

Editor Horseless Age:

Having worked on automobiles and engines for the last several years, I have found that the great trouble with single acting engines is due to the carbon deposit from lubricating oil in the explosion chamber, and on the valves, and I would ask you through your paper, which I read every week, if you think this way of getting the



oil off the piston would cause much loss of power, and would work in the long run?

The piston is cut with a well in the centre, and the oil runs over the top and collects in the centre, and by the force of the explosion it is driven through the piston head and sprayed on the wrist pin. The oil is thus returned to the crank case. The question is whether the smallest hole in the centre would cause any more loss than there is through the plugs, etc. I ask advice and comments—not that I intend to patent or have patented the idea. WM. W. MORSE.

[It is difficult to say just what the effect of a small drill hole through the piston head would be on the power without making any experiments. We are inclined to believe, however, that a very small hole would be closed up with oil or carbon during periods of idleness of the engine, and would then cease to be effective. Any opinions of readers on the efficiency of this expedient will be welcomed.—ED.]

Decatur, Ill., Presents Her Claims.

Editor HORSELESS AGE:

An item claiming for Waukesha, Wis., the championship for number of motor cars in proportion to population appeared in one of your late issues. Now, Decatur doesn't claim to be an automobile centre, has no auto factory near, is really a farming community—yet we have 161 autos in the city and many more in the country. The last census gave us a population of 20,754; we claim now 30,000. On a basis of 30,000 we would have one auto to each 186 inhabitants. Besides, the dealers claim they have sold eight to ten more and are only awaiting them. E. F. K.

Another Owners' Co-operative Enterprise.

In spite of the failure of several automobile owners' organizations on the co-operative plan new organizations of this kind continue to make their appearance. The latest is the Automobile Co-operative Association of America, which has its headquarters in New York city, at 31 West Forty-second street, and is said to be backed by men of high standing in the commercial world. The association purposes to furnish members with automobile accessories and supplies at lower prices than they can be bought for at the regular stores. According to the plans of the association, each member must purchase one share of stock at the price of $5, and must, besides, pay $3 annual dues, which sum of $8 will entitle him to all the advantages of membership for one year. The officers of the association are: James L. Breese, acting president; William H. Woodin, vice president; William C. Dickerman, treasurer: Horace H. Williams, secretary.

"Including tips, taxicab drivers in New York are said to make as much as $75 a week," observes a country paper, and comments: "The delightful humor of men making $75 a week accepting tips from people making from $15 a week up."

The Vanderbilt Cup Race.

The fourth annual Vanderbilt Cup race was contested on the Hempstead Plains circuit on October 24, and was won by George Robertson, driving a 120 horse power Locomobile, fitted with Michelin tires, in 4 hours and 48 1-5 seconds. Herbert Lytle, driving a 65 horse power Isotta-Fraschini, was second in 4 hours 2 minutes 36 2-5 seconds. The race was called off immediately after Robertson had finished. William Luttgen (90 horse power Mercedes), J. Florida (90 horse power Locomobile), Albert Dennison (50 horse power Knox), Emil Stricker (120 horse power Mercedes), and G. Bourque (40 horse power Knox), were running on the course when the race was called off.

This is the first time in the history of the Vanderbilt Cup race that an American, driving an American car, was the winner. The first race, held in 1904, was won by George Heath, an American, driving a Panhard, and the second and third races were won, respectively, by Auguste Hemery and Louis Wagner, both driving Darracq cars. Robertson's speed averaged 64.3 miles an hour, while the best speed in any of the previous races was 61.5 miles, made by Hemery in 1905.

The course was laid out on Hempstead Plains and included the towns of Westbury, Jericho, Woodbury, Central Park and Bethpage. It included about 10 miles of the new Motor Parkway, and the remainder consisted of the regular State and county roads. The course measured 23.46 miles, and was covered eleven times, making a total of 258.06 miles for the race. Owing to rain during the night the course was bad at the turns until about 8 o'clock, when it became dry, and with the exception of two or three spots was in good shape for the rest of the day. The spectators began to arrive at 2 a. m.; they broke down the wire fences on the course and swarmed on the roads. The Irish Volunteers and Pinkerton men, who were to guard the course, did not arrive till nearly 6 o'clock, and had great difficulty in keeping clear enough space on the roads for the cars to pass through, but luckily no serious disaster occurred during the race.

At 6:30 a. m. Florida on a 90 horse power Locomobile was started off, followed by Dennison on a Knox at 6:31, and Stricker on a Mercedes at 6:32. The Brasier car broke a steering connection coming up to the starting line and did not compete. The 100 horse power Renault, driven by Strang, had to be pushed over the starting line, owing to magneto trouble, and succeeded in getting off only after half an hour's work. After making three rounds Strang was forced to withdraw by a burnt out clutch. Gill's 100 horse power Thomas and Chevrolet's 60 horse power Matheson made each but one round, the former retiring with change gear trouble and the latter with a cracked cylinder. The next round saw Kilpatrick's 120 horse power Hotchkiss out with a broken clutch, and Patschke's 60 horse power Acme wtih a broken cam shaft. Ryall's 60 horse power Matheson caught fire in front of the grand stand at the end of his third round and was unable to continue. Foxhall Keene's 120 horse power Mercedes cracked a cylinder and caught fire at Westbury and was out of the race, Keene being slightly scorched about the face. Haupt's 60 horse power Chadwick discontinued during the eighth round, owing to a broken chain.

Toward the end of the race Robertson and Florida, the two Locomobile drivers, Stricker and Luttgen on Mercedes cars, and Lytle on the Isotta, fought for first place. Stricker and Luttgen were delayed by tire trouble, and Luttgen was also obliged to refill and cool down a jackshaft bearing during the eighth round. The Knox cars ran well, but had not the power to compete with the larger machines. The Thomas, driven by J. C. Moore, had a leaky radiator, and was obliged to refill at intervals, thus losing time. The Locomobiles and the Isotta had to pull up several times to change tires, but lost very little time during the process. Florida on the 90 horse power Locomobile was delayed by radiator trouble around 9:30 o'clock, and lost place thereby. At the end of the tenth round Robertson led Lytle by about four minutes, with Luttgen pushing Lytle hard for second place. On the last lap Robertson went off the road at Plainview, but got on again after a loss of two minutes, and though Lytle passed the line first, Robertson came in the winner, but with only 1 minute and 48 seconds lead.

As usual, the crowd immediately swarmed on the course, and several private cars started homeward along the course also. Florida came down toward the grand stand at high speed and collided with a White steamer which had no right on the course, breaking the condenser and mud guard. A young man standing alongside the steamer was thrown down and sustained a fracture of the leg.

Following are the final results:

Car and Driver.	Time.
120 Locomobile, George Robertson	4:00:48 1-5
65 Isotta, Herbert Lytle	4:02:36 2-5

Looking at Things Through a Magnifying Glass.

A Sunday paper in a Western city, a centre of the automobile industry, in a recent issue printed the following item:

"The industry in general is picking up wonderfully, two or three more large concerns locally now having in view the matter of taking on additional hands, one of these being the ——— ——— Company, which can hardly keep pace with its orders with its present crew.

The "crew" of this particular "large" concern a week previously consisted of five men, viz., three assemblers and two painters.

In the Vanderbilt Cup race last Saturday all records in "dipping" are said to have been broken. The jamming together of the crowds when a car was announced gave the best of opportunity to the numerous pickpockets present.

Commercial Applications.

Springfield's Automobile Fire Apparatus.

The accompanying photograph shows the motor equipment of the Springfield, Mass., fire department, the various vehicles being lined up in front of the Winchester Park Station. The machines from left to right are as follows: Auxiliary squad cars B and A, fire chief's car, first assistant engineer's car and hose wagon. Springfield having only a small paid department, and relying on volunteers for the greater part of the firemen, it is necessary to have means for quickly transporting the auxiliary squads or volunteers to the scene of the fire, where they can take charge of the fire apparatus. Hence the use of auxiliary squad cars. As will be seen in the photograph, each car accommodates seven men and a driver, and is fitted with four hand extinguishers, axes and lanterns. The fire chief's car and engineer's car are fitted one with a dinkey seat runabout and the other with a double phaeton body, the equipment of extinguishers and lanterns being the same. The hose wagon carries several thousand feet of hose, varying from 1 to 3 inches, and, like the squad cars, carries fire extinguishers, axes and other tools. This car is intended to carry four hosemen and a driver. The cars were all built by the Knox Automobile Company, and are of 40 horse power.

Motor Trucks in Grocery Delivery.

Two grocery firms of Los Angeles, Cal., have added motor trucks to their transportation equipment within the last two months. The Newberry Company, wholesale and retail grocer, is using a 5 ton truck chiefly for the transportation of its goods from the cars and warehouses to its string of stores, the greater speed and larger capacity of the motor truck giving better results than horse drawn vehicles. Similar work along retail lines is performed by the second gasoline truck bought by the Newberry Company recently, a 3 ton wagon with a two cylinder engine. The H. Jevne Company has also invested in a motor truck for retail delivery purposes, while the Newman Grocery Company, a wholesale firm, has been operating a 3 ton truck propelled by a 20 horse power engine for a year and a half with satisfactory results, it is said.

Indianapolis Police Department to Be "Horseless."

The Indianapolis Police Department will place a second automobile patrol wagon in operation on January 1, having made a successful test with one for the last year. At the present time one gasoline wagon and two one horse wagons are being used. With the new gasoline car the horse drawn wagons will be discarded and the police department will be equipped completely with automobiles. The department now owns a steam touring car for emergency runs and a gasoline runabout for inspection purposes in addition to the patrol wagon.

Commercial Notes.

The city of Chicago has purchased three additional automobiles for the use of the boiler inspection and building departments.

The Hamilton County (Cincinnati) A. C. has authorized the purchase of an automobile for the use of Superintendent George Chrispin.

The Denver, Col., City Council has received offers from the local agents for the Dayton Motor Car Company for supplying three motor ambulances and patrol wagons. The contract has not yet been signed.

An automobile service is contemplated between Roswell, N. M., and Alamogordo, a distance of about 150 miles. Dr. M. R. Eidson, vice president and general manager of the Alamogordo Improvement Company, is promoting the enterprise.

G. E. Rodger, of Chicago, who is organizing the Automobile Owners Garage and Taxicab Company, in Kansas City, promises to have thirty taxicabs on the streets within thirty days. The company plans to build a garage at Eighth and Walnut streets.

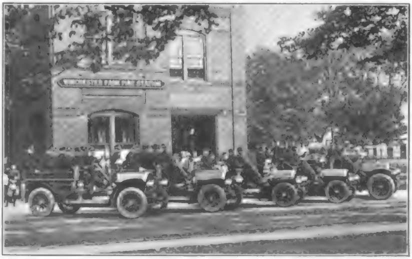
Chief of Police Janssen, of Milwaukee, is indignant over the refusal of the comptroller to sign the resolution giving the department a $3,600 car for its use. Chief Janssen says it is urgent that the police be supplied, and may buy a machine of his own. The trouble seems to lie in the fact that the fire chief was supplied with a machine costing but $1,500, and the police chief is to have a $3,600 car.

Officials of the Indianapolis post office have arranged to lease two automobiles from the Overland Automobile Company, of that city, for the purpose of making a thorough test of gathering mail with them. The test is to last one year and if satisfactory at the end of that time several cars will probably be purchased. The cars will be enclosed with a coupé top measuring 46x41 inches. Professional drivers will be employed and the cars will be placed in service in about two months.

According to a report of Roland R. Dennis, United States special agent in Russia, the manager of a large Russian firm is very much interested in the subject of plowing with traction engines, and would like to hear from American manufacturers building such engines. It is said that he represents an old established house of excellent reputation, with branch offices in all the best places in Siberia. The address can be obtained from the Bureau of Manufactures, Washington, D. C., by referring to No. 2690.

Goodwin & Cassel, funeral directors of Milwaukee, have purchased a motor hearse. At the annual convention of Wisconsin undertakers at Eau Claire last week, however, H. M. Hoppenyan, of Ashland, first vice president and brother to Maytor Hoppenyan, agent for the White and Ford cars in Milwaukee, made a prophecy that motor cars would be exclusively used in funeral processions within three years. Mr. Cassel was present, and on returning to Milwaukee brought the prophecy to immediate fulfillment.

Four motor trucks and buses will be used in establishig an extensive stage system in the Okanogan country, Washington, northwest of Spokane. Two of the cars are of 60 horse power, while the others are 30 and 25, respectively. The larger cars can carry twenty-seven passengers and 10 tons of freight. Two cars go to Kettle Falls, to carry freight between Marcus and the steamer landing 3 miles below Kettle Falls, a distance of 11 miles. F. L. Barney has charge of the cars, and associated with him in the enterprise is Capt. Bruce A. Griggs.



A MODERN FIRE FIGHTING EQUIPMENT, THAT OF THE SPRINGFIELD (MASS.) DEPARTMENT.

LEGISLATIVE and LEGAL

A Decision Regarding the Scope of Fire Insurance Policies.

An instance of the disputes that may arise between insurance companies and their customers in spite of the most carefully worded policies is furnished by the recent case of Preston vs. Ætna Insurance Company, which has just been decided in favor of the insurance company. The policy concerning which the dispute arose contained the following provision:

"It is understood and agreed that this policy does not cover loss or damage caused by fire originating within the vehicle."

In the case in question the car was driven during a dark night in July, 1902, from Pleasure Bay to Monmouth, N. J. At a particular spot the car ran off the road into a ditch filled with water to the depth of a man's knees. It stood there in an inclined position, making an angle of about 40 degrees with the horizontal. Finding it impossible to extricate the machine from the ditch the three men left for assistance, and almost immediately afterward heard the noise of an explosion. Running back, they found the car in flames and the chauffeur senseless on the ground.

The chauffeur died before the trial, so the origin of the fire could be learned only from the three passengers who were not actually present. At the time of the accident two kerosene lamps on the dashboard of the car were lighted. Both insured and insurer assumed that the gasoline ran out of the tank on account of the slanting position of the car, covered the surface of the water, and, its vapor coming in contact with the lighted lamps, took fire and caused the explosion.

The referee, Edward B. Whitney, found that the fire originated "within the vehicle" and awarded judgment to the defendant. The Appellate Division reversed the referee by a vote of 4 to 1, and now the Court of Appeals has sustained the referee by a vote of 5 to 2. The prevailing opinion, written by Chief Judge Cullen, takes the view that it was the intention of the parties to exclude risks of this kind.

Cars May Be Barred from Certain Roads.

In order to test the right of civic authorities to bar automobiles from certain roads a case was recently instituted by Arthur Kingsbury, of Ashfield, Mass., who allowed himself to be arrested for driving a car in Centre street, Ashfield, which has been closed to automobiles by the selectmen of that town. The full bench of the Massachusetts Supreme Court on October 20 found a verdict for the Commonwealth, declaring that selectmen of towns and aldermen of cities have the right to exclude automobiles from certain streets. Kingsbury denied the right of the selectmen to make special regulations as to the speed of an automomobile or motorcycle or to confine their limit of use to certain streets or to exclude their use altogether from other highways.

The opinion, which was written by Chief Justice Knowlton, states that statutory regulations of the speed of automobiles while running on highways are reasonable and proper for the safety of the public. The opinion further states that the Legislature has the right to delegate to selectmen and aldermen police powers, and that in the exercise of such power the Legislature or town officials are acting on well established rights when prescribing that motor vehicles shall not pass over certain roads.

Alleged Speeders May Lose New Jersey License.

Commissioner of Motor Vehicles J. B. R. Smith, of New Jersey, has revoked the license of Felix Froger, the chauffeur of the car which collided with a telephone pole at Edgewater on October 4, in which accident two men were killed and several injured. The commissioner has also ordered Monroe R. Rothschild and Henry Weisl to show cause why their licenses should not be revoked. The two are New York brokers and are reported to have engaged in a road race in New Jersey on October 18. Rothschild and Weisl allege that the publication of the story was a hoax intended for the amusement of their Wall Street friends; but they have failed to keep their appointment with Inspector Smith, and they will probably lose their licenses.

Road Bonds Defeated by California Town.

The opposition of the voters of the town of Lompoc killed the proposed $1,265,000 issue of bonds for a system of permanent highways in Santa Barbara County, California. While every other town and the country districts gave the bonds the required two-thirds majority in Lompoc the bonds were defeated 577 to 24, and this overwhelming negative vote of the one town made it impossible to attain the necessary majority. The Lompoc citizens claimed that their territory had been neglected in the apportionment of the roads to be built with the money, and their opposition was successful. The promoters of the good roads movement, chiefly automobile owners and dealers, are not discouraged, however, and will make another attempt to raise the needed funds within the next seven or eight months.

The New Dutch Automobile Law.

The upper chamber of the Dutch Parliament has recently adopted a new automobile law which authorizes local authorities to limit the speed of automobiles within their jurisdiction to 10 km. (6.25 miles) per hour. Until now motorists in Holland enjoyed great liberties with regard to speed, there being no definite speed limit, but the driver was held responsible in case of accident. This rule, which is greatly favored by motorists everywhere, proved unsatisfactory on account of the exploits of a number of speed maniacs. Every effort was made by the automobile organizations of the country to prevent the passage of the new law; thus, for instance, a series of speed and brake tests were arranged at Schevingue in the presence of a member of the Cabinet and numerous representatives. The limit of 10 km. per hour can, however, be enforced only in communities where there are special local conditions rendering higher speeds dangerous. The Dutch towns and villages are in many cases very long and only sparsely settled, and if this restriction had not been made there is no doubt that misuse would have been made of the new law.

Legal Notes.

The Iola, Kan., city council has under consideration a vehicle tax ordinance imposing an annual tax of $10 on automobiles, and a smaller tax on other vehicles.

Exactly 1,000 automobile licenses were issued by the State of Pennsylvania during the month of September, making the aggregate of the licenses sold 24,727. The sale began last December and has broken all records.

A chauffeur in one of the city departments in Brooklyn and an ex-employee of the New York city finance department were held last week for illegally using the automobiles of the city. The two went to the bridge department garage on October 12 and took out the automobile belonging to the commissioner of accounts, which they kept out until 2 o'clock in the morning. The commissioner of accounts obtained warrants against them on a charge of larceny (of gasoline).

In a suit for damages recently brought in Denver, where a person was injured by a car while it was being driven across the sidewalk out of a garage, the attempt is being made to hold the city jointly responsible with the owners of the garage. On June 26 Horace Castle was run down by a machine leaving the garage of the Tobin Motor Car Company, on Broadway, and sustained injuries for which he asks $10,000 damages. In the suit the city and the Motor Car Company are made joint defendants, it being held that in licensing the garage the city allowed a nuisance to exist whereby the lives of pedestrians are endangered.

Paul Geller, chief engineer of the Adler Automobile Works, Frankfort-on-Main, Germany, was killed a fortnight ago while speeding a racing car in the Forstenrieder Park, Munich. He was only thirty-two years old and had participated with conspicuous success in a number of recent contests in Germany.

MINOR MENTION

Oberdorfer Brass Foundry Company, Syracuse, N. Y., will enlarge their plant in the near future.

The Grout Automobile factory at Orange, Mass., which was closed for three weeks, was to be opened again on October 26.

The Pettingell-Andrews Company, of Boston, Mass., have secured the contract for supplying coils for the Cadillac output for 1909.

A brick factory building is being built in Wenona, Ill., for Charles Burgess, Jr., for the manufacture of the Burgess double tension automobile spring.

The United States Department of Agriculture will shortly build an experimental road on the South Side of Chicago of blast furnace slag and tar or asphalt.

It is reported that the price of the Buick runabout will be increased on January 1 from $900 to $1,000, and the Buick tourabout will be sold for $1,075 after that date.

William Washington, a colored man living near Fishkill, N. Y., is reported to have invented an automobile brake claimed to possess certain advantages over existing types.

The Arsenal Varnish Company, Moline, Ill., is putting on the market a paint for motor cars which can be put on over the old coat successfully by a novice, it is stated.

The Motor Buggy Company is planning to erect a two story brick factory building with basement in East Cass street, Joliet, Ill. Ground was broken for the new building recently.

The Jonz Automobile Company, which recently located in Beatrice, Neb., has completed its experimental machine, which is equipped with a two cylinder, valveless, air-cooled motor.

Dr. William G. Tyner, of Picton, Ont., was found dead underneath his car in a swamp on the morning of October 15. It is thought that on his way home he ran off the road in the darkness.

It is announced that a large addition will be made to the Maxwell-Briscoe plant at Newcastle, Ind., at once, so it can be occupied on February 1 next, and two more additions will be begun next spring.

Capt. Alfred Foote, one of the proprietors of the Holyoke Business Institute, Holyoke, Mass., has been appointed State Inspector of Automobiles, his territory comprising that west of Worcester and Fitchburg.

The Commissioners of Abington Township, Abington, Pa., claim that considerable damage is being done to roads by exhaust discharge pipes which are turned so as to direct the exhaust directly against the surface of the road, and they ask that these discharge pipes be so arranged as to discharge the gases parallel with the road surface.

The Remy Electric Company have opened a New York office in the Thoroughfare Building, Broadway and Fifty-seventh street, Room 211, in charge of H. J. Hinley.

Miss Madeline Edison, daughter of Thomas A. Edison, is reported to have invented a motor road map, which is secured to the steering column of the car, and at night can be lighted up by means of an electric light.

A hill climb is to be held on Solomon's Hill, St. Louis, on November 2, by the Manufacturers and Dealers' Association of that city. The contest committee of the association is arranging the details and soliciting entries.

The J. D. Clark Auto Company, of Anderson, Ind., some time ago built a 50 horse power "Clark Special" for Dr. W. C. Rousch, who drove the car on a test run from Anderson into New York State, a total distance of 1,692 miles.

The entire stock of automobile supplies of the Jordan & Sanders store, at 3924 Olive street, St. Louis, Mo., was destroyed by fire on October 15. The fire is said to have originated from a defective stovepipe. The loss is estimated at $3,500 to $5,000.

I. M. Case, of Laramie, Wyo., the owner of a single cylinder 1904 model Rambler car which is said to have seen steady service for the last five years, has started on a trip East to New York, which he expects to complete in about three weeks.

The officials of an automobile tire manufacturing concern now located in a small town in Illinois, have made a proposition to the business interests of Mansfield, Ohio, to remove their plant to that city, if $15,000 of stock is subscribed for by local investors.

The Boston Automobile Dealers' Association held its annual fall outing to the Ashland Country Club on October 22. A short business session was held, at which President James MacAlman presided. All of the members of the association attended the meeting.

M. C. Viau, general foreman of the Lozier Motor Company, of Plattsburg, N. Y., has closed a contract with the Syracuse Wrench Company, of Syracuse, N. Y., whereby the latter company is to manufacture the Viau "auto grip" pipe wrench, which is of the chain type.

The National Retail Automobile Dealers' Association, of which C. H. Jensen, of Joliet, Ill., is president, and J. A. Crum, of Oshkosh, Wis., secretary, will establish headquarters at the Grand Central Palace Show in New York, at which Secretary Crum will be in attendance.

According to the report of Fred H. Caley, State registrar of automobiles in Ohio, the total receipts from automobile registrations for the month ending October 15 amounted to $2,954.50. The total number of automobiles registered in Ohio up to that date was 10,185, of which more than one-half were owned in Cleveland.

The plant of the George T. Stehling Manufacturing Company, 543-549 Tenth street, Milwaukee, makers of wagons and motor car bodies and wooden accessories, was damaged $3,500 by fire last week. The company is not inconvenienced, excepting in delivery of stock already prepared.

The Oakland Motor Car Company, of Pontiac, Mich., will erect a storage room and testing room building within the next two months, and expect to turn out 1,500 cars for the coming season. The new building will be 60x112 feet, two stories high and of brick and cement construction.

The Elkhart Motor Car Company, Elkhart, Ind., is bringing out a new $1,500 model to be known as the Sterling Model K Roadster. The car has a wheel base of 115 inches and will weigh completely equipped 1,900 pounds. It will be furnished with either a roadster or baby tonneau body.

Woods R. Woolwine and Charles S Anthony, Los Angeles, Cal., have formed a partnership under the style of the Big Four Automobile Company. They handle the Marmon car in Southern California and operate a garage at 110-112 East Ninth street, but are now erecting a new building on Olive street, between Twelfth and Pico streets, to which they will move about December 1.

The Preston Fabric Tire Company, of Buffalo, N. Y., recently incorporated, has purchased the property of the old King Spring Company, at the corner of Niagara street and West Delavan avenue, for $24,000. The building has a frontage of 99 feet on Niagara street and 137 feet on West Delavan avenue. Alterations are being made to adapt the building for the purposes of the new owners.

R. M. Burdick and C. W. Dandewalker have purchased the entire stock and business of the American Motor Company, Eau Claire, Wis., and secured a factory site on Water street in that city. The business of the American Motor Company has been confined so far mainly to the manufacture of marine motors, but it is the intention of the new proprietors to turn out a touring car after designs of Mr. Burdick.

The Speed Changing Pulley Company is dismantling its Indianapolis plant and is moving to Anderson, Ind., where a large factory to employ several hundred men has been erected. For some years the company has manufactured gasoline automobile engines and carburetors in addition to speed changing pulleys. The company was induced to move to Anderson by a bonus offered by the Commercial Club of that city.

That portion of the factory of McCord & Co., Chicago, which is devoted to the manufacture of automobile accessories is to be removed to Detroit, where factory space has been secured from the Hugh Wallace Company. The reason given by the officers of the company for the removal is that they consider it easier to run an "open shop" in Detroit than in Chicago. This department of the company's business has so far been located at 485 Kinzie street, Chicago.

We have been furnished a photo of the four Soot-Proof spark plugs used in the winning car in the Jericho Sweepstakes, and our attention is called to the fact that as shown by the photos these plugs will not remain free from accumulations of soot on their insulators, but that they continue to work in spite of such accumulations as shown by the success of the car to which they were fitted.

Club Notes.

The Michigan State A. A. was compelled to call off the State auto tour which was to have started from Detroit on October 14, owing to lack of interest.

A movement is said to be on foot to organize the motorists of Moline and Rock Island, Ill., and of Davenport, Iowa, into what is to be known as the Tri-City Motor Club. W. H. Vandervoort, president of the Moline Automobile Company, is slated for the presidency.

An effort to organize the automobile owners of Kansas into a State association has recently been made, but evidently has not met with success. A general meeting was called for October 3, but went by default, as none of the auto owners of the State responded to the call.

At the recent election of the Cleveland A. C. the following officers were elected for the coming year: W. F. Bonnell, president; Harry Vail, vice president; Windsor White, treasurer, and C. J. Forks, Jr., secretary. The first two were elected to office for the first time, while the last two were re-elected.

A motor truck operating company, with a capital of $50,000, has been formed at Brunswick, Germany, with the assistance of the Bussing Automobile Company of that city, who make a specialty of trucks. The new company will take over a motor omnibus line in the vicinity of Brunswick, which has been in operation since the spring of 1904, and will, in addition, conduct a motor trucking business in the city.

The A. C. of Vermont held its annual meeting at the Pavilion Hotel, in Montpelier, Vt., on October 15, and elected the following officers for the coming year: W. W. Brown, Springfield, president; A. C. Whiting, Burlington, first vice president; James M. Boutwell, Montpelier, second vice president; Lester H. Greene, Montpelier, secretary and treasurer; C. H. Slocum, Morrisville, director. The club also appointed a legislative committee.

Business Troubles.

Charles I. Scott, seller of automobiles on commission, of 1779 Broadway, New York, has filed a petition in bankruptcy with liabilities $10,036 and no assets. Three stock brokers are creditors on stock transactions and notes.

Watson C. Finger, trustee in bankruptcy for the Charleston Motor Company, Charleston, S. C., will sell the assets of the company at public auction, at 161 Meeting street, Charleston, S. C., on October 30, at 11 o'clock a. m. The assets include a stock of supplies, repair shop outfit, office fixtures, etc.

A petition in bankruptcy has been filed against Max Wineburgh, doing business as the American Automart, 1621 Broadway, New York, by Lesser Brothers for these creditors: Hays Rubber Company, $525; Figman & Treirich, $136, and American Lamp Works, $94. Porter Steele has been appointed receiver. It was stated that the stock in the store is worth $10,000. The liabilities are $10,000.

Garage Notes.

A garage and repair shop is to be established at Rich Hill, Mo.

Work has been begun on the garage to be erected at Charles and Sixth streets, Rockford, Ill.

A. H. Fillow, 87 West street, Danbury, Conn., is building a private garage at the rear of his residence.

Bundy & Woods, St. Johnsburg, Vt., plan to open a garage, which they will place in charge of Jack Bertrand.

The new salesroom of the Genesee Garage Co., 242-252 West Genesee street, Syracuse, N. Y., has been completed.

S. F. Meguire has leased the garage of Frank Elvey, of Douglass, Ariz., and intends to conduct a repair shop and to assemble new cars from parts.

The Franklin Motor Co., of Utica, N. Y., have purchased a building site and will erect a 25x35 foot concrete garage with the Japanese pagoda or bungalow effect.

Joseph Miller has bought the garage of Trump & Nettz, Dixon, Ill., and will move the business back to its old location in the Drenner Building, near the Bishop Hotel.

The A. W. Gump Automobile Co., Los Angeles, Cal., is endeavoring to dispose of its retail agency for the Jackson car to become the Pacific Coast distributors for the same machine.

Daniel G. Meyer, Milwaukee, Wis., has leased a building on South Washington street, and will open same as a garage about November 1. Mr. Meyer represents the Reo line in Milwaukee.

The Ideal Automobile Co., Lebanon, Pa., has purchased the property in Market square which the company is now occupying as a garage. It has a frontage of 33 feet and a depth of 198 feet, and the price paid was $4,000.

A. A. Wagar, president of the Southern Automobile Co., of Mobile, Ala., is organizing the Pensacola Auto Co. in Pensacola, Fla., to handle the White steamer and other lines. The local men interested are W. A. Gablenbeck and F. L. Huyck.

The Stitt-Dillon Motor Car Co., which has secured the agency for the Chalmers-Detroit in western Nebraska and northern Kansas, will shortly open a garage in Hastings, Neb. The company is composed of A. E. Stritt and H. H. Dillon.

The Buick Motor Co. will establish a branch at Eau Claire, Wis., in charge of J. C. Tanberg, of the Tanberg Auto Co. The latter company will discontinue its branches at La Crosse and Winona, and, instead, will establish agencies in every town of sufficient size.

John Lucas, Paola, Kan., is organizing the Paola Automobile Co., and will shortly open a garage in the J. H. Petty Building on South Silver street. A new front is being put in the building to better adapt it to use as a sales office. The company will also carry on a supply and repair business.

The Southern Tier Motor Co., of Elmira, N. Y., whose incorporation we announced in our last week's issue, has elected Guy Shoemaker president and Harry K. Crandall secretary and treasurer. The company takes over the business of the Willys-Crew Motor Co. and the automobile department of the Elmira Arms Co. John Willys, president of the Willys-Crew Co., is now president of the Overland Automobile Co., and is living in Indianapolis. The new company will handle the Overland line in its territory.

The owners of the Woodstock Garage, Woodstock, Vt., plan to erect a new concrete garage building next season to accommodate twenty-five to thirty cars.

New Incorporations.

Walton Motor Co., New York.—Capital increased from $10,000 to $20,000.

Detroit Automobile Brass and Machine Co., Detroit, Mich.—Capital, $10,000.

Dayton Motor Car Co., Dayton, Ohio.—Capital increased from $50,000 to $500,000.

Automobile Supply Co., Chicago, Ill.—Capital increased from $15,000 to $25,000.

Miller Automobile Co., White River Junction, Vt.—Capital, $5,000. To buy, sell and repair automobiles.

Porter Engine Co., Dover, Del.—Capital, $50,000. To manufacture and deal in stationary engines and automobiles.

Reading Taxicab Co., Reading, Pa.—Capital, $20,000. Incorporators: Hunter Eckert, Harry O. Koler and Robert W. Daniel.

Imperial Taximeter Co., New York, N. Y.—Capital, $6,500. Directors: Eugene Cable, Susan A. Cable and Mary A. Cassady.

International Taximeter Co., Jersey City, N. J.—Capital, $25,000. Incorporators: M. Serger Friede, Joseph Thomas and John R. Turner.

American Motor Co., Greensboro, N. C.—Capital, $25,000. Incorporators: H. L. Hopkins, L. R. Hopkins and Thomas Beale. To manufacture, sell and hire motor cars and other vehicles.

American Eagle Motor Car Co., New York, N. Y.—Capital, $5,000. Directors: J. Allen Tallman, Frank Mueller and Joseph Matthews.

Co-operative Automobile Co., Pittsburg, Pa. (under Delaware laws).—Capital, $25,000. Directors: L. E. Neagley, J. T. Vance and A. C. Martin.

Franklin Motor Car Co., Kansas City, Mo.—Capital, $10,000. Incorporators: Louis A. Robertson, Mrs. L. A. Robertson and Mrs. W. C. Renfrow.

Maxwell-Briscoe Cleveland Co. (under New Jersey laws).—Capital, $25,000. Incorporators: H. O. Coughlan, L. H. Guenther and John R. Turner.

Rapid Motor Transportation and Maintenance Co., New York, N. Y.—Capital, $50,000. Directors: Henry C. Hunter, Milton S. Couch and William B. Banker.

Merkel-Light Motor Co., Pottstown, Pa.—Capital, $150,000. The officers are: President, E. S. Fretz; vice president, J. F. Merkel; secretary, G. W. Sherman; treasurer, J. R. Ball; directors, E. R. Cassel, F. S, Brantand, J. C. Rugee.

Velie Motor Vehicle Co., Moline, Ill.—Capital, $100,000. The officers of the company are Willard L. Velie, Charles E. Webber, Charles D. Velie, Stephen H. Velie and George N. Peck. To manufacture motor vehicles of all kinds.

Trade Personals.

Walter Enger has been appointed superintendent of the repair shop of the Bates-Odenbrett Co., Milwaukee, Wis.

Harry Morris, who was formerly connected with the Rauch & Lang Carriage Co., of Cleveland, has joined the sales force of the Buick Cleveland branch.

J. H. Newmarket has been placed in charge of the publicity department of the Oakland Motor Car Co., Pontiac, Mich. He was formerly with the Olds Motor Works.

F. G. Carrie, formerly assistant manager of the New York Franklin branch, has severed that connection to join the sales force of Wyckoff, Church & Partridge, of New York.

Zenas W. Carter has been placed in charge of the publicity bureau of the Pettingell-Andrews Co., manufacturers of ignition specialties, Pearl street and Atlantic avenue, Boston, Mass.

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The Grooved Pulley Drive.

By Morris A. Hall.

The recent interest in the motor buggy or farmer's car, and the corresponding increase in the number produced (both number of different makes and total number produced), a majority of them being belt, rope or cable driven, together with the phenomenal increase in the use of motorcycles, nearly all of which are similarly driven, renders a discussion of this style of drive very timely. In addition a great number of automobile and truck engine accessories, like the oiler, fan belt, pump, magneto, are thus driven, although in all truthfulness it must be said that for these purposes this drive is losing ground.

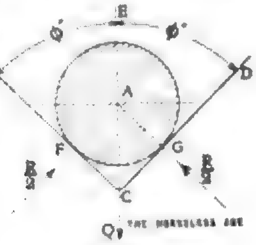

Fig. 1.

The flat wide leather or canvas belt, similar to the belting used in machine shops, is found on a few motorcycles and a very few motor buggies, among them the Price. This is the favorite drive for fan belts, the width used varying from three-quarters of an inch to 1¾ inches. This type of a belt runs on flat or comparatively flat pulleys.

Next we have the round leather belt and its later modifications, rope, wire cable, chain wrapped with leather, cord or canvas. A further modification of this is the triangular or V belt, and its later form, the trapezoidal belt, which is but a triangular form with one edge cut off parallel to the opposite side. All of these run in grooved pulleys. Now let us look into the action of a round or otherwise shaped belt running over a grooved or V shaped pulley.

The pulleys for this work are usually made with an angle of 40 degrees to 50 degrees, and so proportioned to the driving belt that it rests against the sides and not on the bottom of the groove. The belt thus wedges itself in, and when thus wedged in has a greater resistance to slipping than it would have resting upon the bottom of the groove.

Now in Fig. 1 let A represent the centre of a round section belt wedged in a grooved pulley B C D. Let the line E A C represent a centre line passing through the centre of the belt and groove. Let A F and A G be any two lines drawn from the centre of the belt at right angles or normal to the sides of the groove. Let ϕ represent the half angle between the sides of the groove, or 2ϕ equal the total angle. Call the radial force due to the tension of the belt Q, and the normal pressure acting on the sides R, this latter being divided into two equal parts, one, $\frac{R}{2}$, acting on each surface. Let $\mu =$ the coefficient of friction. Then by trigonometry the normal force $\frac{R}{2} = \frac{Q}{2}$ cosec ϕ (1), and the total normal force $R = Q$ cosec ϕ (2); that is, as the belt becomes wedged in the pressure between the rope and the sides of the groove is greater than the radial force due to tension in the belt in the ratio of cosec ϕ to one. Cosec ϕ may vary from 0 up to infinity; with the angles usually used 40 degrees to 50 degrees it varies from 1.56 to 1.31. So we may say that in consequence of the wedging action the resistance to slipping is increased from 31 to 56 per cent.

Now the frictional resistance to slipping may be expressed by the equation

$$\mu R = \mu Q \text{ cosec } \phi \ldots\ldots\ldots\ldots (3)$$

Unwin, "Machine Design," Part 1, page 400, has given us a formula for the ratio of tensions in flat belts which is

$$\text{Hyper Log } \frac{T_2}{T_1} = \mu \theta \ldots\ldots\ldots\ldots (4)$$

$$\text{or } \frac{T_2}{T_1} = \epsilon^{\mu \theta} \ldots\ldots\ldots\ldots (5)$$

$$\text{or common log } \frac{T_2}{T_1} = .434 \mu \theta,$$

in which $T_2 T_1$ are the two tensions in pounds in the belt acting on opposite sides of the pulley. μ is the coefficient of friction. θ is the whole angle of contact on the smaller pulley expressed in radians.

These formulas may be adapted to the present case in the forms

$$\frac{T_2}{T_1} = \epsilon^{\mu \theta \text{ cosec } \phi} \ldots\ldots\ldots\ldots (7)$$

$$\text{or com log } \frac{T_2}{T_1} = .434 \theta \text{ cosec } \phi = K \ldots (8)$$

In consequence of the wedging action $\frac{T_2}{T_1}$ is much greater than for flat belts. With flat belts the coefficient of friction varies from $\mu = .3$ to $\mu = .4$ for leather on iron pulleys. Table I gives some values of the ratio of tensions $\frac{T_2}{T_1} = K$ for various angles of contact, from which it may be seen that the value of the ratio for the average angle of 165 degrees is between 2.4 and 4.2.

Now for this same angle 165 degrees and various values of μ from $\mu = .2$ to $\mu = .3$, Table II gives us some values of the ratio of tensions for belts on a grooved pulley. From this we may say that the average value of the ratio at the ordinary angle is between 5 and 9½ as compared to the same for flat belts given above as between 2.4 and 4.2. We may then amend our former statement to read: In consequence of the wedging action the ratio $\frac{T_2}{T_1}$ is twice as great as for flat belts.

These belts are run at high speeds, and the centrifugal tension is appreciable. If the circumference of the belt section be denoted by γ, the weight per foot may be taken as .028 γ^2 pounds. If the velocity is v feet per second over a pulley r feet in radius, the centrifugal force of one foot of belt will be

$$f = \frac{.028 \gamma^2 v^2}{g r} \text{ in pounds} \ldots\ldots\ldots\ldots (9)$$

The centrifugal tension in the belt will be

$$T = \frac{.028 \gamma^2 v^2}{g} = .001 \gamma^2 v^2 \text{ lbs. (nearly). } (10)$$

There is a limit to this tension, which for ordinary working purposes we may

Table I.

Angle θ in Degrees.	Ratio of Tensions K		
	For $\mu = .3$	$\mu = .4$	$\mu = .5$
90	1.60	1.87	2.19
105	1.73	2.08	2.50
120	1.88	2.31	2.85
135	2.03	2.57	3.25
150	2.19	2.85	3.70
165	2.37	3.16	4.22
180	2.57	3.51	4.81
195	2.78	3.90	5.48
210	3.00	4.33	6.25
240	3.51	5.34	8.12

Table II.

μ	K		
	$2\phi = 40°$	$= 45°$	$= 50°$
.2	5.37	4.49	3.91
.25	8.19	6.55	5.51
.3	12.45	9.51	7.73

place at 20 γ^2. From this the effective tension on the tight side must not exceed

$T_2 = 20\,\gamma^2 - .001\,\gamma^2 v^2$ ....(11)

from which

$T_2 = 20\,\gamma^2(1 - .00005\,v^2)$ ....(12)

If we now go back to our former equation (8), and select 7 as our ratio of tension; that is, if $\frac{T_2}{T_1} = 7$...............(13)

we may introduce this in equation 12, and get the value

$T_1 = 2.9\,\gamma^2(1 - .00005\,v^2)$..............(14)

The driving effort is the difference in the two tensions or

$P_1 = T_2 - T_1$ ....(15)

Now, substituting the values of T_1 and T_2 found in equations (12) and (14), we get the form

$P = 20\,\gamma^2(1 - .00005\,v^2) - 2.9\,\gamma^2(1 - .0005\,v^2)$

$= 17.1\,\gamma^2(1 - .00005\,v^2)$..............(16)

The horse power transmitted is

$H = \frac{P v}{550}$ ....(17)

Substitute for P its value from equation (16), we get

$H = .031\,\gamma^2 v(1 - .00005\,v^2)$...........(18)

As these two equations (16) and (18) give rather small belts, we may alter them to more conservative values, getting as a consequence a greater margin of safety. Thus

$P = 13\,\gamma^2(1 - .00005\,v^2)$..............(19)

$H = .024\,\gamma^2 v(1 - .00005v^2(\gamma)$..........(20)

Table III gives values for rope computed from these two latter formulas.

TABLE III—H. P. OF ROPE.

Diam. In.	Girth In.	Wt. per Foot	H. P. at 10' p.s.	15' p.s.	20' p.s.	25' p.s.
½	1⅝	.067	.54	.80	1.06	1.31
¾	2⅜	.159	1.34	2.00	2.64	3.27
⅞	2¾	.216	1.81	2.70	3.56	4.40
1	3⅛	.279	2.34	3.49	5.58	5.69
1⅜	4¼	.513	4.30	6.41	8.40	8.57

In belt or rope transmission of power we may increase the amount of power transmitted in three ways:

1. By increasing the frictional angle of the pulleys.
2. By increasing the strength of the ropes.
3. By increasing the velocity of the belts.

The first principle is applied in ordinary rope or belt transmission by wedging the ropes or belts in V grooves which, as we have seen above, may double the efficiency. With wire cables these wedge grooves must be used with greater care, because of the injury to the cables. They are so much stronger and may be run so much faster that it is well worth trying.

Various attempts have been made to overcome injury to the cables. Thus they have been tried with large sized pulleys to reduce the bending and breaking action. This has proven quite successful, and those who tried it have gained in the life of the belt and in weight, the weights of ordinary wire cables relatively to equally strong tarred hemp rope being in one case as 16 to 42.

Cables have been used over pulleys with larger angles, thus lessening the tendency to wedge. Of course, this decreases the coefficient of friction and the power transmitted, but is worth while owing to the gain in life of the cable. Cables have also been tried with less tension, which also reduces the tendency to wedge. All these methods have been successful, as have other schemes, such as wrapping the cables with strips of rawhide, covering them with leather, cloth, cord and other substances. The first named has the objection that when the rawhide cuts the ends flop and are noisy and hard to repair. This same objection in a lesser degree holds good for cloth and other coverings, except leather, which properly applied as a complete cover sewed on and well lubricated makes the best drive of all. It is very expensive, the hand sewed cover cost being great.

TABLE IV—STRENGTH OF WIRE.

KIND OF WIRE	TONS	POUNDS
Charcoal Iron..	$1.2\gamma^2$	$2400\gamma^2$
Bessemer Steel.	$1.7\gamma^2$	$3400\gamma^2$
Crucible Steel..	$2.2-3.0\gamma^2$	$4400-6000\gamma^2$
Plow Steel.....	$3.6-4.0\gamma^2$	$7200-8000\gamma^2$

The same result has been obtained in another way by covering light bicycle chains with similar leather covers and using them as a round belt, the idea being that the chain has superior strength, there being no fibres to break one by one. The chain, even when thus covered, will have a lumpy, uneven surface which is thought to drive well. The writer doubts this and thinks

TABLE V.—STRENGTH OF WIRE, ROPE AND CHAIN.

Diameter	Cir or Girth	WEIGHT PER FOOT		BREAKING STRENGTH				WORKING STRENGTH			
		All Wire	Hemp Core	Char. Iron	Bessemer	Crucible	Plow	Char. Iron	Bessemer	Crucible	Plow
¼ inch wire	.78	.104	.092	1,464	2,070	2,680 3,660	4,400 4,880	293	414	536 732	880 976
⅜ inch wire	1.18	.236	.208	3,340	4,730	6,120 8,350	10,000 11,000	668	946	1,224 1,670	2,000 2,220
½ inch wire	1.57	.418	.369	5,910	8,360	10,800 14,800	17,700 19,700	1,182	1,672	2,160 2,960	3,540 3,940
⅝ inch wire	1.96	.655	.577	9,250	13,100	16,900 23,100	27,700 30,800	1,850	2,620	3,380 4,620	5,540 6,160
½ inch rope	1⅝	.067		1,370–2,350				171–294			
¾ inch rope	2⅜	.159		3,000–5,310				398–664			
⅞ inch rope	2¾	.216		4,200–7,200				525–900			
1 inch rope	3⅛	.279		5,490–9,420				686–1,177			
1⅜ inch rope	4¼	.513		9,450–16,200				1,181–2,025			

PITCH	WIDTH, INCHES	BREAKING STRENGTH	WORKING STRENGTH
Diamond, Nos. 9, 11, 21, 29, 31, 33, 37, 1 inch	3/16 & ¼	1,200	240
Diamond, Nos. 45, 46, 1 inch	⅛, 3/16 & ¼	⅛—1,200 3/16 & ¼—1,700	240 340
D. Roller, No. 63, ⅝ inch..	⅛, 3/16 & ¼	1,200	240
D. Roller, No. 65, ½ inch..	⅛, 3/16 & ¼	1,200	240
D. Block, No. 106, 1 inch...	3/16, ⅜ & ½	1,600	320
D. Block, No. 102, 1 inch...	¼, 3/16, ⅜ & ½	1,800	360
D. Block, No. 103, 1 inch...	¼, 5/16, ⅜ & ½	2,500	500
D. Block, No. 105, 1½ inches	½	5,000	1,000
D. Roller, No. 153, 1 inch ..	3/16 & ¼	2,500	500
D. Roller, No. 153, ¾ inch..	¼	4,000	800
D. Roller, No. 155H, 1 inch	⅜	5,000	1,000
D. Roller, No. 151H, 1¼ inches	¼	6,500	1,300
D. Roller, No. 157, 1½ inches	¼	12,000	2,400

that if an advocate of this method was once obliged to repair one of these chains he would easily see its faults.

The saving with the V or grooved pulley over a sprocket is in the cutting of the teeth, the lathe and other machine work on the pulley and sprocket blank being about the same, unless the pulley is cast with a groove in it, in which case there will be an additional large saving. Even though this saving be small, the fact that the four sprockets must be machined and the teeth cut multiples it by that number.

When first made wire ropes were of charcoal iron wire, but now they are made of steel wire. The strongest form has the wire laid parallel and bound externally. Other forms are stranded, a set of wires twisted around a core forming a strand. These may be of four kinds, the wires with a left hand and the strands with a right hand twist, or with both wires and strand twisted in the same direction, which is the common form. This form is more flexible, and the wires, being less sharply bent, wear better and longer, and are less liable to break. In addition, either of these two kinds may have a wire or a hemp core, but those with the hemp core, being more flexible, are the best.

The breaking strength of wire ropes in terms of the circumference girth is given in Table IV, and the weight per running foot in pounds is for small wire cable .17 γ^2, for a hemp core cable 15 γ^2, from which the writer has computed Table V. This shows the diameter, circumference, weight per foot, breaking and working strengths. The last was figured from the breaking strength, using the factor of safety for rope 8, for wire cable 5, and for chain 5.

Table VI shows the standard proportions of grooves for rope driving used by one large company. These figures are equally applicable for wire cables, rawhide belts, chain wrapped to an approximate circular section, or any other form of belt mentioned above.

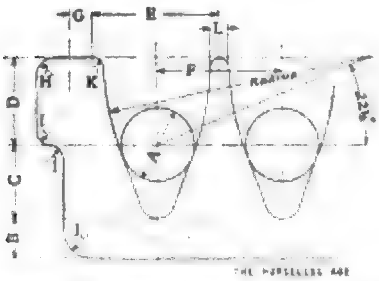

Table VI—Proportions of Rope Sheaves.

Rope Diam. A	B	C	D	E	F	G	H	I	J	K	L
½	¼	7/16	½	¾	¾	3/16	¼	⅛	½	⅛	3/16
¾	⅜	⅝	13/16	1⅛	1⅛	1/16	5/16	3/16	11/16	⅛	¼
⅞	⅜	11/16	⅞	1½	1½	1/16	¼	⅛	11/16	⅛	¼
1	⅜	⅞	1 1/16	1⅞	1⅞	1/16	⅜	¼	¾	1/16	⅜
1⅛	7/16	13/16	1¼	2	2	[illegible]	⅜	¼	⅞	3/16	⅜
1¼	½	1¼	1 5/16	2⅛	2⅛	1/16	⅜	¼	⅞	5/16	⅜

Runabout Cars in Queensland, Australia.

By E. J. T. Barton.

Australia is a country of immense distances. Transport problems are therefore vital. Navigable rivers are but few in number, and so far as the great West is concerned, everything depends on land carriage. Queensland, the State which occupies the northeastern corner of the Commonwealth, having an area of 700,000 square miles, is well supplied with coast ports, but inland freight and passenger movement depends largely on its three main lines of State owned railways. These extend in a generally westward direction over limitless plains, comparable to the vast American prairies. Beyond railway termini, mails and travelers go by coaches, with relays of horses, making an average of about 6 miles an hour. The "ranch man," or squatter, as we term him, thinks nothing of a hundred miles or so with his own team, to the nearest race meeting, or longer distances on his comparatively rare visits to the "big smoke," as he calls the coastal city.

The wool comes down in huge wagons drawn by fifteen or twenty horses, and less frequently by bullocks, sometimes occupying months on the journey, and supplies go westward by the return trip. Roads in these regions exist chiefly on the map, in broad passage ways several miles wide for traveling stock. They would indeed be disappointing to anyone cherishing the Roman or even the British ideas of road making.

Hitherto the use of motor cars has been chiefly confined to the metropolis, where passably good roads exist, and most of the users are medical men with a large practice among the scattered population of city and suburbs. But the motor car habit is slowly extending, and if some clever manufacturer should evolve the class of machine suited to our special conditions it might easily happen that large numbers would find sale in this country. What those conditions are may be judged from what has already been written if taken in conjunction with expressions of opinion collected specially for readers of The Horseless Age, and given herewith

A STATE MINISTER'S TOUR.

No event has done so much to direct public attention to the motor car for general use in Queensland as the recent tour of the Hon. J. W. Blair, an influential member of the State Government, who combines the offices of Attorney General and Minister for Mines. This gentleman, in an official tour a few months ago, traversed the country from north to south, visiting many of the large sheep and cattle ranches, or stations, as we call them here, and studying the wants of the gold diggers and opal miners in their own districts. The journey out and home covered about 3,000 miles, and over long stretches his car achieved a rate of something like 25 miles an hour actual traveling time. The feat was quite unprecedented here in Queensland. It is admitted that as a member of the Government Mr. Blair enjoyed special facilities; the accounts of his trip appearing in the leading daily paper have been widely read, and they have no doubt aroused much thought as to the possibilities of this mode of Western travel.

Asked as to the class of machine in his opinion best adapted for town use Mr. Blair said the 7-8 or 8-10 De Dion had proved most successful in this part of the world; he had had no experience of the American machines. Good hill climbing capacity was certainly a necessity, owing to the nature of the country.

Mr. Blair, as may have been judged already, is a motor enthusiast, and spoke freely of his experiences on the overland trip, and of his views concerning the class of machine required for use in the "bush" or country. "The car of the future in Queensland," he said, "having regard to bush work, as entirely apart from town traveling, will require to be one of immense strength of frame. It will have to be stayed in every conceivable way to resist the effects of jolting. The bolts used will have to be of the finest and most durable material, and some special regard will have to be had to securing rigidity in the fixture of the nuts. But all these must be secured in combination with as light a frame as possible consistent therewith." He considered that the ideal would be a comparatively small car with great power. It might seem anomalous to speak in this way, but it would be of great utility to have a reserve of power, particularly in hill climbing, and in driving the car through sand. He instanced the case of a river bed which had to be crossed, where the sand drift was fully a quarter of a mile wide, and the only way to get over was to cut tracks and lay bushes in them as a sort of corduroy on which the driving wheels could grip. The extra power would also be of great service in making speed on the level country, which usually succeers the stretches of deep and treacherous sand mentioned. He also thought it would be advisable to have the flywheel as far as possible from the ground, consistent, of course, with the stability of the car. This is desirable in view of the boulders and stumps, and projecting ends of sunken trees so often met with in Western travel. One of the wheels may get into a hole, involving great danger from shock to the gear box or to the flywheel. The wheels should be made very strong, and the springs particularly so, and in his judgment wider and larger tires would have to be used, notwithstanding the heavier expense involved. A great number of the cars now coming to Australia were obviously under tired, which accounted for a large number of blowouts and tube troubles. Personally he thought there was a great future in the West for the 30 horse power Panhard. This, of course, was a big and strong car, but if something like the car he had suggested could be obtained, above all combining durability with reasonableness in price, it would be very acceptable to Western men. Another point to which he attached importance was that where a magneto was used it should be gear driven, and as far as possible do away with loss of power by transmission. Personally he preferred to have both a magneto and accumulators for ignition, and both separate.

Finally, when asked his impressions of the prospects of motor car business in the West, Mr. Blair said that the real way to tackle the problem would be for some enterprising firm to send over an expert in machinery to study the question on the spot, and if once the difficulties he had outlined could be overcome, there would probably be a big thing in the business.

CITY MEDICO ON THE AMERICAN MACHINE.

One of our Brisbane medical men, who has consistently worked a little American curved dash runabout since they first came out here, and who calculates that he must have traveled not less than 50,000 miles in this way, said that on the whole it had done very well. He found, however, that it required a great deal of attention; and probably the reason he had been more successful than others was that he had had a good man as chauffeur and had carefully watched matters himself, so that everything had been kept in perfect order. His was one of the few machines of that make now running in Australia. "It got the attention it needed," said he, "and it did the work; indeed, it is a most convenient little car." There was undoubtedly a feeling against the American car. His make of car was the only one so far known here, and it was not everyone who would give it the attention he had done. One thing militatiing against the American cars was that they had no special representative here, and on one or two occasions he had to send all the way to America for what he required in the way of accessories. Even when he sent to Melbourne it meant a lot of delay. As showing his feeling toward the car the doctor mentioned that when recently he had the opportunity of buying one at second hand and at a reasonable price he did not hesitate to do so. This had been quite as satisfactory as his previous investment; but the same close attention was required. One drawback was that owing to the method of construction, when anything went wrong the whole car had practically to be taken to pieces, which meant a loss of one or two days in getting the use of the car. Undoubtedly the parts of the car were not by any means so accessible as they should be. He had also purchased a De Dion car, and, to use his own expression, that was a tip-top car, thoroughly reliable and practically requiring no attention.

Owing to the hilly country and bad roads in the neighborhood of the metropolis it was better to have a car of 10 to 12 horse power. The tendency here had been to get even higher power; but for medical men the most useful car was one so built that it could properly be classed as a runabout. Under 12 horse power was the most suitable for business purposes, including the requirements of the doctors, who were the owners of most of the cars not used exclusively for pleasure purposes.

As to the advantages of the car over horses, the opinion was expressed that there was no saving in expense. One could in Brisbane keep a vehicle and three horses for what the motor car cost; but the great advantage lay in having a means of traveling which was ready at a moment's notice at any time, night or day; and one gets over the ground far more rapidly.

It was mentioned further that there had been a considerable increase in the numbers of cars even during the past month or so, and the total number on the register for the city is now seventy-seven. This, of course, is exclusive of the motorcycles, which have found considerable use in country and suburban work for business purposes.

ANOTHER PHYSICIAN'S OPINION.

A second Brisbane medico, who was at one time secretary of the association here, and who has always taken a keen interest in all motor matters, indorsed the opinion just quoted that in the matter of cost the motor car was about the same as a buggy and three horses, with the qualification—"if it is a car that is really dependable, and not one on which you have to be constantly spending money." But it was pointed out that with such a car the medical man was able to do 50 per cent. more work than was possible with horses. With every practitioner there are some days when it was practically impossible to get through with horses, no matter if he had twenty of them. The small car, however, was best, and he had a 6 horse power which he would not exchange for any larger car. The demand for small handy cars was increasing every day, but the American makes had no show here at present. If a medical man could be sure that he would get a really reliable machine for, say, £250, he would be greatly attracted by the proposition. The French De Dion car was the most popular in Brisbane just now.

THE AGENTS INTERVIEWED.

The managers of our two principal motor car agencies were interviewed, so that the readers of THE HORSELESS AGE might as far as possible enjoy the advantage of inside information. As far as the outlook for the American machines are concerned, the opinion did not differ from that already conveyed. So far no American firm has put a machine on the market which is deemed suitable for Australian requirements. "The cheap American runabouts have not a good name here," said one informant, "and their prospects of sale until such a name has been made are not great. The people here want something absolutely reliable."

NUMBER OF CARS IN QUEENSLAND.

He estimated the total number of motor cars in Queensland at about 100. Most of these are in Brisbane, but there are a few in the principal coast towns further north. With roads such as ours we cannot afford to use anything but first class material. It was possible that there might be an opening for automobiles of the larger type. In fact, there were likely to be sales of one or two of this class of machine from American makers, and if they proved their reliability the business would no doubt increase, as conditions in Queensland were favorable for the larger types. But reliability was the first essential of success for any car on this market. The machine in question, the Holsman, had several features quite new here; the high ground clearance was a great attraction, involving supposed ability to travel over roads where the ordinary car, with its gear case close to the ground, would be useless. The solid rubber tires should be cheaper to run than the pneumatic.

It could not be denied that the little 8 horse power car was what the majority of buyers wanted so far as town use was concerned. There was a sort of craze just now for silent and multi-cylinder machines with handsome equipage; but the smaller machine costs far less for upkeep, and it would do its work well. In the country, for station use, a machine of 20 or 30 horse power would be required, on account of the sandy beds of rivers to be crossed, where there are no bridges, and where the roads are not easy to travel; and if a machine to meet requirements could be provided at a reasonable cost, our informant was inclined to think a lot of people would go in for them.

DURABILITY WANTED.

It was also pointed out by one of the agents consulted that the demand here was for a machine to last for many years. There was not the love of novelty which seemed to prevail in America. Hence reliability and endurance were chiefly desired, and French and English machines were almost the only ones sought after.

The principal firms handling motor cars in this city are the Canada Cycle and Motor Agency and the Howard Cycle and Motor Company. Both firms have commodious garages, and handle Canadian, French and English machines almost exclusively.

Runabouts Popular in Western Canada.

By J. D. Benham, Winnipeg.

A realization of the value and practical utility of the runabout is being forced upon the business and professional men of western Canada by the experience of those who have adopted this means of transport, and even farmers are becoming convinced of its decided advantages over the horse for the purposes for which this class of machine was devised. The latter may seem a strong statement, but it is nevertheless true; and the number of farmers in the West who are using the automobile instead of the horse for roading is increasing every day. The writer knows of a dozen or more who have recently purchased cars, and the expressed opinion of some of these is that there is no more useful implement around the farm than the auto, especially in the busy seasons, when the horses are all engaged or tired out. A notable instance of this is Mr. Kerr, of Franklin, Man., who farms 1,200 acres of wheat land and uses the auto freely in superintending his farming operations, as well as for pleasure. He has proved its practical utility, and finds that in case of a breakdown in machinery on the farm it is just the thing for a quick run to town for repairs, as the journey can be made and work resumed in the time it would take to go one way with a horse. On a big farm this is a great factor to be considered, especially during harvest and threshing. Of course, it is only the moderately priced cars of proved reliability that interest the average farmer

The medical men of western Canada are beginning to make use of these handy little machines in largely increased numbers, and the consensus of opinion seems to be strongly in their favor. Indeed, doctors who live in the outlying districts and in the rural centres now recognize that a light car is an absolute necessity, as it enables them to cover the long distances on many of their emergency calls with the smallest possible waste of time. The difference in the speed of the auto and the horse in these districts, where the nearest doctor is often 50 miles away, has been the means of saving more than one life and also a great deal of unnecessary pain owing to the comparatively prompt medical attention it brought within the reach of the settlers.

SEVERE WINTER CONDITIONS.

There are still a large number, however, who hesitate to purchase a car owing to the difficulties experienced in their use during the winter, when the temperature often falls to 25 and even 40 degrees below zero. In such weather conditions the water cooled car is useless. It is to this class of possible patrons that the manufacturers of the good air cooled cars should turn their attention, for the field is ripe for a vigorous selling campaign.

None of the makers of air cooled cars are at present represented by agents in western Canada, owing to the fact that the majority of the automobile dealers are strong supporters of the water cooled car. The introduction of the newer idea will probably take some time unless the manufacturers will arrange a campaign of their own for the purpose of demonstrating the possibilities of the light air cooled car for the medical man.

A car fitted with a cushion tire of proved efficiency would receive more attention than the one fitted with the ordinary pneumatic. The reason of this lies in the fact that in the majority of cases the nearest source of supplies for renewals is hundreds of miles away. As the average country doctor cannot afford to carry a stock of spares, a burst cover would mean that the car would be out of commission for six or seven days, which in turn would necessitate the expense of hiring a livery team. The serviceable cushion tire is undoubtedly what is wanted for the prairie trails, and the manufacturer who would cater to this trade should bear this in mind.

TESTIMONY OF A CITY DOCTOR.

However, the city practitioners here are unanimous in indorsing the runabout for their use. "How could I get along without it?" is the way Dr. Black voices his opinion of the little machine he uses constantly. "Nothing would induce me to return to the horse and buggy for my practice," he continued. "Formerly I never seemed to have a moment to myself free from my practice. Now I can make my visits in about half the time with no bother or trouble whatever and am able to enjoy a little respite from work. It exactly fits the requirements for emergency medical work, is always ready and always handy. I procured my present machine last November, and beginning with the first of December I kept a careful account of the expense of its upkeep; and it may surprise you to know that it did not cost me as much as would keeping a horse in a boarding stable. For six months, including the winter--and I used it constantly during that time except on one or two exceptionally cold days--it cost me just $128, or a fraction over $21 per month, $60 of which amount went for garage storage charges. A horse would have cost me $30 a month straight. I had comparatively little trouble with the cold, although my machine is a water cooled one. I used the ordinary non-freezing liquid, which is a mixture of glycerine, wood alcohol and water, which worked most satisfactorily even in a temperature as low as 30° below zero. That is a pretty good recommendation and a fairly severe test of the practical utility of the auto for medical work. At any rate it's the 'horseless age' for mine."

Dr. Watt, another highly successful practioner here, voiced his opinion of the runabout in the words--brief but very expressive: "A little expensive but entirely satisfactory; so satisfactory, indeed, that I would not dream of being without my machine. I never have any bother with it and I find it suits my purposes exactly. There is no comparison between it and the old way of the horse and rig for the medical man with a city practice. The latter belongs to the past and the machine to the twentieth century."

IN THE REAL ESTATE BUSINESS.

But it is the real estate broker who has probably reaped the greatest benefits from the use of the light car, as the experience of dealers here is that it often means the closing of a sale to be able to show prospective clients the property on the market quickly and in comfort.

"For the sale of suburban properties I consider the auto almost indispensable, and the money invested in the machine is the best advertisement of my sub-division that I have yet devised. The short time occupied in conveying buyers to the land creates a favorable impression in their mind and removes that feeling that 'the lots are too far from downtown,' which so often prevented possible sales when we showed our clients around by horse and buggy. The latter method took three times as long and had a corresponding effect on the sale. The runabout is a silent salesman which I would not care to be without."

Another prominent real estate broker gives an even more hearty endorsement of the light machine as a necessity to a successful realty business. "The light car has proved conclusively to me," he said, "that it is a great time and money saver, and I think it should appeal equally to the ordinary business man who has something to offer to the public. I closed a deal which netted me $300 two days after I got my machine which I am satisfied I would not have effected had I not had that car. That certainly reduces the cost to me and it will soon pay for itself by the extra business I am able to command. It enables an agent to keep a far larger number of business engagements, which must result in a corresponding increase in the transactions, which mean money."

Several of the firms here have large interests in the town site surrounding the shops of the National Transcontinental Railway which is now under construction. The town site is located 4 miles from the city, and the real estate dealers who are placing it on the market find the auto indispensable to business, and one of the big firms has two machines which are in commission all the time.

FOR TRAVELING SALESMEN.

The automobile affords great possibilities for the commercial traveler as a means of transport in this country, where the towns are small and scattered and where the trains will not permit covering more than one or possibly two in a day under ordinary conditions without heavy livery bills. This has been proved beyond argument by the experience of W. G. Bale, the hustling representative of an American house, who this season made a trip from Winnipeg to Edmonton and return through practically pioneer territory with most satisfactory business results. Recounting his experience to the correspondent of The Horseless Age, Mr. Bale gave it as his opinion that a year or two would see the automobile largely used by commercial travelers who cover the three provinces of Manitoba, Saskatchewan and Alberta, as it is not only a quicker means of transportation between short distance stopovers, but it is also more economical from the viewpoint of expense. "Probably the chief lesson to be learned from my experience," said Mr. Bale, "is the fact that the auto permits you to map out your trip according to your desires and business prospects, enabling you to visit outlying towns with great facility and little expense. It combines recreation and business, and keeps the drummer healthy and happy. Besides, I think autos specially constructed for the travelers will materially add to their advantages, and these, no doubt, will come if there is shown to be a market for such a product. Along this line I might suggest a machine with plenty of room and sufficient strength in the rear end, where a box could be placed instead of the usual seats for passengers. In this all samples, except of the most bulky nature, could be carried, making them always convenient and handy when wanted for display before customers. A machine for this traffic should be equipped with cushion tires, and in this way it would be possible to obviate the necessity of carrying spares and repairing pneumatics on the road. Attention to this important point and one or two other minor details, such as larger gasoline, oil and water tanks, which would enable the traveler to cover long distances without taking on supplies, would make the auto invaluable to many commercial men. It would, of course, be impossible to use the automobiles during the winter in this country, and probably for a month after the spring breakup, but even making allowance for this the use of the auto during the summer and fall will result in a distinct saving in expenses. Travelers carrying different lines could work together, as I and a companion did in my recent trip, which cuts the cost in half without in any way interfering with the interests of the house.

"The question of utilizing the automobile for commercial work is well worth the serious attention of every wholesale house in Winnipeg, because I have demonstrated beyond argument its possibilities if generally adopted. The daily cost of running is less than railway fare and livery, while the amount of territory that can be covered may be just doubled. I am also convinced that a small machine might be an economical investment for the firms for their city travelers."

USED BY THE CITY ENGINEER.

Some time ago the city of Winnipeg decided to procure a small runabout for the use of the city engineer's department for the inspection of the local improvement and other corporation works, which are done here almost entirely by day labor under the direct supervision of the engineer. This involves an immense amount of traveling around over such a scattered city as Winnipeg is, but the runabout solved the difficulty, enabling the engineer or his assistants to personally see what is going on and to give to the works a close supervision which has been found practically impossible before. The machine is regarded by the civic authorities and the engineer as the most economical and effective means of conveyance possible.

IN CONTRACTORS' SERVICE.

Several contractors have begun to use the runabout here for their inspection work, and those with large and important works requiring periodical supervision find their machines indispensable. One of these even uses his machine for carrying rush orders of fine grade lumber to his buildings, and can frequently be seen whirling along the street with his stripped machine freighted with material. Its speed and convenience, they say, commends the runabout to them.

Some Mechanical Hints.

Wing nuts on tire bolts invariably have to travel over too much thread. By slotting a bush, as at A (Fig. 1), and combining it with a recessed washer, B, much time and temper may be saved.

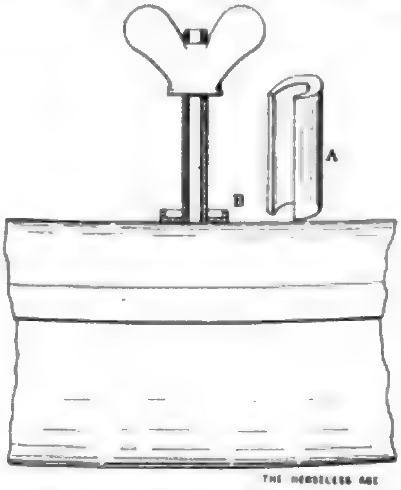

Fig. 1.—Tire Valve Stem Bush.

An Oldham coupling for light work is shown in Fig. 2. The driving members are made by the loops A and B at either end of a short coiled spring. The loops lie at right angles to each other.

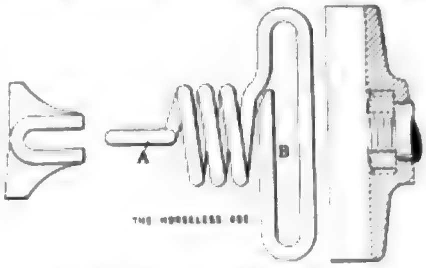

Fig. 2. Light Oldham Coupling.

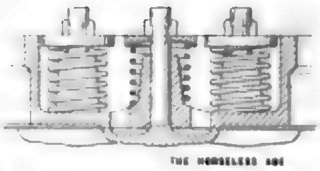

Fig. 3.—Triple Ported Inlet Valve.

Fig. 3 shows a triple ported inlet valve, used at one time by the Napier Company, of England, the object being to overcome the inertia of a large automatic valve. It is based on the principle that the sum of the circumferences of three circles is greater than the circumference of the circumscribing circle. The construction was abandoned upon the adoption of mechanically operated valves and on account of difficulty of keeping tight three different valves.

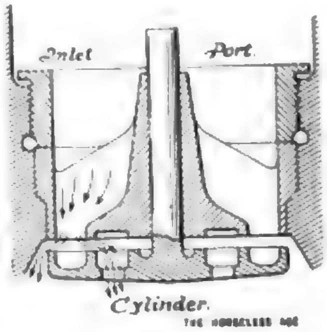

Fig. 4.—Eccentric Seated Inlet Valve.

Fig. 4 shows an old three ported inlet valve, first used on the 1900 60 horse power Mercedes in combination with a variable lift, produced by adjusting the rocker arm clearance. It was afterward copied and in 1904 abandoned by the English Napier firm.

Fig. 5 illustrates a useful and simple jointless universal coupling. The square spring plate A, with either a circular or a square hole in the centre, is bolted diagonally to the opposed forks of the joint. This is a particularly good vibration type.

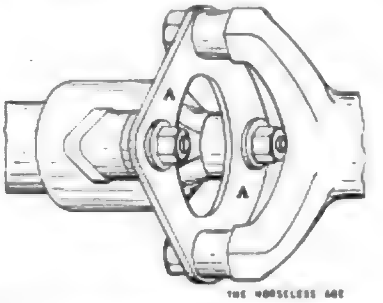

Fig. 5.—Jointless Universal Coupling.

A German consular report calls attention to the growing use of motor cars for the transportation of mail in Spain. The following lines have already been established, and others are contemplated: Avila-Bejar, Avila-Penaranda de Bracamonte, Avila-Segovia-San Ildefonsa, San Esteban de Pravia-Vega de Rivadeo, Deva-Motrico-Ondarroa-Berriatua-Plaza-Lequeitio.

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The Strong Trend Toward Standardization.

In the announcement of changes in the new models for 1909 there have been two items which clearly indicate that automobile design is tending toward certain standards, and that deviations from these standards, even in the case of the most prominent firms, will be gradually dropped. The two instances we have in mind are those of a manufacturer who has hitherto mounted his change gear lever on the steering column, but will now fit the regular side lever for gear changing, and of another who has so far confined himself exclusively to side chain driven cars, but has now brought out a shaft driven light car. Both of these manufacturers occupy positions of the first rank, but have been obliged to change their long continued practice by the force of public demand.

In the case of the change from a steering post lever to a side lever we are inclined to believe that this reflects public preference only in an indirect way. We have never heard any objection raised to the steering post lever, but, on the contrary, have frequently seen it highly commended. However, the steering post location of the gear lever is impractical in connection with the selective type of change gear, which is almost a necessity when four forward speeds are provided, in accordance with the ruling demand in the field of high class, large touring cars. The manufacturer in question confines himself to this class of car, and has this year adopted the four speed selective gear on all models. We conclude, therefore, that it was the difficulty, if not impossibility, of endowing a steering post lever with a selective motion that led to its abandonment rather than public preference for the side lever.

For light cars of medium and high grade the shaft drive has become the recognized standard. The single chain drive has gained a reputation of cheapness, probably through its exclusive use on early cars which deserved this characterization. The side chain drive is considered more complicated, and when unprotected, as it generally is, more troublesome than the shaft drive. The chain case is, of course, a remedy for this defect, but such a device which is readily detached in case of chain breakage and which does not detract from the appearance of a light car remains still to be invented. The solid or stationary axle is generally more rigid, the chain drive is easier on tires, and the chain when in good condition is undoubtedly somewhat more efficient than the shaft and bevel gear, but the buying public seems to regard these various advantages as incommensurate with the advantages of the shaft drive in a light car, and in consequence there is today on the market hardly a single make of light car pretending to the character of "high grade" that is not fitted with a shaft drive.

Autogenous Welding in Automobile Repairs.

The new metallurgical processes permitting of welding and brazing cast iron and other cast metals ought to considerably enhance the value of cars for which repair parts can no longer be obtained. Such parts of the cars as are machined from bar stock, etc., can, of course, easily be replaced by any repair shop; but when a complicated casting breaks, or a drop forging is ruined, in a collision, for instance, the owner is in a "sea of trouble," because in the absence of the patterns or dies it is practically impossible to duplicate these parts, except at prohibitive expense. The various methods of brazing and welding cast metals which have recently come into prominence bid fair to change all this, however. In fact, they even promise to reduce the demand for repair parts of the more complicated shapes on which a great deal of machine work has to be done. We believe even that it was especially the heavy losses incurred in failures of gasoline engine cylinders—very costly and often very much abused in the hands of novice motorists—that led to the development of some of these processes. At any rate, the owners of plants at which these processes are practiced have always laid special stress on their ability to repair cracked or broken cylinders, broken crank cases, gear cases, etc.

Until some years ago it was considered impossible to braze cast iron, the usual brazing flux, borax, apparently not having the proper effect on this metal. Recently, however, a flux has been discovered which makes it possible to braze parts of this metal together. Another process for joining cast metals of all descriptions which has now been exploited several years is the Goldschmidt Thermit process, which makes use of the great heat developed on combustion by an aluminum compound, which is mixed with metal dust and placed in a mold formed around the break which is to be repaired and is then ignited.

The latest process to be developed is that known as autogenous welding, or what would perhaps be best described as acetylene blowpipe welding. This process seems to be destined to play an especially important part in automobile repairing. As compared with the Thermit process, we are inclined to believe that it is better adapted for repairing small and complicated parts, the Thermit process being applied to best advantage to heavy castings. As compared with brazing, the autogenous welding process has the advantage that the joint is of the same metal as the part, and all traces thereof can be eradicated; besides, if properly made, an autogenous weld should be stronger than a brazed joint.

Plants for autogenous welding are now being established in various parts of the country, and owners of cars for which spare parts can no longer be obtained would be well advised to note the location of such plants. To successfully repair such parts as damaged engine cylinders requires, of course, a good deal of skill, and it will probably be some time yet before a considerable body of really skilled autogenous welding operatives will have been developed; consequently, failures will probably be more frequent for some time after the process has come into extensive use. Also, the prices charged for work will probably be higher for the present than later on, when the wide range of application of the process is widely known and the plants are kept busy and are forced by competition to keep their charges down as low as is consistent with the time and materials consumed in doing the work. But automobile owners who have the misfortune to break a costly casting will generally find it to their advantage to get an estimate of the cost of a repair by this process.

Taxing Features of Automobile Laws.

There is apparently much misunderstanding among automobilists in regard to the nature of the fees which are imposed by our motor vehicle registering and licensing laws. Even those who have in hand the recently instituted test case attacking the constitutionality of the New Jersey act have made at least one serious error.

It should be understood at the outset that these fees, which owners and drivers are compelled to pay, do not constitute taxes upon property. The Associated Clubs of New Jersey, through their counsel, claim that the New Jersey fees demanded from owners of automobiles, whether resident or non-resident, violate the constitutional provisions of the State of New Jersey requiring all taxation to be according to "value." This constitutional provision, which is similar to provisions found in other State constitutions, applies only *to property* taxation, and does not have any reference to occupation or privilege taxes.

The State of New Jersey does not tax automobiles as property, and it is difficult to understand how counsel for the New Jersey clubs can entertain such a proposition. The New Jersey exactions are merely license fees, if they can be held not to exceed a reasonable sum. If it can be shown that the fees are greater than seems to be reasonable, they constitute not a tax upon the value of the vehicle but a tax upon transit. Property taxation does not in any form enter into the theory of the New Jersey Motor Vehicle Law.

Whether the amount of the registration fee is based upon the horse power or is determined by some other reasonable method is immaterial, provided an unreasonable sum is not charged for the license, considering what the expenses are to be maintain the motor vehicle department. This is a simple rule of the law of taxation and is easily applied.

It is indeed strange that in the State of New York all that any automobile owner needs to pay is $2, which payment is final and entitles the owner to a perpetual license. There are probably more automobiles in the State of New York than in any other jurisdiction of the United States, still this fee of $2 has proven to be adequate for the support of the department issuing licenses to owners and chauffeurs. In New Jersey the owner of a 30 horse power automobile is compelled to pay $10 annually and $4 every year for the privilege of driving. The $2 paid by an owner to the State of New York not only pays for the registration of his vehicle, but also entitles him to drive on the public highway. There is a great discrepancy between these figures. The value of motoring is no more in New Jersey than it is in New York, still its cost is higher in the former State.

Relative Reliability of High Priced and Low Priced Cars.

The reliability which, in general, characterizes the modern high grade car is fast becoming as proverbial as was the undependability of the average automobile a few years ago. Owners of the highest priced large cars are frequently met with who testify to a season's experience free from any mishaps, other than tire troubles. Such testimony acts very strongly to heighten the confidence of the buying public in the dependability of cars of this class. This confidence is by no means unwarranted, for it is a fact that the utmost resources of engineering skill have been drawn upon to guard these vehicles against every possible chance of failure.

There is no doubt that the high priced, high grade car is substantially freer from derangements and breakages than are cars of lower price and grade. The purchaser of the former car certainly should and probably does get something for his money in that direction. More careful assembling and testing and better and more carefully applied fastening devices are the main cause of the reduced trouble account of the high priced car. A higher grade of machine work, checked by a more rigid inspection system is another important factor. In a great many instances, but in no means all, of late, the character of the materials used gives the high priced car an advantage, but in the matter of design there is very little if any superiority to be credited to this type of car.

While it may freely be admitted that the high priced large car is, as it should be, more reliable than a low priced vehicle, there is one consideration which tends to make the difference in this regard appear greater than it actually is. The large, high priced car is almost invariably driven and cared for by a professional chauffeur, while the small, lower priced car is in most cases driven and taken care of by its owner. The chauffeur, if he be a conscientious one with due professional pride, utilizes a very considerable proportion of the time during which he is not in active service in inspecting every part of his car. He tries every nut and other holding device, attends to each minor detail of lubrication and keeps all moving parts in correct adjustment, at the same time looking after all possible sources of weakness.

The average owner who cares for his own car takes whatever time he puts into inspection and adjustment from his business or recreation. He naturally endeavors to cut this time outlay as short as possible and in so doing almost necessarily fails to forestall many derangements which would be prevented by the careful daily grooming performed by the chauffeur who gives his entire working time to his car.

The result is that the chauffeur in the main prevents trouble from developing, while it only too frequently "comes to a head" in the case of the vehicle which enjoys only the somewhat cursory care of the busy owner.

It is probable, too, that the average owner of a large, expensive car has no idea of the amount of work which his chauffeur habitually does upon his car in order to obviate road difficulties. When a bad breakage occurs or extensive machine work is done he usually is aware of it in a general way, but of the almost daily work of inspection and adjusting he is not, as a rule, cognizant.

The owner who does his own work is aware of every time he has touched a wrench to his car and it is thus natural that his season's experience with his machine is spoken of in rather different terms from that of the owner who keeps a man.

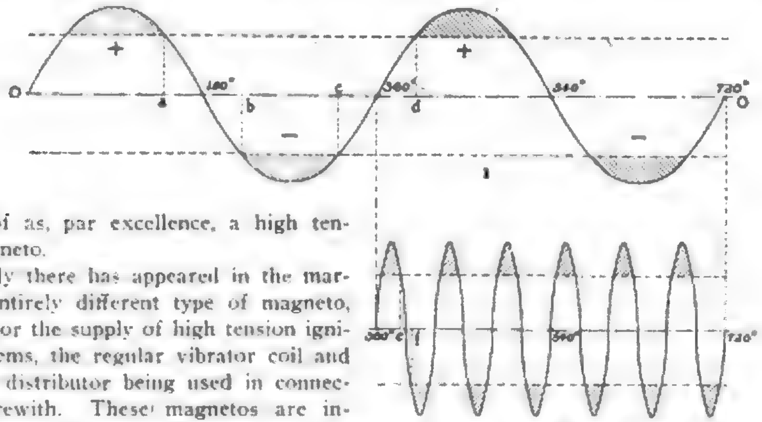
It would seem from the above considerations that there is presumably rather less difference in inherent reliability between these two classes of cars than appears at first thought.

Magneto Nomenclature—Some New Types of Magnetos.

By Albert L. Clough.

Magneto nomenclature is at present in rather a "mixed up" condition. Until very recently the term low tension magneto has referred to a generator suitable for the supply of a make and break or low tension ignition system. Such machines are generally of the synchronous, alternating current type (1) gear driven from the motor, but may be of the non-synchronous direct current type, belt or friction driven.

At the same time a synchronous, a. c. magneto furnishing a low tension armature current and energizing a high tension ignition system through a non-vibrating coil and distributor (2) is sometimes known as a low tension machine, as it is *per se*, and sometimes as a high tension machine, as it is when considered in connection with its step-up coil and the character of the ignition which it performs. A synchronous a. c. magneto producing within its own armature a high tension current, suitable for jump spark ignition (3), is generally spoken of as, par excellence, a high tension magneto.



FIGS. 1 AND 2.

Recently there has appeared in the market an entirely different type of magneto, adapted for the supply of high tension ignition systems, the regular vibrator coil and timer or distributor being used in connection therewith. These magnetos are intended as substitutes for the storage or dry batteries ordinarily used as the electrical sources for jump spark ignition and are of the non-synchronous type; that is, no provision is made to secure a certain predetermined cyclical relation between the position of the generating elements of the magneto and the point of ignition contact. These magnetos may produce either an alternating (4) or a direct current (5), and may be geared or driven by belt or friction pulley. They are strictly low tension generators, producing ordinary battery voltages.

It is rather difficult to devise a logical nomenclature covering these various types of magneto, and sometimes impossible adequately to describe the ignition system of a magneto ignited engine without adverting both to the character of the current furnished by the magneto (and the auxiliary apparatus regularly furnished with it), and also to the character of the ignition itself, whether high or low tension.

A fairly rational classification is secured by calling the type above designated as

(1) A low tension synchronous magneto.

(2) A high tension synchronous magneto with step-up coil.

(3) A high tension synchronous magneto.

(4) A non-synchronous low tension magneto.

(5) A direct current low tension magneto.

The terms synchronous and non-synchronous are obviously used only in connection with alternating current generators. If, for instance, a particular car has jump spark ignition and uses a magneto of type (2), the whole situation is completely described by stating that "its ignition is by means of a high tension synchronous magneto with step-up coil." If, for example, ignition is by jump spark and the source of current is a type (4) magneto, it is rather necessary to state that its ignition is by means of "a non-synchronous low tension magneto with vibrator coils."

SUBSTITUTES FOR BATTERIES.

The purpose of this article is primarily a consideration of the magnetos now so vigorously being introduced to operate vibrator coil, jump spark outfits. A magneto of this type acts solely as a source of current and does not perform the distributing function, as do types (2) and (3), nor does it perform the voltage raising function, as does type (3), nor the circuit breaking function, as do types (2) and (3). When these magnetos are used the distributing function is performed by the timer or distributor adapted to battery use, the voltage raising function by the coils or coil (dependent upon whether a timer or distributor is employed), and the current breaking function by the coil vibrators. In the operation of vibrating coils from a battery or a direct current magneto a constant voltage is always available to operate the vibrator whenever the timer closes the circuit. With the vibrator coil supplied from an alternating current magneto, the conditions are quite different, as is crudely shown in Fig. 1. Here is represented diagrammatically the voltage wave produced by a two pole magneto of the armature type (in contradistinction to the inductor type), rotated at crank shaft speed. Waves of alternating direction and of 180 degree length are produced, four waves in all being produced per four stroke cycle. It may be assumed that during one-half the duration of each wave the energy delivered is sufficient to actuate the coil vibrator. These effective portions of the waves are shaded. It will be observed that during the portions of the cycle *a*, *b*, *c*, *d* and so on, of 90 degrees each in length, the magneto is not effective to energize the vibrator, as the current is approaching a zero value, passing zero and beginning to build up in the opposite direction during these periods. If the correct instant for the spark to take place happened to fall at *a* or *c*, the timer would make contact at one of these points or slightly before, but the vibrator would not begin to act until point *b* or *d* had been reached. There would thus be a maximum error of retardation in the spark of 90 degrees caused by the magneto and firing might not take place until the piston was fairly half way down on its stroke. If the connection between the magneto and the engine were an entirely non-synchronous one the chance of the timer's closing the circuit at an instant of ineffective current would be equal to the chance of closing it during a period of effective current and thus one-half the explosions would be more or less delayed. The average delay of these explosions might be expected to be about 45 degrees of crank angle and the average for all explosions 22½ degrees.

NON-SYNCHRONOUS MAGNETOS.

In Fig. 2 is represented the wave of a two pole armature type magneto driven at six times crank shaft speed. It will be noticed that there are, in this instance, twenty-four electrical waves per cycle of the engine, instead of four. Assuming, as before, that during one-half of each wave the energy in circuit is sufficient to start the vibrator, the ineffective periods are of the length *e-f*, or 15 degrees of crank angle in duration. If the timer makes contact at *e* a delay of 15 degrees in the passage of the spark may be attributable to the magneto. The average lateness of delayed ignitions may be expected to be about 7½ degrees, or one twenty-fourth of the stroke, and the average lateness of all ignitions about 3¾ degrees of crank angle, or one forty-eighth of the stroke. Such inequalities as these latter in the time of igniton are not serious in practice.

The two foregoing examples are cited merely to show the necessity of a high frequency of alternation in an alternating current magneto employed for operating coils. It is quite obvious that the single spark type of high tension ignition is practically not operable from a magneto of this type, on account of the fact that the instant of the single "break" may at times coincide with a period of ineffective voltage, in which case the igniton in question would not take place at all. With the vibrating coil system each ignition is sure to take place, but certain ones are considerably delayed, and there is a slight average delay of all the ignitions corresponding to a slight retardation of the spark timing lever.

There are two ways in which the desired high frequency of alternations may be attained, first, by increasing the speed of rotation of the magneto armature to several times that of the engine, as illustrated in Fig. 2. This expedient is adopted in one very well known type of bipolar non-synchronous magneto, which is belt or friction driven, and which is said to be able to operate successfully at 10,000 r. p. m., or over six times the ordinary full load speeds of most vehicle engines. This is pretty fast running, even for a light, balanced part mounted on ball bearings, and is likely to be characterized by considerable noise and a rather rapid rate of wear. The second manner of increasing the rate of alternation is by increasing the electrical impulses per revolution through the employment of a multipolar field. The use of such a field enables the speed to be kept within reasonable limits without sacrifice in the frequency.

MULTIPOLAR MACHINES.

The multiplication of field magnets is, however, somewhat objectionable, as the bulk, weight and cost of the instrument are considerably increased thereby. If a magneto of this type is to be made an integral part of the motor flywheel, a multipolar construction may prove much more desirable than in the case of the separate magneto, and by rotating the fields moving wire and moving contacts may be avoided.

By the use of a bipolar field and an armature of the polar type as many complete cycles per revolution may be produced as there are pairs of poles in the armature. The resistance of the inactive armature coils is, however, always included in the circuit.

This type of construction is being used by one large concern, a two pole field being employed, having its pole pieces 90 degrees apart, while the armature is in the form of a Maltese cross with a coil on each leg, the four coils being connected in series. Four impulses are produced per revolution, two adjacent armature coils being active and the remaining two inactive, at all times.

It should also be remarked that the employment of the stationary winding and rotating two part inductor type of construction secures four waves per revolution instead of two per revolution as produced by the common armature type of machine. An important advantage of this type is that there is no moving wire on these machines, and therefore no slip contacts are involved. It would seem that the inductor type possesses decided advantages over any other for this service.

A non-synchronous magneto constructed upon this plan has recently been brought out, which, with a single moving part (the inductor) a single stationary coil of copper ribbon and two bipolar fields, delivers six electrical waves per revolution. It is intended to be driven at four times crank shaft speed. At this rate of rotation there will be forty-eight waves per cycle, and this frequency will entail a maximum timing error of but 7½ degrees, an average timing error of 3¾ degrees and a timing error in the average explosion too small to be considered. With a magneto of so high frequency as this there should be nothing in its operation to distinguish it from one of the d. c. type.

SELF REGULATING QUALITY.

There is one characteristic of these a. c. magnetos that is of especial value. The high armature inductance, especially as the frequency is increased, closely limits the output as the speed increases. While such a machine is usually capable of starting the engine readily when it is cranked, neither the current nor the external voltage are likely to build up disastrously, even at the highest speed of which the engine is capable. Internal electrical reactions serve to keep within safe bounds the energy delivered to the coils.

Another point worthy of consideration is that the algebraic sum of the current passing through the vibrator points is, in any considerable length of time, zero, there being an equal flux in each direction. There is thus practically no transference of metal from one platinum point to the other and a minimum of "pitting" or "teating" of the points.

Of course, a magneto of this type, acting, as it does, merely as a substitute for the battery in supplying vibrator coils, does not carry with it all the advantages of the high tension magneto, nor does it remove the objections inherent in the vibrator coil system itself. The same large range in spark advance, always necessitated by the vibrator lag, is of course necessitated when the coils are energized from a magneto, as when supplied from a battery, and possibly a little more. A "fast" coil and vibrators should be used with these a. c. magnetos.

DIRECT CURRENT MAGNETOS.

The direct current magneto may be used to supply a vibrator coil system, as well as the alternating current type. Such magnetos are usually of the bipolar type, with a drum wound sectional armature, commutator and brushes. As the current delivered is a continuous one, there is in this case no question of delayed ignition due to the timer contact being made at or near a zero point in the wave. The voltage is always ready to energize the vibrator the instant the timer makes contact. These little machines are usually designed to operate at about 6 volts, thus taking the place of six dry cells or a three cell accumulator. The voltage from such a direct current armature builds up rapidly with increase of speed, as its inductance is low, and thus provides very little inherent regulation. Field distortion comes in to a certain extent to limit the output, but it is generally found necessary to employ an automatic governor pulley, capable of maintaining the rotary speed nearly constant. Although this clutch pulley is an extra complication, it is not at all a serious objection in practice, as the device may be very rugged and has to transmit but a minute amount of power. These clutch pulley automatic speed controllers frequently operate for years without giving trouble. The necessary use of brushes on a commutator in connection with these small d. c. magnetos is another objection which is likely to be overestimated. With a commutator of liberal dimensions, a multiplicity of brushes with good spring holders and a carefully enclosed structure, very little trouble need arise from commutation. A magneto commutator gives much less difficulty than does the commutator of a small shunt wound dynamo intended for the same service. In the latter case the brush contact must be exceptionally perfect, else the dynamo field will fail to build up and the machine prove inoperative. The magneto field is always built up and the full voltage developed in the armature at all times, so that the brush contact is not nearly so "fussy" a matter as with the dynamo.

Either the a. c. or the d. c. magneto of the "battery substitute" type gives excellent satisfaction, and, so far as the independence it gives over outside or exhaustible sources of current is concerned, it is on a par with the more expensive and delicate high tension magneto. These little machines, especially those of the inductor type, can be made exceptionally rugged, and, if driven by gears and well enclosed, should be about the last place on the whole car to look for trouble. It is evident that magneto generators of the types here considered are likely to be used in enormous numbers, especially upon moderate priced cars. In the writer's opinion their introduction is a decided boon to the industry.

It has developed in the bankruptcy proceedings now being carried on in London against the Westminster Syndicate, Ltd., a concern established to promote other companies, that the promoters paid to the French Leon Bollee firm the sum of $200,000 as a purchase deposit on the manufacturing business, with the stipulation that the whole of this amount was to be forfeited if the deal did not go through. The promoters failed to raise the necessary capital and the whole $200,000 was lost.

An American consular officer in a European city reports that an application has been filed with the local government for permission to run a service of motor buses to several outlying villages. The capital of the company is to be about $100,000, and arrangements have been made for the purchase of some of the cars required, but the promoters are now asking for catalogues of American machines. Full descriptive matter should be sent in duplicate as soon as possible to the consular officer making the report, in order that it may be referred to the inquirers. Refer to No. 2,728.

Power Control for Truck Work.

By "Designer."

The field of automobile engineering is really boundless and the student in this field is constantly finding some new thing to momentarily occupy his attention. The idea of this article came to the writer as he watched a 5 ton truck being manœuvred with difficulty on a dockside a few days ago. The load was more bulky than heavy and the available moving space was decidedly cramped. The driver did his best, but it took him twenty minutes of hard work to get out from the hole. It appeared to me a waste of time and labor, and detrimental to the efficiency of the truck, and it set me thinking of some way to overcome such difficulties. The following is merely a rough outline of my conclusions, and, no doubt, will be severely criticised on the score of complication, but I submit it for whatever its interest to the readers of The Horseless Age may be.

Some months ago, on becoming acquainted in a professional capacity with a well-known truck maker, I had occasion to drive one of his vehicles for some miles, and at the end of the drive I had to acknowledge considerable fatigue. I grant that the unaccustomed position and the unnecessary clumsiness of the control may have had something to do with it, but I am accustomed to continual and hard driving of machines, so that these things alone cannot be held responsible. I spoke to drivers who operate such vehicles continuously, and each and every one described his nightly fatigue in unmeasured terms. The cause was attributed to the physical exertion required by the steering, which is entirely in line with my own observation, and when the width of the flat tired front wheels is considered it is not hard to understand. The manœuvring of a truck requiring arduous physical exertion even when in motion, imagine the expenditure of energy required of the driver with the machine stationary, as was necessary in the case referred to in the introductory paragraph of this article. Then the steering road wheels must be returned beyond the normal to secure position on the backing operation, and possibly two or three repetitions will be required in especially cramped quarters where the total manœuvring length is only a few feet. Such positions are the rule rather than the exception, and it is by no means generally possible to secure greater clearance.

My idea is to use power steering by a mechanism so arranged that control may be effected from two or more locations on the vehicle. For instance, the truck has a bulky load, so that the driver cannot see behind him, but, being a fixture about his control, he must reverse in ignorance of the actual path the rear end of his vehicle will pursue. Inasmuch as the steering ratio must necessarily be extraordinarily low, much time and labor is expended in recramping the gear to go forward again, and repeating the operation in the second backing, provided the first backing has not given the desired clearance. Moreover, quick moves, which are at times necessary for safety and always desirable for speedy point to point work, are more than difficult; errors in judgment are more liable to occur, and returning to the straight is uncertain.

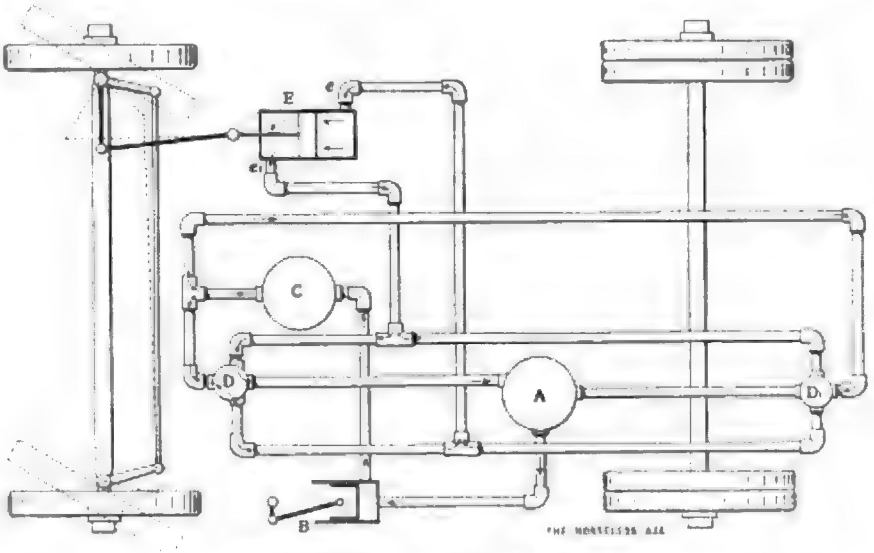
To provide means of control at different points of the vehicle, i. e., make it workable from either end, like a street car, to facilitate quick handling, to insure greater immunity from accident, to prevent fatigue on the part of the driver are objects which can all be accomplished by providing a power steering and universal control system. The principle by which these things may be accomplished is not difficult to determine. Obviously, fluid pressure is the simplest means, and air being unsuitable, we must resort to a hydraulic system. Following would be the essential parts of the system: A pressure pump drawing the fluid from a reservoir. A pressure accumulator for fluid delivered from the pump and from which it could be redelivered at high pressure to the working portions of the system. A working cylinder suitably linked to the steering gear so that the motion of its piston would cause a corresponding motion of the steering wheels. A common pressure circuit connecting the control locations with the accumulator. Distributing valves, whereby the fluid under pressure might be admitted to the working cylinder connected with the steering wheels, on either side of the piston, so as to secure the necessary direction through suitable leads. Exhaust leads whereby the fluid would be returned to the storage tank to be redelivered to the accumulator. I would complete the system by the addition of (1) a working cylinder for the purpose of handling the clutch; (2) a working cylinder to operate the low and reverse gears; (3) a working cylinder to operate one set of brakes.

Thus the control devices could be limited to a small hand wheel, or lever if preferred, for the steering, and two small levers or pedals, one for changing from low to reverse speeds and the other for the clutch and brake operation, all of these being duplicated to give similar effects in corresponding positions. Thus the labor on the part of the driver would be minimized, and I think certainty of action could be ensured.

The diagram, Fig. 1, indicates the piping arrangement. A is the storage tank, B the force pump feeding to the accumulator C. Thence pressure is communicated to the common lead connecting the steering valves D and D_1. The arrows in the diagram show the steering road wheels about to move to a position indicated by the dotted lines, with the result that the working cylinder E is being fed from one end, *e*, and is exhausting from the opposite end, e_1, back through the third port in the steering valve D to the reservoir A. The action would obviously be the same if valve D_1 were being used in place of valve D. Suitable connections for the clutch brake and change speed cylinders are quite obvious and are not shown in the diagram.

Catch Phrases.

In recent years catch phrases have been introduced extensively by the sales and publicity departments of automobile factories, and among the phrases that have come under our observation are the following: "Built like a watch," "built like a gun," "built like a locomotive." It is putting it mildly to say that these statements are incorrect technically, the similarity in the construction of these various products of industry and of the particular automobiles referred to being limited to the fact that all are made chiefly of metal by mechanics. Moreover, these phrases really do not imply any special virtue, as there is certainly no better workmanship or material required in either a gun, a watch or a locomotive than in an automobile.



Power Control for Truck Work.

Maintenance and Repairs

Combined Automatic and Hand Control of Carburetors.—A Lamp Lighter.

By W. F. Davidson.

In this article an attempt will be made to describe some improvements which the writer made on his car last winter and which, he hopes, may be of use to some other autoist.

The most important improvement was a carburetor air control valve, and hence this will be considered first. The carburetor on the machine—a four cylinder—was of standard make but was not entirely satisfactory as it "choked" easily and the gasoline consumption was rather large. After considerable experimenting it was found that the air inlet control valve was not sufficiently automatic. As no changing of the valve spring or other adjustment would remedy this, manual control was resorted to. The carburetor on the machine in question is set down below the frame and closely in front of one of the motor supporting arms, so that the change was not as easily made is it might have been had the carburetor been higher up. A new brass air inlet valve chamber was cast of brass, as shown in Fig. 1. The casting was only finished in the valve seat, the flange joints and the hole for the spring adjusting rod. This latter rod should preferably be of steel, well polished and hardened slightly. No dimensions of these parts can be given, as they would have to be determined by the special conditions. It would probably be well, however, to make the valve chamber as near like the one originally on the carburetor as possible. The control rod is connected by a suitable linkage to a small lever on the steering post or dash. This linkage should permit a movement of the rod of a little more than an inch. The spring and gasoline should then be adjusted so that the motor runs best at moderate speeds when the air control lever is on about the middle of its quadrant, which allows considerable adjustment to be made for high and low speeds. On the car in which this was used it cut the gasoline consumption from 9 to 11 miles per gallon and made it possible, as was often necessary, to open the throttle very quickly without "choking." If the motor did "choke" it was easily cleared out by increasing the spring pressure. The results, as a whole, were very satisfactory and the little trouble of occasionally changing the adjustment was amply paid for in a steadier running motor, reduced gasoline consumption and easier starting.

Another device which, though simple, was very convenient, was an electric headlight lighter. To make this the burners were removed and fibre tubes—vulcanite answers as well—slipped on and the burner replaced. The space between the burner and the tube was then filled with asbestos wicking forced in with a small tool. Two German silver wires were then fastened around the tube as shown in Fig. 2 and the ends brought up so as to form a spark gag very close to the tip and about one-thirty-second or three-sixty-fourths of an inch long. An old ignition coil was then connected to the ignition battery through a small push button and the secondary connections made as in Fig. 3. For making these latter connections No. 14 B. & S. rubber covered wire answers very well and is much cheaper than regular secondary cable. If the generator or tank is where it can be reached from the seat, the lamps may be lighted without leaving the seat at all, or often without stopping the car.

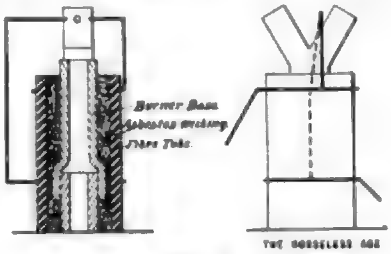


Fig. 2.

Spring Lubrication.

Last winter when overhauling his car the writer decided to try and improve the spring action and stop a squeaking in them. The springs were taken off and the leaves separated by wedging or disassembling. All rust was then removed with kerosene and emery cloth and the springs were put back after a liberal coating of grease and flake graphite had been applied to the leaves. The result was an easier spring with no squeaking.

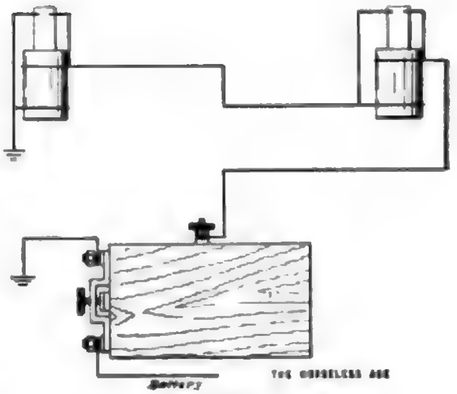


Fig. 3.

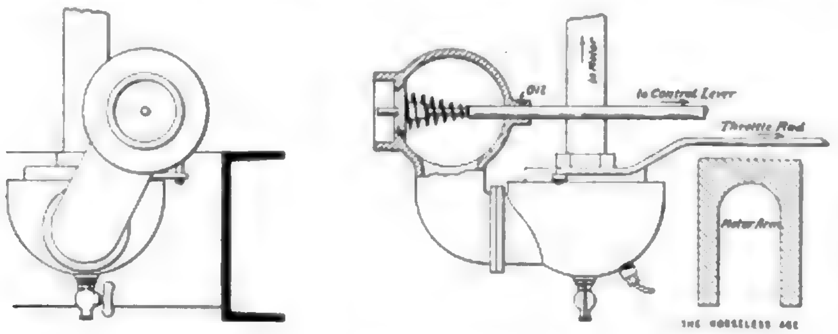


Fig. 1.

Road Danger Signals.

The Good Roads Congress recently held in Paris during one of its sessions occupied itself with the question of danger signals for roads. This subject has received a great deal of attention in recent years, and numerous touring and automobile organizations have issued "codes" of road signals of their own, some of these comprising as many as fifteen different signals. In consequence numerous contradictory views were expressed, and every organization represented endeavored to have its code recognized. The International Union of Touring Clubs recommended a single danger signal, with the word "Care," to be placed wherever a lowering of the speed is advisable. Two representatives of the Touring Club of France, Messrs. Chaix and Ballif, eventually recommended the adoption of a set of four signals, as follows: One for obstructions in the road, one for railroad level crossings, one for curves and one for dangerous road crossings. These signals are to be in the form of symbolical figures, so that they can be read by everybody. This recommendation was adopted by the Congress, and the representatives of the various governments present pledged themselves to urge their governments to legally introduce these signals in their respective countries.

Did You Ever . . . .?

The following is part of an article which recently appeared in the Cleveland (Ohio) *News*, and in modified form in several other newspapers. It suggests the query: Do newspaper editors ever stop to think?

60,000 PEOPLE HAVE MADE JUST 65,000,000 AUTOS.

In the output of 65,000,000 automobiles, the number manufactured last year, 60,000 people were concerned.

These figures have recently been computed by the National Manufacturers' Association. They show an output of 10 1-5 cars by each person engaged.

Did you ever stop to think of these figures in connection with the automobile industry? Did you ever stop to think that the automobile is an absolute and practical necessity?

Did you ever • • •

A Wheel Distance Gauge.

By Piersoll Sargent.

It is most important in side chain driven cars that the centre to centre distance between the countershaft and the wheel sprockets should be the same on both sides. Inequality in these distances would cause the chains to run hard. The ordinary method of ascertaining if the distance between the centre of a front wheel and centre of the real wheel on the same side is equal to the corresponding distance upon the other side, is by means of a tape. The distance on one side is usually measured off first and the other side is then adjusted to correspond. But, as all engineers know, a tape measure is never very accurate. The proper use of a tape requires some skill, and a layman will, as a rule, not be able to make as accurate measurements with a tape as an expert. Furthermore, tapes and cords have a tendency to stretch, which renders accurate use without correction very uncertain. To enable motorists and motor repairmen to correctly align their cars the author has devised a distance gauge, something on the order of calipers, in which he has endeavored to combine lightness in weight and rigidity with accuracy and low cost of construction. The original gauge on which this is patterned was designed by the writer while in the engineering department of one of the best known automobile factories, and several are in use in the assembling, testing and repair departments of this factory at the present time. The gauge as shown here will serve for cars of any wheel base up to 130 inches. Previous to its adoption a sort of calipers was used to take the distance from the centre of the counter shaft sprocket to that of the rear wheel, but in the case of cars being tested or undergoing repair work it was necessary to take down a sprocket guard and reach around the fender, for which reason its use was abandoned in these departments. The gauge is also used in taking distances between other points on cars, etc., and undoubtedly will prove advantageous for garage use.

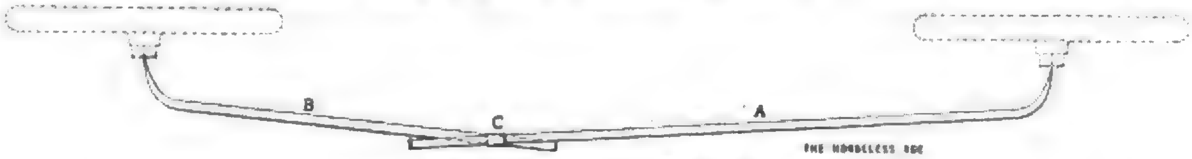
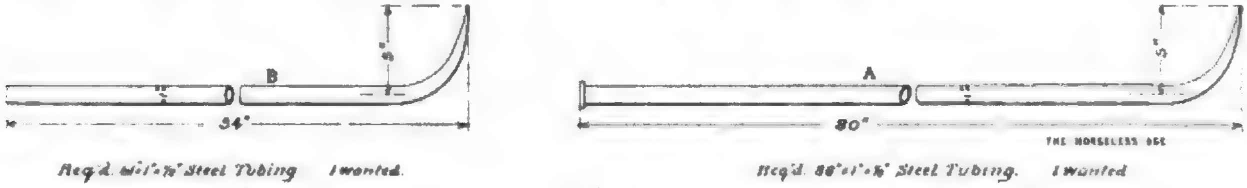


Fig. 1.—Distance Gauge in Use.

As will be seen by the first figure, the gauge consists of three parts, the bar A, the leg B, and the combined slider and joint C. Seamless tubing was used for A and B, Fig. 2, to combine lightness with rigidity. The ends were bent over and hammered to a point, and the end of A opposite to that of the point was hammered over to prevent the slider from coming off. The sleeves of the slider, D and E, were made of strap steel, 3½x2x$\frac{3}{32}$, while the pivot base, Fig. 6, and the pivot supports, Fig. 4, were iron castings. The pivot pin was an ordinary one-quarter clevis pin, five-eighth inch long. The two halves of the pivot supports were welded together on the edges and the interior finished smooth with emery cloth. Only one of the supports was drilled and tapped, for the lock screw F (Fig 3), which was an ordinary three-thirty-second inch screw with a milled head. The sliders D and E, Figs. 7 and 3, are fitted over A and B just snugly enough to allow of sliding when some force is used. The pivot base and pivot supports were fastened by three-thirty-second inch rivets, but could be equally well welded on. A piece of three-thirty-second inch wire was used to pin the pivot base and clevis pin together. The screw F was used to retain the leg and bar at the desired angle with one another, friction between the pin and the supports being found insufficient, owing to the weight of the tubes.


B
54"
A
80"
5"
THE HORSELESS AGE
Req'd. [illegible] Steel Tubing 1 wanted.
Req'd. 88"x1"x⅝" Steel Tubing. 1 wanted

Leg. Fig. 2. Bar.

It must be understood that the construction is not suitable for use as a vaulting pole or walking stick, but simply as a measuring device. It is calculated to withstand considerable wear and tear, however. Working dimensions which can be understood by any machinist are given in the figures, the depth of finish only being not given, but left to the discretion of the constructor. The estimated cost is between $1.75 and $2, including the castings, cost of raw material, but not labor.

In making use of the device the steering wheels of the car must first be turned parallel with the axis of the car. Now place the point of the bar A on the centre of the hub cap of the front wheel, and adjust the leg B until its point touches the centre of the hub cap of the rear wheel. Clamp the pivot in position by means of the lock screw F. Taking the gauge to the other side of the car, and placing the point of the bar A on the centre of the front wheel hub cap, the point on leg B should touch the centre of the rear wheel hub cap if the distance is the same on both sides. If it is not, the distance rods may be lengthened or shortened until the required distance is obtained. The gauge is intended to be hung up on pegs when not in use.

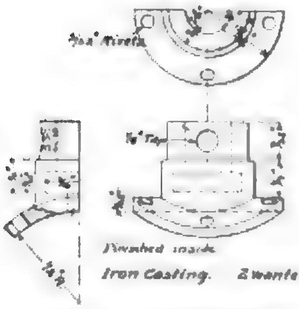


Fig. 4.—Pivot Support.

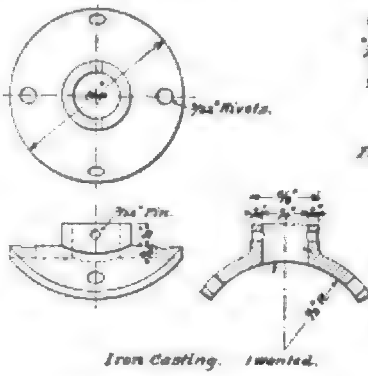


Fig. 6.—Pivot Base.

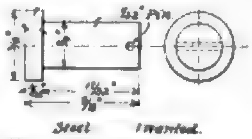


Fig 5. Pivot Pin.

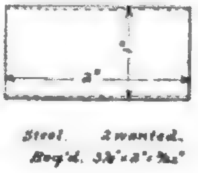


Fig. 7.—Slider.

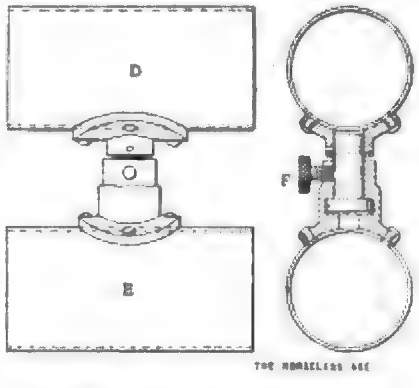
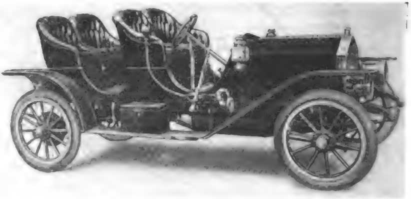


Fig. 3.—Assembly of Pivot Joints.

NEW VEHICLES AND PARTS



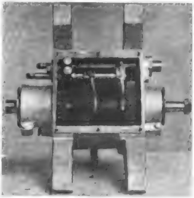
Thirty Horse Power Great Western Car.

The Great Western 1909 Models.

The Model Automobile Company, of Peru, Ind., will build three different models during the coming season, known respectively as Model 20, Model 21 and Model 22. The three models are identical, except as regards the engines, and these differ only in dimensions. The Model 20 is a 30 horse power, Model 21 a 40 horse power, and Model 22 a 50 horse power car, all three being quite similar in lines to the seven passenger, 50 horse power touring car, which the company has been building for the last three seasons. The cylinder dimensions of the three models are 4x5 inches, 4½x5½ inches and 5x6 inches, respectively. The 50 horse power car weighs 58 2-5 pounds per rated horse power, the 40 horse power car 62½ pounds, and the 30 horse power 63⅓ pounds as a runabout, and 62½ pounds as a tourer. The construction of all three models being alike, the following description applies to all:

The cylinders are cast separately and machined all over on the inside so as to secure uniform compression. Very liberal water jackets are provided, wider at the top than at the bottom. The pistons are roughed inside and out, and then annealed before being ground, to insure equal expansion when heated, and a perfect fit over the entire length. The exhaust valve is located in the head and completely surrounded by water. The intake valve is at the side, and located as close to the cylinder as possible. The upper end of the half inch exhaust valve stem is cupped out for a steel ball against which the rocker arm works. The object aimed at in this construction is to eliminate noise and side thrust. The inlet valve lifters are adjustable, and are also provided with this ball arrangement. The cylinders are offset one-half inch.

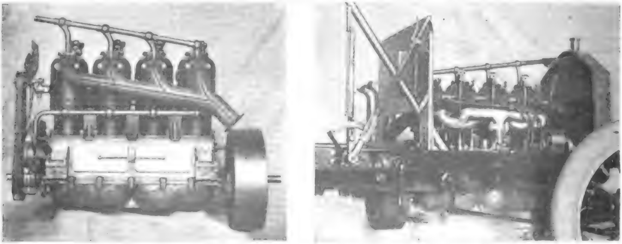
The crank case is of aluminum in two halves, and is provided with large hand holes to permit of adjusting the connecting rod bearings. The crank shaft is supported in five bearings, which are carried by the studs, securing the cylinders to the crank case, thus relieving the latter of the strains due to the explosion. The bottom half of the crank case can be quickly removed without interfering with the bearings, as can also the cylinders. The five main bearings on the crank shaft are of nickel babbitt fitted into manganese bronze bearing caps. The connecting rod bearings are also of nickel babbitt, all these bearings being die cast. The crank shaft is made from a drop forging which is heat treated and ground to size.



Change Gear Box. Cover Removed.

All the valves are operated by a single cam shaft. The cam shaft gears, as well as those for the pump and magneto, are enclosed in a separate oiltight case, which is divided in such a way that either the pump or magneto may be removed without disturbing the rest of the gears. In fact, by removing the cover of this case and taking off two nuts, the whole cam shaft can be taken out through the front end of the motor. The cam shaft gears are provided with helical teeth to eliminate noise. The circulating pump is of the gear type, and circulates the water to a flat tube radiator, back of which on an adjustable bracket is mounted a fan which is driven from the crank shaft by a one inch belt at a speed three and one-half times that of the engine.

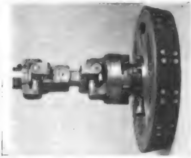
Two independent sources of ignition current are provided. A high tension magneto is located on the right forward crank case arm, and a battery is also carried on the



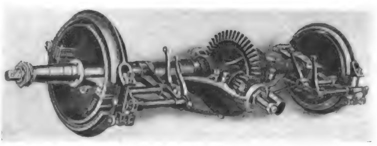
Exhaust Side. Great Western Motor. Inlet Side.

car for use in starting, or in case of failure of the magneto. The carburetor, which is located on the right hand side of the motor, is of an automatic, water jacketed type. The exhaust gases are carried from the cylinders at the left hand side through a cast iron manifold of gradually increasing diameter and very easy bends. A seven lead sight feed oiler is arranged close to the exhaust manifold, with the object of insuring that the oil shall remain fluid in cold weather. This oiler is driven by means of an eccentric and ratchet motion, which is, of course, positive. The splash lubrication system is made use of for the engine.

The clutch is of the conical type, and is faced with Raybestos, and provided with springs under the facing to insure easy engagement. The operating collar of the clutch is provided with a ball bearing to take the thrust. This thrust collar is made in halves so as to be easily removed. The connection between the clutch and gear box consists of a double universal joint, and a square sliding joint to allow for the clutch disengaging motion. The change speed gear is of the selective sliding type, giving three forward speeds and one reverse. The gears are of nickel steel, oil hardened, and all shafts are mounted on roller bearings. The countershaft gears are keyed and forced on by hydraulic pressure, being spaced by tubular separators. The reverse gear is forged integral with its shaft. The drive shaft is round and milled with four integral keys, and is hardened and lapped to size in the bearing. The drive to the rear axle is by shaft and bevel gear. The rear axle is of the floating type, with 1⅜ inch shaft mounted on roller bearings, and provided with a spur type differential. The bevel gear and the differential casing have a thread and nut adjustment for adjusting the mesh of the gear and pinion. When the car is loaded the driving shaft forms a straight line. The rear axle housing is riveted and brazed, and carries the cast steel brake brackets and dust flanges. The front axle is of the I section type, and a one piece forging. The steering pivot is provided with a hardened thrust bearing designed to eliminate wear.



Clutch Cone and Universal Joint.



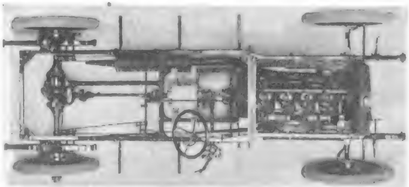
Great Western Rear Axle Construction.

Two independent sets of brakes are provided, both acting on drums secured to the rear wheels. One set is internal expanding, and the other set external contracting, the latter being lined with camel's hair fabric. The external brakes are operated by a pedal, and the internal brakes by a lever, and both sets are claimed to be double acting. The steering device is of the worm and gear type, a complete gear being used instead of a sector, and forged integral with its shaft. All parts of the steering gear are drop forgings. The tie rod of the steering mechanism is hardened. The steering hand wheel has a metal centre with Circassian walnut rim. The worm and gear mechanism is enclosed in a dust proof housing, which is provided with eccentric bearing bushings permitting of adjusting the mesh. On top of the steering wheel are the control levers for the spark and throttle, which move over a stationary sector, and do not turn with the steering wheel.

The frame is of cold pressed nickel steel of channel section, with a sub-frame for supporting the power plant. On Models 20 and 21 full elliptic rear and semi-elliptic front springs are used, while on No. 22 all springs are semi-elliptic. The dimensions of the springs on the different models are as follows: On No. 20, 38x1¼ inch rear, 38x2 inch front; on No. 21, 40x1¾ inch rear, 40x2 inch front; on No. 22, 56x2 inch rear, 40x2 inch front. The wheel base is 106 inches on No. 20, 114 inches on No. 21, and 122 inches on No. 22. The tire equipment, is 32x3½ inches on No. 20, 34x4 inches on No. 21, and 36x4½ inch rear and 36x4 inch front on No. 22. The wheels are of artillery construction, with dished spokes and mounted on ball bearings. A metal pan extends underneath the car, being hinged to one side of the frame and clamped to the opposite side, so it can be easily dropped when it is desired to reach any of the lower parts of the mechanism. The control is by a change gear lever at the right hand side, which gives the high speed by pulling to the rear; there are also one brake lever, one brake pedal and one clutch pedal. The upholstering and painting are automobile red, except for the runabouts, which are finished in French gray with black upholstering.

The Humber Taxicab.

The latest addition to the various makes of taxicabs in service in New York city is the Humber, manufactured by Humber, Ltd., of Coventry, England, and for which the Humber Import Company, of 1599 Broadway, New York, are agents. The motor of this cab is of the four cylinder vertical type, with individual cylinders, the water jackets being cast integral with the cylinders. The bore is 3½ inches and the stroke 3¾ inches, with motor running normally at 1,200 revolutions. Splash lubrication is provided in the crank case, the oil being delivered from a hand pump on the dash. A mechanical lubricator mounted on the dash feeds the clutch and gear box in addition to the centre bearing of the crank shaft, sight feeds being provided so that the flow to each part may be ascertained. The crank case is of aluminum alloy and is in two parts, the bearings being suspended in the upper half, the lower half forming an oil basin. Ignition is by accumulator and coils, or by high tension magneto, as desired. A description and illus-



Plan View of Great Western Chassis.

Coventry Humber Four Seated Motor Cab.

trations of this motor will be found in The Horseless Age for September 30, 1908.

The clutch is of the cone type, leather faced and mounted on ball bearings. A box coupling connects the clutch to the line shaft of the change gear, which is of the selective type, giving three forward speeds and one reverse, with direct drive on the third. The change gear casing is made in halves, the shafts lying side by side in a horizontal plane. An extension of the casing forms the chamber containing the shifter rods, etc. Inspection doors are provided for the gear casing and the shifter casing, both doors giving access to the contents of the casing. Final drive is by a universal jointed shaft to a bevel driven live rear axle, the half axles working in ball bearings, and being supported by the heavy tubular casing which contains the bevel gears and the differential. All gears run in grease, the casing being packed to prevent leakage. The driving reaction is taken up by the springs. The front axle is of seamless steel tubing, with spring saddles shrunk on. The steering knuckles are fitted with ball bearings throughout.

The frame is of pressed steel, the cross members and subframe being of seamless steel tubing. Half elliptic springs are fitted in front and platform springs in the rear. The wheels are of the artillery type, 30 inches all around, and are fitted with 3.6 inch tires. The wheel base is 96 inches and the track 55 inches, enabling the vehicle to turn in a 22 foot circle. Ten gallons of fuel are carried in a tank under the driver's seat, feed being by gravity. Speeds are changed by means of a ball ended lever at the side of the car, and the side brakes are actuated by a pull back lever in a similar position. The usual brake and clutch pedals are fitted, as well as a keel plunger accelerator. Spark and throttle levers work over quadrants on top of the one armed steering wheel, which latter is a distinctive feature of all Humber cars. The landaulet body fitted is provided with ample knee room for four people inside and a trunk space with folding platform is provided alongside the driver. One of the points in regard to the body of this car emphasized by the builders is the absolutely weather proof joint where the leather head and roof are joined together, protecting the passengers from leakage, etc.

The Heinze Ignition Specialties.

The Heinze Electric Company, Lowell, Mass., has recently brought out a magneto for use with the ordinary timer and vibrator coil system of jump spark ignition. In applying this magneto to a car thus equipped, it is only necessary, after mounting it, to connect the magneto terminals to the coil switch in place of one or the other battery. This generator is of the low tension type furnishing a voltage approximately equal to that of the customarily used battery. Although not of the synchronous type it is intended to be gear driven from the engine at double its speed. It is essentially a two pole alternator with a four coil polar armature, the construction of which is as follows (Fig. 1):

The field consists of three magnets, A, of circular arc shap[illegible] These are bent into their circular form by means of special machinery recently installed. The pole pieces, B, are of soft iron screwed to the poles of the field magnets. A somewhat novel form of armature is used, the core, C, of which is of a large number of very soft iron stampings of Maltese cross form, assembled and keyed to the armature shaft. On each arm of the cruciform armature thus formed is wound a coil, D, of insulated copper ribbon of flat section which fills the space between the armature hub and the polar projection of the arm. These four coils are connected in series, and as the two pole pieces of the field are located at 90° apart, the two adjacent armature coils which are simultaneously passing the pole pieces are in action at the same time, and the other two are idle. The effect is that there are four positive and four negative impulses per revolution of the armature shaft, and, considering that the magneto is run at double the speed of the engine, the error in the time of the average spark due to the correct instant therefor falling on a period of too low current should be negligible in practice. About one-half of the time period of each wave is stated to be sufficient for effecting ignition. No governor pulley is required upon this form of magneto to maintain the voltage constant, as the inductance of the armature prevents excessive currents.

A tight cylindrical brass case, E, fits around the outside of the field magnets and the ends of this case contain the annular ball bearings, F, F, of the armature shaft. One end of the armature winding is connected to the magneto shaft and grounded, and the other end is brought out through an insulating shaft bushing and connected to a contact button, H, on the shaft end, upon which presses a metal spring, J, which, in connection with binding post, K, forms the live terminal of the machine. It is intended that this magneto and its driving gears shall be housed in a horizontal cylindrical cavity contained in an aluminum casing bolted to the engine crank case, into which the brass shell of the magneto fits. In case of any defect developing in the magneto it may readily be withdrawn from the housing for inspection and, if necessary, another magneto may be substituted, as the sizes are standardized.

In the use of this magneto, the timing of the spark is accomplished by rotating the timer of the battery system in the usual manner, and there is no discernible differ-

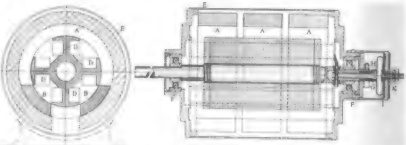


Fig. 1.—Heinz Magneto.

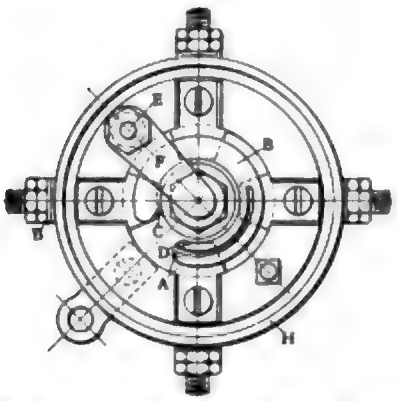


FIG. 2.—HEINZE DOUBLE BRUSH CONTACT TIMER.

ence in the performance of the motor whether it is sparked by battery or by the magneto. As the direction of current flow through the vibrators is alternating, it is claimed that there is little or no fitting due to the electrolytic action of the arc at the vibrator points. The absence of a commutator or other moving contacts at or in the magneto itself certainly tends to insure reliability in service. Starting is readily effected in this magneto without recourse to the battery.

A few details regarding the manufacture of the Heinze unit coil may be of interest. The thoroughly annealed iron wires forming the core are accurately cut to length, and a quantity of these is weighed out in order to secure an exact amount of iron in each core. These wires are then bunched, held in cylindrical form by means of tie wires, and then soaked in a bath of hot composition, which firmly cements them together. The tie wires being removed, the core is filed to shape and the ends are polished. The core is insulated by a winding of high puncture test, oiled paper, and the primary, of two courses of silk covered wire, is then laid on. The primary terminals are of very flexible, braided copper cable, and the joints here and in all other parts of the coil are soldered, non-corrosive paste being used. The primary and core are then boiled in paraffine. End insulation of the primary is by means of washers of the oiled paper. The spool which is to receive the secondary is turned out of kiln dried hardwood, and its central hole is of such a diameter as just to receive the primary. In the outside surface of the spool are turned eight deep grooves to receive the sections of the secondary. These spools are boiled in paraffine before being filled. Instead of, as formerly, winding the secondary in two sections, it is now wound in eight coils, reducing in that proportion the danger of a breakdown by reducing the potential acting between the ends of a single coil. The wooden spool, after having slots sawed in the separating partitions for the wire to pass through, is placed in a winding machine which is fitted with a counter. Exactly the predetermined standard number of turns of silk covered wire are wound into the first groove, an occasional paper separator being used between courses. After this groove is filled the wire is passed through the communicating slot and the next groove is filled with exactly the same number of turns, and so on until the whole spool is completed, when the flexible braided copper terminals are soldered on. The secondary is then boiled in paraffine, and is again boiled out after the primary is inserted. Unit boxes of kiln dried matched wood are employed, which are paraffine treated, and when the coil itself is placed in the box a special insulating wax of high melting point is poured in after the connections of the cables to the outside brass contact strips have been made. This wax is allowed to fill all crevices, and then the box is finally filled and is ready for the cover plate, which carries the soldered connections for the vibrator. The metal plate upon which the vibrator is mounted is of pressed steel, and the holes therein for the reception of the vibrator parts are drilled through a template to standard spacing. This plate is given an attractive hand finish and lacquered. All vibrator parts are standardized, and large use is made of brass rod, drawn to special section, giving the required shape of the required part when cut off to standard length and finished. The screw parts are made on automatic screw machines.

A change has been made in the 1908 Heinze vibrator. Instead of mounting the stationary contact point in the lower end of a screw, which is turned into the bridge to a shoulder, and there secured by a clamping screw, the upper stationary point is now riveted right through the bridge, and thus permanently secured. This obviates the necessity for the use of silver solder, which, when the coil is overloaded, is apt to melt and cause sticking of the points. It also obviates the chance of tampering with this part of the vibrator on the part of the user. The spring adjustment is in the form of a thumb nut, with no slot to which a screwdriver can be applied to the detriment of the parts. This new vibrator is said to operate at a very high frequency, the moving platinum point being held by a very light and flexible spring, riveted and also soldered to the copper plated soft iron armature. The contact points themselves are of platinum-iridium alloy, and are of very liberal size. The coil boxes in which the units are assembled for dashboard service, and which carry the automatic inside contacts, are built of several species of selected mahogany to match the finish of the car. For the high tension binding posts a very substantial screw clamp is used, and the terminal caps are of porcelain with a molded thread, instead of rubber or composition.

Two styles of timer are being manufactured by this company. The first is of the jackknife switch contact type, Fig. 2. The base and shell H is turned out in a single piece from dense gray fibre of high insulating quality and the very substantial bronze bearing is inserted therein. On the inside surface of this bearing is turned a coarse square section thread which is filled with a heavy graphite lubricating composition which cannot escape at the bearing ends. The stationary contact sectors A are of hardened steel with beveled edges, like the blades of a knife switch, and their terminals are brought out to posts B on the periphery of the shell, provided with nuts and washers. The moving contact B on the shaft is of double brush form, like the fixed contact of a switch, and connection is successively made by this double brush to both sides of each fixed steel contacts when the shaft is turned. These brushes are of phosphor bronze and very long, of circular arc form clamped to the shaft at one end, C, and split at the other, D. They are so long that they bend but slightly, as the fixed contacts pass between them. They are readily reversible for engines turning in counter-clockwise direction. A special ground connection brought out to a post E on the back of the shell is provided. This is formed by a phosphor bronze spring, F, pressing against the end of the timer shaft.

There is in reality a quadruple electrical contact provided in this construction, as each half of each split brush, when it touches the fixed contact, is sufficient to give the requisite conductivity. The contacts are self cleaning and all parts are packed in grease. A spun aluminum cover is used, secured by two cotter pinned thumb nuts. In the face of the shell is turned a groove into which the edge of the cover fits, and in this is laid a small rubber tube which seals the cover against loss of lubricant or access of moisture. The clamping shaft collar is made to fit any make of engine and two set screws, 120 degrees apart, are provided. A spring washer between the collar and the bearing maintains the alignment of the contacts. This timer may be had for engines of any number or arrangement of cylinders.

The roller contact timer, Fig. 3, is of quite conventional design in most respects. The bearing is graphite packed. The insulating shell is tooled out of dense, non-absorbent black vulcanized fibre, and the segments and roller are of steel and hardened. Between each two of the steel con-

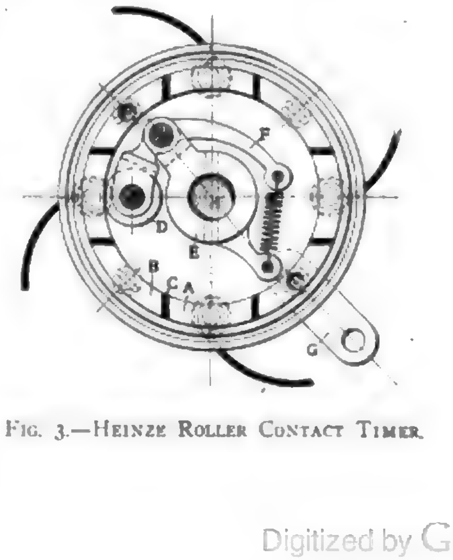


FIG. 3.—HEINZE ROLLER CONTACT TIMER.

tact segments A is a "dead" segment B, also of hardened steel, and rubber insulating strips C are used to separate each segment from its neighbors. The edges of the segments are so formed that when the binding posts are attached all the segments are firmly held in circular alignment, providing a perfectly smooth path for the contact roller D. A common fault of timers of this type, in which the space between the segments is filled with fibre or other insulating material, is that the latter wears at a different rate than the segments, and after a time the roller "jumps" when leaving the insulating spacer for the next contact segment, resulting in a late contact at high speed, a contact period very much reduced in length or an entire failure to make connection.

In this timer the roller, when leaving a live segment, passes over the narrow insulating spacer, which is only about one-sixteenth of an inch in width, and then enters upon the adjacent hardened steel spacing segment, which is identical in surface and wearing qualities with the live segment. The result is that, as the roller is always traveling over a uniformly hardened steel surface, the wear is constant at all points, and no inequalities capable of causing "jumping" are developed. The main rotating part E is of bronze and fastened to the shaft end by a taper pin, the projecting small end of which is cotter pinned. The pivoted, spring pressed arm F, which carries the roller, is also of bronze, secured by a steel pin in the main rotating part, and acted upon by a coiled steel spring. The contact roller bearing is a steel pin. This timer is intended to be packed with grease, and its working parts are covered by a spun aluminum cover, secured by two thumb nuts and sealed in its groove by a rubber tube gasket. The timing arm G is of heavy brass, mortised into the fibre shell, and the shaft collar is secured to the engine shaft by two steel set screws 120 degrees apart. This timer is made for motors of any number of cylinders and any size of shaft.

The 1909 Rambler Spare Wheel.

A unique feature of the 1909 Rambler line is the spare wheel and inflated tire. All 1909 four cylinder Ramblers are fitted for this equipment, which consists of a wheel complete, except the hub centre, on which is carried a complete tire inflated. The wheel is secured to the hub centre by six bolts. Removing the six nuts from these bolts, the wheel can be detached by means of special tools, a wheel puller and a socket wrench. Only three minutes are required to make the change, it is claimed. This spare wheel is a regular wheel in every particular. It fits on either front or rear, and it is not necessary at the end of the trip to change it. In the event of tire trouble the injured tire can be repaired, replaced on the original wheel inflated, and that wheel is thereafter carried as a spare wheel. The manufacturers state that besides being a handy provision against tire trouble, an extra wheel is always valuable in case of need. Special brackets are provided to carry the wheel and tire, and an extra charge is made for the complete equipment.

Buick and Olds Agency Reorganizations.

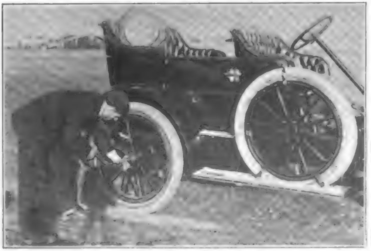
The recent expulsion of the Buick Motor Company and the Olds Motor Works from the Association of Licensed Automobile Manufacturers has entailed a reorganization of their agency connections by these two establishments. Of course, where either of these now unlicensed firms was represented exclusively the agent could change his status from that of a "licensed" to that of an "unlicensed" dealer without any inconvenience; but where several lines were handled he was confronted with a question of choice, and it seems that various dealers handling a well assorted line of licensed cars stuck to their former affiliations.

It is a noteworthy fact that the two firms which have recently left the licensed fold occupied leading positions among licensed makers as manufacturers of low priced cars, and that their admission to the ranks of unlicensed makers will lead to a sharper contrast in the matter of price between the licensed and unlicensed branches of the industry than has heretofore existed. There is now no faction in the Licensed Association marketing a product corresponding to that of the Ford, Buick, Maxwell, Reo and Brush companies, and in consequence it may be a difficult thing for the Licensed Association to hold some of its agents down to their agreement to handle none but licensed cars, especially in districts where there is a strong demand for low priced machines. A chance therefore offers itself for a licensed manufacturer to bring out a low priced runabout. It is an undoubted fact that its position as the only licensed maker of a moderate powered, low priced touring car was one of the strongest factors in the making of the Buick Motor Company, and a similar opportunity seems now to be offering.

Apparently the secessionists from the licensed camp are not being received by their unlicensed confrères with any show of friendly feelings, for report has it that protests have been made against their admission as exhibitors to the Grand Palace Show, and that neither the Olds Motor Works nor the Buick Motor Company will exhibit there.

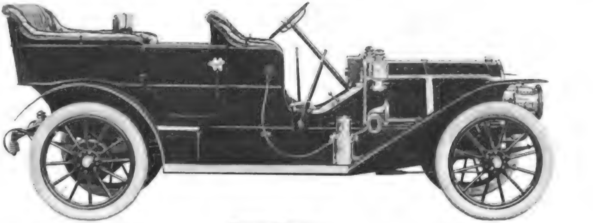
Pope Hagerstown Plant Sold.

The Hagerstown plant of the Pope Manufacturing Company, at which Pope-Tribune cars were formerly built, is reported to have been sold to the Montrose Metal Casket Company, the price agreed upon being between $65,000 and $70,000. The sale, however, still needs the confirmation of the court before it becomes effective. The plant covers a floor space of more than 3 acres, and during its busiest period during the bicycle era gave employment to 1,700 men.



Rambler Spare Wheel Carried on Car. Removing Damaged Wheel.

Spare Wheel Ready to Be Put in Place.



RAMBLER MODEL 45.

The Race Control Situation.

That the agreement reached between the American Automobile Association and the Automobile Club of America is only a truce and that it will not clear the racing situation in this country is becoming daily more apparent. The Automobile Club appears to be in the ascendency as a power in racing matters and the Automobile Association on the decline. There is now talk of a new club (or perhaps the term corporation would be more fitting) to assume control of racing in this country. The men behind this scheme are connected with the Long Island Motor Parkway enterprise. It is planned that this new body shall take the place of the Vanderbilt Cup Commission and control unrestrictedly the races for the Vanderbilt Cup and for the Grand Prize of the A. C. A., together with any other races that may be held on the Parkway. In other words, the officials of the Parkway are seeking to establish themselves as the highest authority in control of automobile racing so they may not have to take directions as to the conduct of races from outside parties. The names linked with the new scheme are those of William K. Vanderbilt, Jr., Jefferson De Mont Thompson, Henry Sanderson, Judge E. H. Gary, W. M. Hamilton and Robert Lee Morrell. These include prominent members of both the A. C. A. and the A. A. A.

Grand Prize Race Entries Closed.

The entry lists for the Grand Prize Race of the A. C. A., which is to be held at Savannah, Ga., on Thanksgiving Day, closed on November 1. There are a total of twenty-two entries, including six American, six Italian, five French and five German. The list of the drivers, with their cars, is as follows:

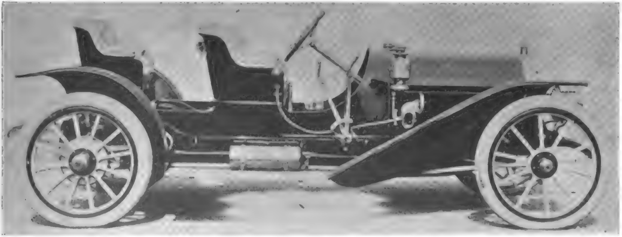
Louis Wagner (Fiat).
Felice Nazarro (Fiat).
Ralph De Palma (Fiat).
Henri Fournier (Itala).
Alexandre Cagno (Itala).
Giovanni Piacenza (Itala).
Victor Hemery (Benz).
Rene Hanriot (Benz).
Fritz Erle (Benz).
Willy Poege (Mercedes).
—— Salzer (Mercedes).
Lucien Hautvast (Bayard-Clement).
Victor Rigal (Bayard-Clement).
Arthur Duray (De Dietrich).
Francois Szisz (Renault).
Lewis Strang (Renault).
H. T. Grant (Locomotive).
Cyrus Patschke (Acme).
Harry Michenor (Lozier).
F. Norton Seymour (Simplex).
—— —— (National).
Willie Haupt (Chadwick).

In the Light Car Race, which will be run on the day preceding the Grand Prize Race, there will be twenty starters, including three Chalmers-Detroit, four Buicks, three Oldsmobiles, four Maxwells, and one each of the following: Lancia, Isotta-Fraschini, Cameron, American Aristocrat, Gregoire and S. P. O.

The Rambler 1909 Model 45—Correction.

The cut herewith was erroneously captioned "Thomas 6-40 with Special Body" in our issue of October 21, while it actually shows the Rambler Model 45. The correct cut of the Thomas 6-40 is also shown here.

An automobile service has been established between Tuckerton and Atlantic City, N. J., daily trips being made. It is the intention of the promoter of the line to extend it as far as Barnegat, to connect with the Central Railroad of New Jersey.



THOMAS 6-40 WITH SPECIAL BODY.

COMMUNICATIONS

Failure of Automatic Air Inlet to Quickly Respond to the Throttle.

Editor Horseless Age:

If you can give me any advice in the next number of your paper in regard to the following it will be greatly appreciated. Would say that my auto is equipped with a two cylinder, 12 horse power motor. It has automatic intake valves, and is fitted with a carburetor that also has an automatic air valve. The carburetor has no hot air intake, and the distance of the pipe between the motor and carburetor is about 16 inches.

The engine runs very well when the spring on the automatic air valve of the carburetor is screwed down tight, not allowing the valve to work; but then the engine uses a great deal of gasoline (it runs only about 10 miles to the gallon). When I allow this valve to work (that is, using more air), I can travel about double the distance to a gallon, but on opening and closing the throttle the engine misses a few explosions, but otherwise runs well.

I have been told that carburetors with automatic air valves never work well on an engine with automatic intake valves. If this is the case, kindly tell me what sort of a carburetor will best suit this motor, or what you think the trouble can be?

John Gaul, Jr.

[The simplest remedy for this trouble is undoubtedly that described in this issue under Maintenance and Repairs. By providing a movable support for the spring of the automatic valve you can suppress or regulate the automatic action at will.—Ed.]

A Question in Hydrostatics.

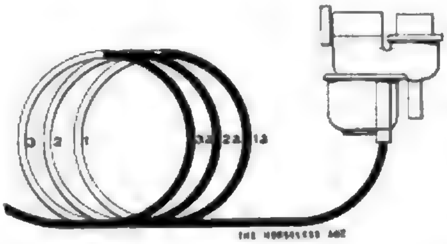
Editor Horseless Age:

Referring to an article by Albert L. Clough, page 544, Vol. 22, No. 17, of The Horseless Age, I should like to ask you as a matter of information, is the pressure of the gasoline contained in the three coils illustrated in the diagram equal to the pressure of the sum of the heights of the three columns, or to only the pressure of the height of one column?

When looking at it from one point in my own eyes I see but the pressure of one column. When I try to get an analogue to the slug pump, I see the pressure of the height of three columns, and then from still another point of view, considering the siphonic action, I see the pressure of but one column.

L. E. D.

[This point will probably be rendered clear by the following considerations, having reference to the accompanying sketch. Supposing that the branch 1 of the last spire of the coil is filled with vapor, as indicated in the drawing. Then the pressure in this portion of the spire is evidently somewhat above atmospheric pressure, as it must support the column of gasoline in the end of the pipe leading to the carburetor. We will assume that the excess pressure above atmosphere in section 1 of the coil is equal to the pressure due to a head of gasoline equal to the diameter of the coil. The flow through the coil will evidently begin when the gasoline in section 1*a* of the coil reaches the top of this spire. Then there will be a pressure on top of the gasoline in section 1*a* equal to the gaseous pressure in section 1. At the bottom of section 1*a* the pressure will be greater, owing to the weight of the gasoline in section 1*a*. Under the assumption made above, this pressure will be double the pressure in section 1, and we will call it 2 units. As it is the gaseous pressure in section 2 of the coil that supports the column of gasoline in section 1*a*, it is obvious that the gaseous pressure in section 2 is equal to 2 units throughout, and this same pressure is exerted against the top of the column of gasoline in section 2*a*. At the bottom of section 2*a* the pressure is increased by another unit, owing to the weight of the gasoline in this section. In section 3 of the coil, the gaseous pressure is, therefore, 3 units and at the bottom of section 3*a* the total pressure is 4 units.



It will thus be seen that the pressure in such a coil is cumulative. In reality the conditions would be not exactly as shown in the illustration. For instance, if when the pressure was applied there was the same amount of vapor in the top portion of each spire, owing to the differences in pressure in the various spires after the pressure was applied, the volumes of vapor would be compressed to different degrees in the different spires, and if the vapor completely filled section 1 of the coil, it would not quite fill section 2, and still less section 3. But the total pressure necessary to force gasoline through the coil would be equal to that of a head of gasoline equal to the sum of the heights of the vapor columns in all of the spires.—Ed.]

The Carbon Content of Steel—The Omitted Decimal Point.

Editor Horseless Age:

I wish to call your attention to a slight error on page 578, issue of October 28 of your publication, and while it is a typographical error which could not be misconstrued by the engineering fraternity, it might lead a non-mechanical motorist to infer that steel with a very high percentage of carbon was suitable for use in various parts of the motor car.

In the communication from G. S. Granlund, relating to a somewhat ingenious but old method of repairing a broken tooth in the gear, reference is made to scarfing "two pieces of 35 per cent. carbon steel" in place of the broken teeth, which had been removed by suitable means.

This is quoted to show that the elimination of such a small thing as a decimal point may lead to an error, while if not serious, may prove misleading to those who do not know and whom it is desired to instruct. The addition of a decimal point so that the steel will be .35 per cent. carbon, or, roughly, one-third of 1 per cent., gives the proper term applied to such steel as was undoubtedly used in making the repair mentioned.

Victor Page, M. E.

Match Lamp Lighter an Old Idea.

Editor Horseless Age:

I was very much interested in seeing your description of the novel French match lighting attachment, with accompanying illustration. Immediately on seeing this picture I looked among my odds and ends and found a device almost identical in design and absolutely the same in operation as the one illustrated. I got this match lighter with an oil lamp for my bicycle away back in 1895 or 1896, and found it very useful at that time. I put it away and thought no more about it until seeing your illustration.

There is a disadvantage in this device that has come up in the last four or five years. With this device it is impossible to ignite the birdseye match, because only the point of the match ignites, the other part being only a fuse or flame conducting material. I tried yesterday with some birdseye matches to make them light but failed absolutely.

I thought it might be interesting to know of another case where these apparent novelties are really old in design and application.

E. A. Barnes.

Adjusting the Mesh of Bevel Gears.

Editor Horseless Age:

Will you please tell me the method of adjusting the bevel gears of a shaft driven car? After driving a new car about three months a roaring noise developed, much like the sound of a car on the second gear. The machinist at a local garage and myself seem to be unable to adjust it properly. The bevel gears and differential are carried between two roller bearings adjustable by means of two collars. Any information you can give will be much appreciated.

Olympic.

[Without seeing the axle it is impossible for us to tell you definitely how it can be adjusted. The collars on the roller bearings are probably only for the adjustment of these bearings and have no effect on the mesh of the gears. It is, of course, possible that the mesh can be adjusted by moving the differential in the direction of the axle, but usually the means for adjusting the bevel gears are on the pinion shaft. We would advise you to closely inspect the bearing supports for the pinion shaft and see whether they cannot be moved inward and out. If the pinion is moved inward or toward the differential, the gears will, of course, be brought into closer mesh, and vice versa. The correct adjustment can only be determined by measuring the clearance at the bottom of the teeth at their outer or bigger end. The amount of this clearance depends upon the pitch of the teeth, and you must, therefore, first determine the pitch. Measure as closely as possible the diameter of the gear wheel at the centre of the teeth, in inches, and count the number of teeth in the gear. The number of teeth divided by the diameter gives the diametrical pitch, which you will probably find to be either four, five or six. If it is four, there should be at the bottom of the teeth a clearance of one-thirty-second inch; if five, one-fortieth, and if six, one-forty-eighth inch.—Ed.]

Makers of Optical Indicators.

Editor Horseless Age:

Will you kindly inform me through your columns of the manufacturers of any photographic reflecting indicators for obtaining pressure diagrams from high speed engines?

T. S. Bailey.

[There are only two such indicators on the market, viz., the Hospitalier and the Schultz, both of foreign manufacture. The former is handled in this country by Hugo C. Gibson, 630 West 135th street, New York, and the latter by Joseph Tracy, 116 West Thirty-ninth street, New York.—Ed.]

Indiana Good Roads Bureau Formed.

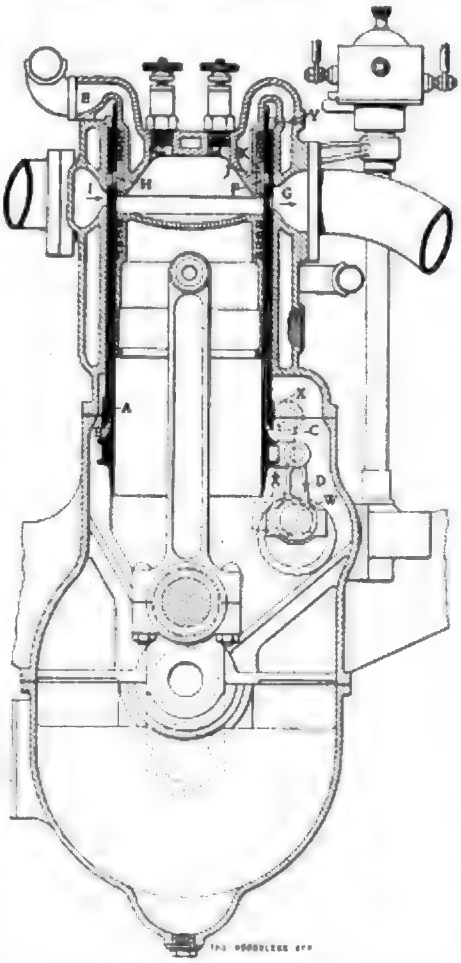
The Indiana Bureau of Good Roads, with headquarters in Indianapolis, is being organized for the purpose of urging a reform in the present system of road building in that State. A temporary committee has been appointed consisting of R. A. Brown, president; George C. Pyle, secretary, and F. I. Willis, treasurer. At the session of the Indiana Legislature next January a bill authorizing the creation of a State Highway Commission, to have charge of all road building in Indiana, will be championed by the bureau. While millions of dollars are being spent on Indiana roads, the bureau believes that much of it is being wasted in the building of roads that will last only a short time. In many instances bad drainage, bad grading and later neglect cause their ultimate destruction.

Racing Cars Excluded from London Show.

The Society of Motor Car Manufacturers and Traders, which conducts the annual Olympia show, which takes place this year November 13 to 21, has just notified all of the exhibitors that no racing cars must be exhibited at any of the stands and no notices regarding racing achievements displayed. It is said that this action was taken by the Society at the request of King Edward himself, and that this came as the result of the numerous fatal accidents in connection with automobile speeding which have recently occurred in England. During the time of the recent Isle of Man four inch race there was a great popular outburst against racing, which has not subsided yet.

The Knight Motor.

We print herewith the sectional view of the Knight motor which was inadvertently left out of the article on this motor in our last week's issue. Readers who take an interest in this motor are requested to refer to this cut when reading the description of the valve action of the motor as published in the last week's issue.



Knight Engine.

The Paris Conference of the Recognized Automobile Clubs.

As already briefly reported in these columns, the Conference of Recognized National Clubs, which convened in Paris on October 19, decided that during the seasons of 1909 racing cars should be limited to a bore of 130 mm. for a four cylinder motor and to a minimum weight of 900 kgs., or 1,984 pounds. This bore of 130 mm. was originally recommended by Germany, Italy and Belgium, while France recommended 140 mm., England 120 mm., and America a maximum cylinder capacity of 10 litres. After a protracted discussion of the matter the French delegates gave their consent to the adoption of 130 mm. bore, but they insisted upon the low weight limit of 900 kg. originally proposed by them, and this, too, was adopted. The other clubs recommended weight limits of 1,000 and 1,050 kg. For six cylinder motors the limit of bore is 106 mm., which gives almost exactly the same piston area. It was also decided that double piston motors should be rated the same as ordinary single piston motors, while formerly the bore of such motors was restricted to a lower limit. The proposal of the Italian A. C. to establish a classification of touring cars for competition purposes was not acted on. The proposal of the Belgian A. C. to appoint an international sport committee was postponed to the meeting to be held on November 30.

The Coming A. A. A. Elections.

It has been given out that President William H. Hotchkiss of the American Automobile Association, who has held the office for two years, will not consider re-election. The natural successor to Judge Hotchkiss under the unwritten rule established by custom in the A. A. A., would be first vice-president Lewis R. Speare, of Boston. Mr. Speare states that he is not seeking the office, but this may be only the usual early disclaimer. Under the circumstances the following expression of his views, given by Mr. Speare to a representative of a Boston paper, may be of interest:

> I am heartily sick of the racing game and would like to have the A. A. A. drop it altogether. The way this sport is controlled at present is not a credit to anyone connected with it, and racing is only a slight portion of the great work being carried on by our association. Everything else is lost sight of because racing is popular and arouses the public interest. There are other matters, however, that are far more important to the owners of automobiles, such as legislation, good roads and the work of touring boards. These are things that the real automobile people have most at heart, and it is in carrying them forward to successful issue that an association such as ours can best demonstrate its usefulness.

Road and Route Map for Californian Motorists.

The Automobile Club of California has just issued a route book and road map containing many valuable data in a condensed form so as to make them easy to refer to. The Livermore Valley is being marked with automobile signs by the club, and work will soon be begun on the road to Sacramento, the State capital. The work of marking the roads of California with automobile signs will be continued as long as the fund lasts.

A new trackless trolley service has recently been inaugurated in the outskirts of Vienna, Austria, between Neustift and Sallmannsdorf. The line construction is on the Stoll system, and four Mercedes electric cars are being used for the present.

Commercial Applications.

Commercial Motor Vehicle Development in New York City.

By H. H. W.

New York city doubtless presents the most numerous and most varied examples of the application of the motor truck. Practically every line of industry furnishes such examples, and all types of trucks are in use. New York city is so situated that an enormous amount of trucking is necessary for the transfer of goods from the railroads to the warehouses and stores, etc. Formerly this work was done exclusively by horses, but on account of the congestion, great space occupied by horse trucks, amount of care required by horses, and health conditions, manufacturers and dealers have been looking for some other more advantageous means for the transfer of their goods. Theoretically, the motor truck is the only sure solution of the problem, but there are many considerations involved which, unless thoroughly understood, will prevent this type of truck from becoming a financial success. This branch of industry has already received several serious setbacks through manufacturers entering the field without a thorough understanding of the conditions involved and attempting to put a special commercial body on a regular pleasure chassis. The natural result of this was the early failure of these trucks, much to the dissatisfation of the user, and there are to-day many dealers who, on account of this experience, will have nothing further to do with the motor truck, and it will be some time before their confidence will have been restored.

The manufacturer must first realize the requirements of a truck and then must literally hammer the fact into the heads of the buyers that the trucks have their limitations and must have as careful attention as horses. One often sees a horse truck loaded up to the horse's capacity on good roads, with the result that the truck is stalled on slippery or muddy streets, requiring outside help and causing loss of time. Many users of motor trucks follow this same procedure, and because the truck succeeds in pulling through under its own power congratulate themselves on being able to get so much more work out of it, little realizing that they are laying the foundation for future trouble. Such are the conditions the manufacturer must contend with after he has designed and manufactured a thoroughly efficient and reliable motor truck, and unless each truck is carefully watched dissatisfaction is sure to arise. Builders of stationary engines have their men for months at a time watching a new installation in spite of the fact that the purchasers of the machine have skilled engineers of their own. Although it would, of course, not be practical to do the same in the case of every truck sold, it would be possible and perfectly practical to have a man visit the users regularly and see how the truck was being run and under what conditions. This would prevent many mistakes, to the general satisfaction of all concerned.

The successful operation of motor trucks depends upon four factors. The most important of these is the driver, for more hinges on his work than on any other one thing. He should be fully responsible for the truck, and, while he may not be required to do the repair work, should be required to report all trouble, however small, and see that it is corrected. He should, also, be fully capable of judging whether the load is excessive or not, and should have authority to reduce it if necessary. A great deal depends upon so driving as to avoid all the rough spots possible and not to strain the car.

Second in importance to the driving comes the manner of taking care of the truck, including storing, washing, etc. A private garage, in the hands of a reliable mechanic, undoubtedly presents some advantages; but it is a question whether, for less than four cars, these advantages justify the additional expense. With electric trucks, at least, where less than four are used, it is too expensive to hire a skilled man to take care of them. In small installations, with a lesser number of vehicles, the trucks usually do not receive the proper attention. With four or more the service could doubtless be made very satisfactory by hiring a skilled mechanic or mechanics who take entire charge of the upkeep. For merchants who do not require more than one truck, the best plan is undoubtedly to hire a truck from a central station making a specialty of this business. With a well organized force of mechanics, which a station of this kind would economically permit, the service could undoubtedly be made satisfactory and depreciation reduced to a minimum.

Next in importance comes the question of the load to be carried. It is to be regretted that many users seem to think that it is the best policy to put as heavy a load as possible on the truck, regardless of its capacity. The writer has talked to several users who were proud of the fact that they could overload their trucks far beyond their capacity. One user complained that the gears in the change gear case had crumbled away. Further conversation revealed the fact that this truck, which was of 5 tons' capacity, was frequently loaded up to 10 tons and driven long distances. The wonder is that nothing but the gears failed with this increased load.

The last, but not necessarily the least, consideration is the speed at which the truck is driven. The use of solid tires and heavy springs causes such excessive vibration at even medium speeds that too much cannot be said against the temptation to fast driving. While it is generally the result of the inclination of the driver, it is, however, often the order of the manager that the goods be hurried to their destination. The electric truck has the advantage over the gasoline truck in this respect on the level or up hill, as it cannot be driven at an excessive speed owing to its limited power, but it is not superior on down grades. If an electric truck is allowed to run down grade unchecked the speed may easily become so great as to cause the armature to burst. If the driver cannot be made to drive within the safe limits of the truck he should be gotten rid of, or a non-tamperable governor should be placed on the engine.

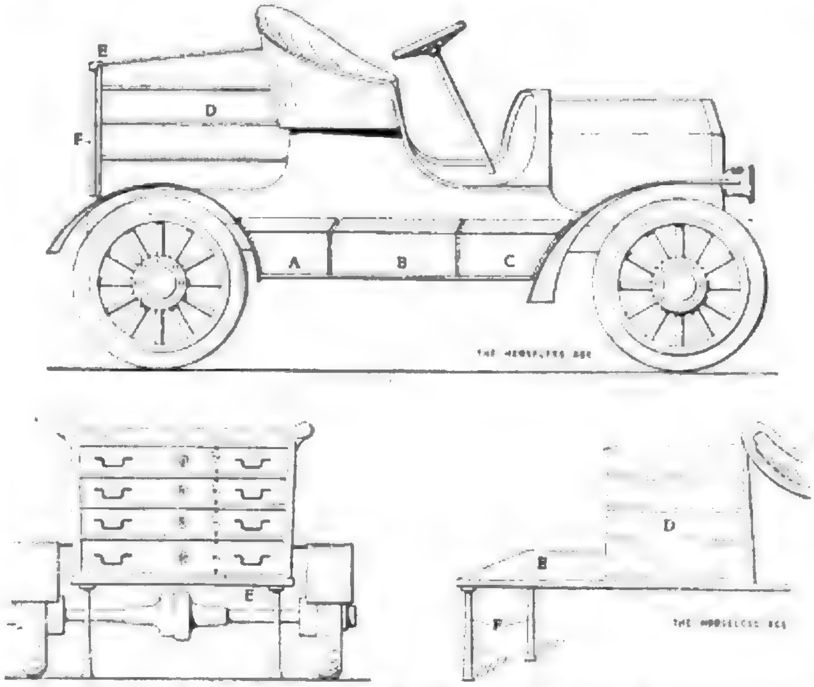
When these conditions are fully understood and a good truck is selected, the service will in most cases prove more economical than an equal horse service; besides, the equipment will be cleaner and take up less room. The smaller amount of room taken up by this type of truck, its greater ease of control and its cleanliness appeal to all business men desiring to better their service. New York city really has reached a point where a vehicle of this type is necessary to solve the problem of the rapidly increasing congestion on the streets. Striking examples of this congestion are found on West street and other downtown streets. The elimination of the horse for trucking purposes would make a much cleaner and better city. Besides, it would more than double the capacity of the streets for traffic. Of course, a great deal will have to be done to the streets to put them in good condition for the practical use of motor trucks, but once in good condition their deterioration will be much less rapid than with horses. Many of the downtown streets are in such outrageous condition that they threaten to shake any truck to pieces in a short time.

The present introductory article will be followed by a series giving descriptions of the services of different firms in the metropolis, classified according to the different lines of business in which they are engaged. Efforts have been made to make these articles fairly comprehensive, but doubtless a few users of single cars have been omitted. Wherever possible the cost of operation has been obtained, but in many cases users refused it, either because they had kept no special account of this branch of their expenses, or, as one man said, they are "not going to give the public the benefit of their experience." This last policy is rather narrow, to say the least, and the conclusion that the writer came to was that the service had proved unsatisfactory in this case.

Up to a couple of years ago the electric truck had the field almost to itself in New York city, but of late the gasoline truck has made itself evident, and is rapidly forging to the front, if it is not there already. In respect to simplicity and ease of control the electric truck undoubtedly has the advantage, but because of the necessary great dead weight carried (which means current consumption and increased wear on tires), rapid deterioration of the battery (which is expensive of renewal), and its limited radius of action, it does not appear to be as economical generally as the gasoline truck. The latter has an almost unlimited radius of action, and is capable of hauling heavier loads at greater speeds than the electric. On the other hand, it is more complicated and requires somewhat more attention than the electric. In the minds of the majority of users and prospective users, the gasoline or internal combustion engine truck is the one that will come into wellnigh universal use.

A Commercial Traveler's Car Design

A reader residing in South Africa sends us the accompanying sketch of what he considers a suitable car for his own purpose, making business trips through the country. In that country repair shops are few and far between, and a good supply of tools and spare parts must therefore be carried along, for which purpose no less than five tool boxes are provided, carried on the running boards. On the rear deck are four drawers, of the approximate dimensions given, and back of these is a sort of tailboard or flap-back, as our correspondent calls it, which can be let down and supported on legs at the outer end so as to form a table.



A, B, C, tool boxes (on off side C is omitted). D, drawers, made to fit car, approximate size given. E, flap back, hinged at bottom to open as shown. F, legs hung on pivots so as to support E, when in use.

Motor Truck Competes With Electric Lines.

The field of the motor truck has been extending so rapidly in southern California that during the past month the gasoline driven vehicle has entered into competition with the freight carrying electric roads, and if the motor truck cannot supplant the freight service in electric interurban lines it seems destined to bring about radical cuts in the rates charged for the service by the trolley lines. For more than five weeks the Angelus Motor Company, a small concern, has been operating a gasoline truck between Los Angeles and the beach towns of Venice, Ocean Park and Santa Monica, though three distinct and separate electric lines span the distance between the beach and Los Angeles, and though these lines are thoroughly equipped an dably managed the motor truck has succeeded in working up an excellent freight business, and the venture is said to have paid so well that the promoters are planning to add two other trucks to their equipment.

Los Angeles is the central supply point for all the suburban towns, over a score in number, in a radius of 25 miles. The grocers, butchers, dry goods and other merchants in these smaller towns do not carry large stocks; they rely upon the electric lines to replenish their stocks from day to day as needed. Taking advantage of this situation created by the trolley freight service, the Angelus Motor Company endeavored to obtain for itself a share of the daily freight business between the Los Angeles wholesalers and the retailers at the beach points. In this it has succeeded to such a degree that the truck on almost every trip is filled to its capacity at rates that leave a good margin of profit. The maximum load of the truck is 5 tons; it has a two cylinder engine producing 40 horse power, and it is fitted with solid tires. Its highest speed is 10 miles an hour.

With a full load the time required to make the distance of 14 miles between the city and the ocean usually is two hours. No attempt is made to force the truck to its utmost speed, since the electric freight cars with their frequent stops at wayside stations can only make the trip in two hours.

Two round trips a day are made by the truck. Early in the morning ,the motor wagon carries fruit, vegetables, fresh meat and similar articles from the commission houses in Los Angeles to the grocers, butchers and restaurants in the beach towns; in the afternoon the heavier freight, hardware, dry goods, paper and other supplies are carried. On every item of freight the motor truck cuts the rate asked by the electric lines; the largest part of the truck's morning freight consists of fresh meat. The rate for this article on the electric lines is 12 cents per 100 pounds. The rate on the truck is 11 cents. But this reduction of 1 cent per hundred, or 20 cents per ton, would not have been sufficient inducement for the business men of the beach towns to change from the electric roads if the motor truck did not save them the expense of hauling the goods from the freight station to their places of business. The transfer of the goods from the cars to the stores costs the merchants of the beach towns 5 cents per hundred, $1 per ton, or $20 for the average carload. The motor truck does away with this expense. It delivers the goods direct at the store of the merchant, thereby effecting a saving of 6 cents per hundred pounds.

Horse drawn vehicles cannot, of course, compete with either the electric lines or the motor truck in the interurban business. The motor truck transports 5 tons over 14 miles in two hours; a double team in good condition makes the distance in four and a half or five hours, pulling only 3 tons, and after the return trip it is impossible for the team to attempt a second journey over the route the same day. Even one round trip each week day will ruin a team of good horses within eighteen months. The expenses for help are almost equal. It costs $5 per day for the driver of the motor truck and his helper, $3 for the driver and $2 for the helper, while the same expense for a double team amounts to $4.50 per day. Including wages, repairs, gasoline, oil, batteries and accessories, but exclusive of depreciation, the operating expenses for the first month of the truck's service were a trifle more than $7 per day, while the average receipts were $15 per day. Allowing 20 per cent. of the invested capital for depreciation, still the weekly profit of the truck would be between $30 and $35.

One most important item has not been considered so far in the review of the truck service, and that is reliability and promptness. During the initial five weeks the owners of the truck have been lucky; no serious delays in the delivery of the perishable goods have been encountered, but during the coming rainy season delays will be inevitable unless a reserve equipment is maintained by the company. Though California is fortunate enough to be free of blizzards, snowdrifts and ice covered highways, the winter rains do damage the roads and often make them almost impassable. The demands upon the engine and the frame of the truck will be trebled when the wet season begins, and it is altogether probable that more than once the strain of the rough and muddy roads will put the truck temporarily out of business. In such a contingency all the business worked up by the new concern would be at stake, and probably a large part of it would be lost unless a reserve truck could be sent out immediately to take the place of the one disabled and finish the trip. Prompt and regular delivery is one of the features of the trolley freight service that enabled the suburban merchants to get along with small stocks; they will not consider the vagaries of a motor truck service in buying their suppplies when they can get reliable service at higher prices from the electric roads. In order to succeed the motor truck service must work with the clock-like regularity of a railroad system. If it does not it is doomed to failure. The truth of this maxim was proved in the instance of a Los Angeles truck company starting out with sixteen large electric trucks. Though the field was excellent, though power was cheap and climatic conditions made the work easy the year round, the enterprise failed because all of the sixteen trucks were put into use at once and all began to be in trouble at once, so that no reserve was on hand. The service became erratic and unreliable from the beginning. In a still greater degree reliability is necessary in the competition of motor trucks with electric lines for the suburban and interurban traffic.

The field for motor freight trucks in suburban and interurban service around Los Angeles will be improved materially during the next two years, when the network of permanent highways, costing $3,500,000, will have been completed. A good roadbed and heavy rails are essential for the operation of the high powered, heavy, speedy electric freight cars, and a firm, smooth, hard road is just as essential for the operation of a motor truck service at all seasons.

A Man Hunting Automobile.

A four cylinder, seven passenger touring car, with a motor developing 45 horse power, has been part of the equipment of the sheriff's office of Los Angeles County, California, and since the county supervisors authorized its purchase a year ago the machine has been of invaluable assistance to that official. In dozens of midnight raids on "blind pigs" situated far out in the rural districts of the county the motor car has demonstrated its superiority over horse drawn vehicles, since it enables four or five officers to reach the suspected place at top speed and surprise the illicit bar before warning can be conveyed to the proprietor. In the service of legal papers requiring the utmost speed the automobile excels, but its chief usefulness has been found while chasing prisoners or escaped criminals.

A large part of Los Angeles County consists of portions of the Sierra Madre and other mountain ranges, rising to a height of 7,500 feet, through which a number of passes lead to the Mojave Desert to the north. Fugitives from justice by preference choose this rugged, waterless, parched plain, and in former times most of them succeeded in making their escape once they had reached the trackless desert. Since the advent of the automobile the desert is no longer the favorite refuge of the criminals. Last January James Westfall, a fugitive accused of having stolen a herd of horses and mules, was captured 235 miles north of Los Angeles, in Inyo County, after relentless pursuit by the man hunting automobile. While the automobile passed through the San Francisquito Pass it had to ford a half dozen mountain streams swollen by the winter rains and snows, and when it reached Mojave, a town in the desert of the same name, it was discovered that the horse thief had left the place four days prior to the arrival of the automobile, riding north on a fresh horse. The distance made by the rider in four days was covered by the officers in the automobile in eight hours, and the horse thief was arrested while asleep in a corncrib. A few months ago another band of horse thieves was broken up when the machine, after the sheriff had learned the whereabouts of the gang, arrived at a lonely spot in the Coast Range, 45 miles from Los Angeles, an hour and a half after starting.

In consideration of the rough, broken nature of the uninhabited regions the automobile has to penetrate, an elaborate outfit is carried. It is equipped with a common siren, an electric siren and a whistle, similar to the one carried by a locomotive, in order to be able to attract assistance if necessary. Block and tackle, picks and shovels are always taken on out of town trips to conquer sand and fords; of course, a full set of tools is carried, and a supply of heavy clothing for the officers. A dozen inner tubes and six extra casings, besides a storage tank containing 25 gallons of gasoline, complete the equipment. Besides the wages of the driver, the automobile necessitates a monthly expense of $20 for the garage where it is kept; the bills for gasoline, oil, etc., average $25 per month, exclusive of tire expense. Since the driver is a competent mechanic, able to make repairs and adjustments, the bills for this class of work have been only $1.75 during the machine's first year of service.

Operate More Taxicabs.

The Western Motor Car Company, of Los Angeles, Cal., after operating two taxicabs for a period of six months, has decided to increase the number of the machines to six, and perhaps more, if the business warrants it. The company representing the manufacturers intended to operate the two original taxicabs simply to demonstrate their earning capacity for the purpose of creating a market for the machines, but the operation of the cabs furnished such satisfactory results, it is claimed, that the cars will remain in the hands of the present owners.

Commercial Notes.

The British War Office is organizing a military tractor competition for February, 1909, to extend over a period of fourteen days. The winning vehicle will be purchased outright by the War Office.

The Taxi Service Company, of Boston, has filed notice of an increase in capitalization from $120,000 to $350,000. The company will issue $40,000 additional common stock and $190,000 preferred stock.

The Milwaukee Y. W. C. A. is considering the advisability of purchasing a motor car to overcome what is said to be the greatest difficulty in operating an employment agency, that connected with the safe delivery of applicants to situations.

Irwin S. Scrimger, Detroit agent for the Olds Motor Works, on October 7 started a taxicab service in that city with two machines, with a stand in front of the Metropole Hotel. The fare is 30 cents for the first half mile and 10 cents for each one-quarter mile thereafter.

A motor truck manufactured by the Randolph Motor Company, of Chicago, is being used by a cement firm to carry a 1,600 pound load of cement daily from Chicago to Aurora, Ill., and back. This test will be continued for 100 consecutive days, that is, if the truck stands up.

A new taxicab company has been formed to operate Renault cabs in San Francisco. The capital stock of the company is $300,000, and among those interested are Fay C. Beal, C. M. Beal, Geo. P. Fuller, L. W. Harris, R. J. Marx, Frank Hooper and Clarence R. Ward. The company expects to begin operations inside of two months.

The Bucyrus Transportation Company has been incorporated to run a motor passenger line between Bucyrus, Ohio, and surrounding villages, most of which have no railroad connections with the county seat. An order for several twenty passenger buses is said to have been given, and it is the intention to start the service about December 1.

John C. Curtis, manager of the Huntington Auto Transit Company, Huntington, Ind., announces that five cars have been bought for the service from the Coppock Motor Car Company, of Decatur, Ind. The first two of these are to be delivered about December 1, and it is the intention to begin the service December 15. Each car will carry sixteen passengers, and the bodies will be of the general form of trolley car bodies.

A 30 horse power gasoline truck has been purchased by the Polk Milk Company, of Indianapolis, and is being used in collecting milk from farmers. Previously this work has been done by interurban freight cars, requiring farmers to haul their cans to the nearest interurban station. Under the new system the truck drives to the farmer's house, collects his cans and takes them to the milk company's Indianapolis headquarters. A daily route of about twelve miles is covered, the trip requiring about three hours.

LEGISLATIVE and LEGAL

Responsibility of Driver for Display of Rear Lights.

A test case is to be made in Rochester, N. Y., to decide the question whether under the law an automobile driver can be fined if his rear lights go out while he is driving at night without his noticing it. George J. Bauer was arrested under these conditions a short time ago and fined $10, but the fine was suspended when Mr. Bauer's counsel announced that he would take an appeal to test the statute on this point. Attorney Forsyth, representing Bauer, said: "There is nothing in the statute making it a crime not to have lights lighted. The language of the statute is that every motor vehicle while in use on a public highway shall be so constructed as to exhibit (during certain hours of the night) two lamps showing white lights a certain distance from the direction in which the vehicle is proceeding, and red lights visible in the reverse direction. If the machine is so constructed that it has in fact the lights, if one or all of them are extinguished without fault of the driver there is no crime."

License Revocations in Massachusetts.

The Massachusetts Highway Commission is conducting a vigorous campaign against reckless and incompetent drivers of automobiles. Up to date seventy licenses have been revoked or suspended this year. Of this number forty were revoked for the following reasons, viz.: twenty-seven for reckless operation, six for intoxication and four for taking out machines without owner's consent. The Highway Commission based its action in these cases upon the evidence obtained at investigations and hearings and also on court records. Eight licenses were suspended because the death of some person was caused by an accident. In two of these cases the licenses were restored after a hearing, as the board found that the operators were not to blame.

Fighting Garage License.

Property owners in the vicinity of 5 Remington street, Cambridge, Mass., are making strong objection to the granting of a license to sell gasoline and conduct a garage at that address. The board of aldermen of Cambridge gave a hearing on the matter October 20. Several who spoke against the granting of the license stated that they conducted furnished room houses, and that if the garage was operated in their vicinity they would have greater difficulty in renting their rooms and would have to be content with smaller rents.

Legal Notes.

Fire Chief Dunn, of Hoboken, N. J., is endeavoring to induce the Hoboken fire board to pass a regulation regarding automobile garages and other places where gasoline is stored in large quantities, so as to reduce the fire risks.

An ordinance has been adopted in Seattle, Wash., which prohibits the standing of cars on Cherry street in that city. The measure becomes effective in thirty days. The present automobile hiring stand on Cherry and Second streets will be abolished.

Coroner Killip, of Rochester, N. Y., in handing down a decision of accidental death in the case of a woman killed in an automobile accident there, recommended that the Legislature compel manufacturers to limit the speed of their cars to the legal limit of 20 miles per hour.

Representative Ridgeway, of Austin, Tex., who is the author of the automobile law now in force in that State, announces that at the next session of the Legislature he will endeavor to have corrected the typographical error in the law, whereby automobiles are required to have their lamps lighted during day time instead of at night.

Owing to the activity of the Indianapolis police, 878 automobile owners out of an estimated 1,400, have paid the annual license fee of $3 required by the city. This is the largest number since the ordinance went into effect in 1903. The number in previous years has been 200 in 1903, 296 in 1904, 358 in 1905, 422 in 1906 and 503 in 1907.

The cases pending against E. R. Thomas, which grew out of his automobile accident at Long Branch some months ago, and on which there was to be a hearing on October 21, were postponed to November 21. There are three charges against Mr. Thomas, viz., one of reckless driving, preferred by Chief of Police James Layton; one of exceeding the speed limit and one of driving without a New Jersey license, preferred by Commissioner of Motor Vehicles J. B. R. Smith of New Jersey.

Another Foreign Invasion Reported Imminent.

In the early years of the American automobile industry, from 1900 on, the cry of the public was for French cars, Darracqs, Panhards, Decauvilles and others. Prices charged ranged from 100 to 200 per cent. above Paris prices, but they were eagerly paid. With the advent of the Mercedes cars in 1902 prices soared. The market had come to be looked upon as a good one, and nearly thirty foreign manufacturers were soon represented in this country. But meanwhile the domestic manufacturer was improving his product, new companies were formed, and cars were sold at much less than foreign prices. Excellent copies of foreign cars were made, or details from the best foreign practice were incorporated in American cars, with the result that the European manufacturer saw his market contracting, and, in some cases, disappearing altogether.

In 1905 the lowest price at which a foreign car could be bought complete with body, but minus lamps, horn, top, etc., was $4,000 for a 16 horse power model. During the next two years prices were gradually cut, until a similar model could be bought for $2,800. Agents for foreign cars who would not or could not cut prices went to the wall, and several agents were forced to combine to remain in business.

The foreign manufacturer or his agent has always labored under a disadvantage in this country in having to pay 45 per cent. ad valorem duty, shipping charges for 3,000 miles, boxing and cartage, and also for the upkeep of a costly showroom and garage. The prices were of necessity high, as the manufacturing cost could not be reduced owing to the methods used.

Prices of cars today are as low as they can possibly be made, if any profit is to remain for the agent. The costly showroom was a necessity during those times, but it is said that a number of agents went to pieces in trying to "live up to their quarters." Against all this we have the American manufacturer, who pays no customs duty, no shipping charges and very little for boxing and cartage. He also formerly maintained a costly showroom, but today is gradually getting over that. The advantage he had over his foreign competitor was great, not only in price but in time of delivery. The general buying public being able to get a domestic car of the same power for less than the price charged for the foreign product, gradually ceased to buy foreign cars, and the import figures have been on the decline ever since.

It is now reported that the foreign manufacturers are again to invade the United States, this time with reduced prices, but the same quality of workmanship. They have reduced their cost of manufacture to a very low figure, and while they do not hope to compete with the $500 to $1,500 cars in this country, they purpose to be active competitors in the field for cars above $1,500. There are said to be four principal firms engaged in this movement; particulars of their plans have as yet not become public, but two of them at least are coming over with cars of from 8 to 20 horse power, for which they consider the market condition better than for high powered cars. The firms reported as coming over are De Dietrich, Darracq, De Dion and Delaunay-Belleville. All have been represented in this country before, but their first experiences were not altogether successful.

Mail collection by automobile was introduced as an experiment in Lynn, Mass., on Monday of this week, an 18 horse power Ford car being used for the purpose. The car was specially fitted up for the service. Formerly it required two men and two horses to collect the mail in the district which is now to be covered by one car.

OUR FOREIGN EXCHANGES

Statistics of the German Automobile Industry.

In a recent issue we referred briefly to the statistics regarding the German automobile industry gathered by the German Department of the Interior. The last issue to hand of the *Allgemeine Automobil-Zeitung* contains a very complete review of the figures obtained in this compilation, and we consider it of interest to return to this subject. The statistics were gathered by means of question blanks, which were prepared and sent out to the various manufacturers with the assistance of the manufacturers' associations. The figures given represent the condition of the industry during the three years 1901, 1903 and 1906, respectively. It would have been practically impossible to obtain reliable figures prior to 1901, and they would, moreover, have been of little interest, as previous to that year the automobile industry had not developed to any great extent. One of the difficulties encountered in compiling the statistics was that so many important German automobile firms are also manufacturing other lines of goods, and in their case it was therefore necessary to determine as nearly as possible the proportion of the whole capital of the concerns and of their total number of employees and officials engaged in automobile manufacture. In connection with the figures for 1906 it needs also to be pointed out that a considerable number of companies which were organized in the course of this year are not included in the statistics, while, on the other hand, those who ceased to do business during this year have also been excluded, it being impossible to obtain complete information regarding them. It is, of course, obvious that the figures obtainable regarding the development of an industry cannot be absolutely definite and correct, yet there can be no question that in this instance the figures give a clear and correct idea of the growth of the German industry and of the various changes which have accompanied it.

TABLE I.

Number of—	1901.	1903.	1906.
Works	12	18	34
Workmen	1,589	3,289	10,347
Technical employees	116	228	612
Commercial employees	68	167	486
Average for each establishment—			
Workmen	132.4	182.7	304.3
Technical employees	9.7	12.7	18.0
Commercial employees	5.7	9.3	14.1
	Marks.	Marks.	Marks.
Capital invested	7,636,225	16,306,126	43,001,814
Wages of workmen	1,814,591	3,815,929	13,323,578
Salaries of technical staff	270,241	556,582	1,549,104
Salaries of commercial staff	150,419	398,595	1,067,164
Value of power, fuel, etc	144,715	431,251	1,601,869
Value of chief materials used	2,643,386	6,742,321	26,202,632
Average capital per works	628,018	905,895	1,264,759
Percentage cost of production—	Per Cent.	Per Cent.	Per Cent.
Wages	36.0	34.1	30.5
Salaries	8.6	8.0	6.0
Power, fuel, etc	2.9	3.6	3.7
Materials	52.5	56.3	59.8
Average annual earnings of—	Marks.	Marks.	Marks.
Workmen	1,142.0	1,150.2	1,287.7
Technical employees	2,329.7	2,441.1	2,531.4
Commercial employees	2,300.3	2,386.8	2,232.3

TABLE II.

There were manufactured—	1901.	1903.	1906.
Motorcycles	41	2,991	3,923
Automobiles and chasses—			
a, Passenger vehicles—			
1. For private use	831	1,258	3,924
2. For trade use	13	52	942
b. Goods vehicles—			
1. Delivery wagons	26	82	160
2. Heavy trucks	13	56	155
3. Special vehicles	—	232	37
Total	884	1,450	5,218
	1901.	1903.	1906.
Total value of—	Marks.	Marks.	Marks.
Motorcycles	35,750	1,428,361	2,328,684
Automobiles and chasses—			
a. Passenger vehicles—			
1. For private use	4,364,217	8,855,041	29,789,475
2. For trade use	81,935	491,797	9,690,481
b. Goods vehicles—			
1. Delivery wagons	142,400	580,157	905,379
2. Heavy trucks	124,272	656,166	2,202,092
3. Special vehicles	......	11,625	448,164
Total	4,712,824	10,594,786	43,035,591
Parts, motors, repair parts, etc	906,220	2,083,093	5,678,505
Grand total	5,654,794	14,106,240	51,042,780
Average value of—	Marks.	Marks.	Marks.
Motorcycles	872.0	477.6	593.6
Passenger vehicles—			
a. For private use	5,246.6	7,038.9	7,591.5
b. For trade use	6,302.7	9,457.6	10,287.1
Goods vehicles	6,837.7	9,599.6	10,101.2

By studying these tables it is found that the individual firms have grown considerably in the five years covered by these statistics. The proportional value of the total annual production grew from 75 per cent. of the invested capital in 1901 to 118 per cent in 1906. The selling value of the products represented 112.4 per cent. of the cost of production in 1901, 118.1 per cent. in 1903, and 116.7 per cent. in 1906.

German Commercial Vehicle Trials.

A conference was held in Berlin a short time ago regarding the commercial vehicle trials which are to be held next spring jointly by the Imperial A. C. and the German Automobile Manufacturers' Association. Several representatives of the Minister of War attended this conference, and the question was raised whether these trials might not at the same time serve as official tests for the so called bonus vehicles. The manufacturers' committee proposed to hold the contest in May, but the representatives of the War Department declared that this would be entirely too late for the official tests, which would have to be held no later than March, so the vehicles could be tried on bad roads and in snow. The committee seemed to have no objection to this date, and it is, therefore, likely that the trials will be held in March, 1909. The trials proper will extend over fifteen days, and, besides, the cars will be exhibited at points along the route on three days.

The itinerary has not been definitely decided upon, but the trials will undoubtedly start at Berlin, from where the cars will probably proceed westward to the industrial district in Rhenish Prussia, thence up the Rhine to Strassburg, thence to Stuttgart, where the trials will end. It was decided not to admit cabs to the trials. The different classes of vehicles that will be admitted will be divided as follows::

Class 1—Covered omnibuses for eight to fourteen passengers.
Class 2—Covered omnibuses for more than fourteen passengers.
Class 3—Delivery wagons for 300-1,200 kg. load.
Class 4—Light trucks for 1,201-2,000 kg. load.
Class 5—Trucks for 2,001-3,500 kg. load.
Class 6—Trucks for more than 3,500 kg. load.
Class 7—Motor road trains.

In the class for delivery wagons pneumatic tires will be permitted. It had been proposed to combine a tire contest with the vehicle contest, but as no representatives of the tire industry attended the meeting no decision regarding this matter was taken.

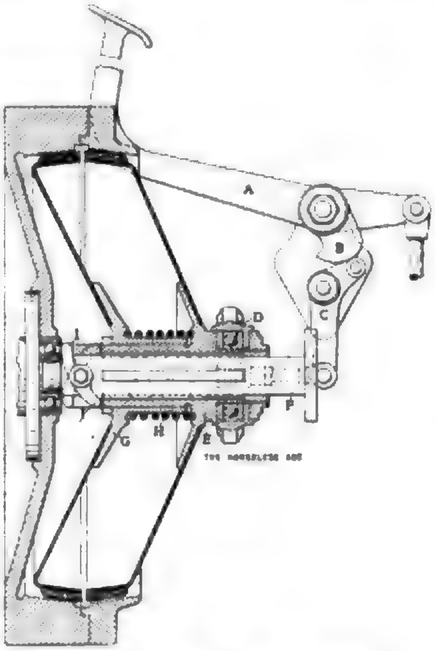
As fuels, either gasoline, benzol, alcohol or kerosene may be used, as desired; but if the contestant desires any other fuel he must so notify the contest committee. Fuel consumption tests are to be held in connection with the trials, but it has not yet been decided whether they will be restricted to one day or extend over the whole period of the trials, which latter would necessarily involve considerable trouble. The average speeds have been fixed for the various classes as follows: Classes 1 and 3, 25 km. p. h.; Classes 2, 4 and 5, 18 km. p. h.; Class 6, 15 km. p. h., and Class 7, 12 km. p. h. These speeds are for runs through comparatively level territory, and if the route leads through a hilly district the committee may suitably reduce these speeds.

The Financial History of the Fiat Company.

Some time ago the report went through the press that the Italian Fiat Company had reorganized, after having lost two-thirds of its working capital, the capital stock having been reduced from 9,000,000 lire to 3,000,000 lire, and new shares having been issued to bring up the outstanding stock to the original figure. A recent Italian Government report gives some interesting information regarding the financial history of this firm. According to this report the Fiat Company in 1900 lost 18,000 lire; in 1901 it reduced its loss to 10,000 lire; in 1902 and 1903 the affairs of the company broke just about even. In 1904 the first dividends were paid, a small percentage. In 1905 the dividends rose to 20 per cent., and in 1906 they reached the extraordinary value of 80 per cent., since which time no further dividends have been paid.

At the time that the old board of officials was deposed a vote of confidence was passed to the retiring president, Scarfiotti. This proceeding would have been extraordinary if the company had actually lost two-thirds of its working capital, as was then understood to be the case. It now appears, however, that the capital lost was at no time paid in in "cold cash" by the stockholders, but was created by a stroke of the pen. The matter is cleared up by the following statement, which has recently been made public:

When the Fiat Company was first organized its capital stock amounted to 800,000 lire, which was divided into shares of 25 lire nominal value. The shares being traded in on the Milan Bourse, their selling value rose with the prosperity of the company, and reached the unprecedented figure of 2,500 lire some time after the 80 per cent. dividends had been declared. The establishment by the company of agencies in all parts of the world, and its success in international competition were other factors which tended to boost the value of its stock. In the swirl of enthusiasm which followed the stockholders demanded that the nominal value of their holdings should be increased so as to bear some reasonable proportion to the selling value thereof, and accordingly each share of 25 lire nominal value was exchanged by the company for two and one-half shares of 100 lire nominal value; in other words, the nominal value of the stock was increased tenfold. At the same time the capital stock of the company was increased from 800,000 lire to 9,000,000.



Daimler Double Cone Clutch.

This was in 1906. The following year the reverse movement set in in the automobile industry. The financial stringency, which originated in America, rapidly spread to all industrial countries, and greatly reduced the demand for high priced cars. In addition, the Italian industry had to contend with protracted strikes, and the result was that the quotations for automobile stocks dropped rapidly on the Italian Bourse, most of all those for Fiat stocks. Meanwhile, a condition of stability has again been established, and it is now found that the original shares of 25 lire still have a value of 125 lire, so that the stockholders have really little to complain of, though their dreams of unmeasured wealth of a few years ago may have been shattered. It is stated that the Fiat works, when fully occupied, can turn out 5,000 cars a year, and at the present time, instead of being closed down, as is the impression in some quarters, they are giving employment to 2,700 workmen, and overtime is often required. The enterprise has also been brought onto a sounder basis by the recent reorganization, by which the paid up working capital was actually brought up to 9,000,000 lire.

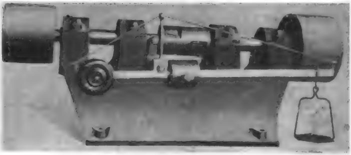
New Daimler Double Cone Clutch.

The German Daimler Motor Company have recently patented a double cone clutch which is understood to be used in their commercial car. A sectional view of the clutch is shown in the accompanying drawing. The operating pedal A is mounted on the frame of the vehicle and to its shaft is secured a cam piece B, which acts on a bell crank C. The latter connects through a pair of rods with forked ends to the ball bearing trunnion collar D on the hub E, to which is secured one of the pressed steel cones. The hub E is arranged to slide freely on the shaft F, which is provided with four feather keys. Concentric with the hub E is arranged another hub G, to which is secured the second pressed steel cone. The two hubs are pressed apart by the coiled spring H, whereby the two cones are forced into engagement with their respective female cones. At the forward end of the shaft F are pivoted two short double armed levers I and J. The upper arm of one of these levers and the lower arm of the other bear against projections of the inner hub and the other arms of the two levers bear against projections of the outer hubs (which fact is not very clearly shown by the drawing). The effect of this arrangement is that when the rearward cone is pushed froward by means of the pedal A, the forward cone is simultaneously drawn rearward, thus insuring positive disengagement of both cones.

The Farcot Transmission Dynamometer.

The dynamometer herewith illustrated, which has been recently brought out in France and subjected to a series of tests at the Automobile Club laboratory in Levallois-Perret, is composed of two claw pinions, A and B, mounted on two shafts, which are carried in two ball bearings each. These two claw pinions are connected together by a sleeve, C, which is entirely free and the claws of which engage into the recesses of the pinions. The sleeve, which insures connection between the motor shaft and the driven shaft, transmits the torque by taking purchase on balls *b*, lodged between the claws, corresponding to each of the two pinions. In consequence, the sleeve is absolutely free to move in the direction of the axis of the two shafts.

The contact surfaces between the claws of the free sleeve and those of the claw pinion of the motor shaft are plane surfaces parallel with the axis of the shafts. On the other hand, the contact surfaces between the claws of the sleeve and those of the



Transmission Dynamometer.

claw pinion of the driven shaft are helicoidal surfaces, having for their axis the common axis of the two shafts. For this reason the free sleeve is forced in the direction of the axis by a force proportional to the torque transmitted. A roller carried by an arm, L, fixed to a horizontal scale beam, provided with a sliding weight and scale pan, opposes the lateral displacement of the sleeve, and by moving the sliding weight along the scale beam the lateral thrust of the sleeve C may be exactly balanced. The scale beam is graduated to read in horse power for a certain speed of revolution, viz., 1,000 r. p. m. To find the actual horse power transmitted for any other speed of revolution it is only necessary to multiply the indication by the actual speed, and to divide this by 1,000. It is also an easy matter to construct curves which will give the actual horse power corresponding to any indicated horse power for any given speed.

The formulæ used in connection with this dynamometer are as follows:

$$F = T \tan \alpha, \quad \ldots\ldots(1)$$

where F is the lateral thrust on the sleeve. T the tangential pressure at the point of contact of the balls, and α the angle of inclination of the helical plane.

$$P = T \tan \alpha \ \frac{l}{L} \quad \ldots\ldots(2)$$

where P is the weight of the sliding piece, l the length of the short lever arm, and L the length of the scale arm. In the actual device $l = 100$ mm., L is the variable distance of the sliding weight from the pivot, $\alpha = 8$ degrees and $\tan \alpha = .14$. From (2) we may deduce the length of the long arm of the theoretical lever.

$$L = \frac{T \tan \alpha \ l}{P} \quad \ldots\ldots(3)$$

Let K be the constant of the device, so that we have the equation of equilibrium

$$K\,L = R\,T, \quad \ldots\ldots(4)$$

where R is the radius of the circle of ball contact (55 mm. in the device). Substituting in (4) we obtain

$$K = \frac{P\,R}{\tan l\,\alpha} \quad \ldots\ldots(5)$$

The Effect of Steel Studs on the Roads.

A county justice in Derbyshire, England, writes to *The Motor* as follows with regards to the effect of steel studs in tires upon the roads: "I have made it my business to observe the effect of steel studs in this neighborhood, and do not endorse the statements frequently made that the studs do serious damage to the roads. The marks made are not for a single moment to be compared to the injuries inflicted by the calks of horseshoes nor by the iron tires of heavy motor trucks. No matter how careful and skilled the chauffeur, to drive without non-skids on damp roads or on greasy setts or wood pavement is to court disaster to the occupants of motor cars and other vehicles alike, as well as to foot passengers."

German Military Subvention for Motor Trucks.

The German Reichstag some time ago appropriated 800,000 marks to be expended in bonuses on motor trucks to be placed at the disposal of the army administration in case of war. For each truck a "one time" payment of 4,000 marks and an annual payment of 1,000 marks, in the nature of a maintenance allowance, are to be made. The sum appropriated permits of paying this bonus on 160 trucks. The army administration has distributed this number among the leading German manufacturers of motor trucks, as follows: Büssing, 44; Daimler, 35; Gaggenau, 20; N. A. G., 25; Scheibler, 6; Stoewer, 4. Besides, the Daimler Motor Company has agreed to organize two operating companies, one in Berlin and the other in Frankfort-on-Main, and in consequence has been allowed twenty-four additional trucks of the subventioned type. These twenty-four trucks must be kept in use either at the works of the Daimler Company or by one of the two operating companies. In order to aid the manufacturers in disposing of these trucks the army administration will keep a number of the different makes constantly on view at the headquarters of the Engineer Corps, Experimental Department, where they can be seen at any time by interested parties, the army administration either selling them at cost minus the 1,000 marks maintenance allowance, or renting them out for periods of any length, at a rental equal to the maintenance expenses. There was considerable rivalry among the German truck manufacturers, each wanting to be assigned as large a number of these trucks as possible, and some friction was engendered.

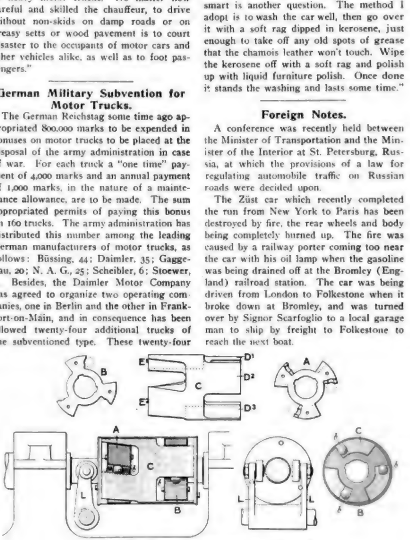
Obtaining a Polish on Coach Work.

A correspondent in *The Motor* writes on this subject as follows: "Everybody ought to know that dusting the body work causes scratches; but to make the old varnish look smart is another question. The method I adopt is to wash the car well, then go over it with a soft rag dipped in kerosene, just enough to take off any old spots of grease that the chamois leather won't touch. Wipe the kerosene off with a soft rag and polish up with liquid furniture polish. Once done it stands the washing and lasts some time."

Foreign Notes.

A conference was recently held between the Minister of Transportation and the Minister of the Interior at St. Petersburg, Russia, at which the provisions of a law for regulating automobile traffic on Russian roads were decided upon.

The Züst car which recently completed the run from New York to Paris has been destroyed by fire, the rear wheels and body being completely burned up. The fire was caused by a railway porter coming too near the car with his oil lamp when the gasoline was being drained off at the Bromley (England) railroad station. The car was being driven from London to Folkestone when it broke down at Bromley, and was turned over by Signor Scarfoglio to a local garage man to ship by freight to Folkestone to reach the next boat.



Details of Farcot Transmission Dynamometer.

Rainier Motor Car Company Fails.

A petition in bankruptcy has been filed against the Rainier Motor Car Company, of Saginaw, Mich., with a sales office at Broadway and Fifty-sixth street, New York city. The action was taken in behalf of the following creditors:

Pembroke C. Chrysler, $468 for commissions; J. J. Higgins, $549 for commissions, and Hartford Suspension Company, $262 for merchandise.

Griggs, Baldwin & Pierce, attorneys for the creditors, allege that the company is insolvent, is unable to pay its notes and accounts at maturity; that a large number are overdue and unpaid, and that last week the company paid $3,000 to the Bank of Saginaw, Mich.; also paid various amounts to other creditors, in the aggregate between $5,000 and $10,000. The sheriff has attached the factory at Saginaw on a claim of the Auto Crank Shaft Company and the business there is entirely stopped, to the great detriment of the other creditors.

According to a statement made by the attorney for the company, the latter is solvent, being only temporarily embarrassed and expects to work out all right if it gets a little time. The company had done a large business and did not have ready cash to meet present obligations. The liabilities are $220,000, of which $50,000 are secured. Normal assets are larger than the liabilities and the real assets are at least $200,000.

Judge Hough of the United States District Court appointed Jesse Watson receiver, with a bond of $5,000. It was stated that at each place of business there is a large quantity of material and merchandise, and about $50,000 of the assets are in this city. There are many automobiles which are in parts about to be made up, some of which have been sold and upon which deposits have been received, and unless they can be assembled and delivered the sales will be lost, the materials will go to waste and deposits will have to be returned.

There are a large number of creditors and many of them have sued the company. The company is a New York corporation, incorporated March 7, 1907, with capital stock $1,000,000, of which $800,000 is common and $200,000 preferred, and took over the business of the Rainier Company. John T. Rainier was president and treasurer. Prior to the incorporation of the company and the establishment of a factory at Saginaw the firm handled a car made under its name at the Garford factory in Elyria, Ohio, and it also handled the electric trucks of the Vehicle Equipment Company.

Great Increase in Imports.

A great increase is shown by the imports of automobiles for the month of September, there being imported 219 cars valued at $352,295, and parts valued at $103,038, as compared with 102 cars valued at $253,628 and parts valued at $37,594 in September, 1907. Of the cars imported in September last 33 were from the United Kingdom, 156 from France, 2 from Germany and 27 from Italy. During the nine months ending with September there were imported 956 automobiles, valued at $1,803,889 and parts valued at $451,469, as compared with 730 automobiles valued at $2,310,922 and parts valued at $46,801 for the same period the previous year.

During September last there were exported 128 automobiles, valued at $235,607, and parts valued at $42,310, a total of $277,917, as compared with 113 automobiles valued at $179,041 and parts valued at $32,832, a total of $211,873, in September, 1907. During the nine months ending with September, 1908, there were exported 1,812 cars valued at $3,805,569 and parts valued at $477,159, a total of $4,282,728, as compared with 2,421 cars valued at $4,442,478 and parts valued at $521,407, a total of $4,963,885, during the same period for the previous year. The following table shows the distribution of the exports:

	——Nine Months of——		
	1906.	1907.	1908.
Exported to—			
United Kingdom	$1,021,908	$1,503,791	$1,541,480
France	271,319	532,383	533,334
Germany	111,767	158,274	145,732
Italy	239,744	242,191	219,533
Other Europe....	178,689	261,061	192,274
British North America	766,431	1,086,541	997,882
Mexico	546,064	512,682	218,670
West Indies and Bermuda	203,169	222,311	121,473
South America...	103,459	185,054	98,158
British East Indies	26,267	28,711	23,487
British Australasia	100,913	154,496	59,380
Other Asia and Oceania	57,189	50,863	104,833
Africa	10,672	7,480	6,081
Other countries..	6,588	9,038	20,411

Buick" Buggyabout."

It is reported that one of the new models of the Buick Motor Company for the coming season will be a "Model 14," which will be known as a buggyabout and sell for $450, more or less. That the Buick Company was experimenting with a motor buggy was reported in these columns some months ago, and evidently the experiments have proven satisfactory and induced the company to take up this line. With the Studebaker Automobile Company this makes two large, long established concerns which have entered the motor field.

Brazier Cup Contest.

The sixth annual contest for the Brazier Cup was held under the auspices of the Philadelphia A. C. on Saturday last, and was won for the second time by G. B. Fletcher driving a Packard car. The course was about 65 miles in length, and embraced Lansdowne, Swarthmore, Media, Newtown Square, Devon, Valley Forge, Norristown, Broad Axe, Ambler, Fort Washington and Chestnut Hill. The regulations required that all local speed rules be complied with. There were three secret controls along the route where judges timed the cars as they went past. The first car was sent away at 9 a. m., and shortly after 1 o'clock p. m. the winner finished the run. The results of the contest were as follows:

Owner.	Car.	Penalty.
G. B. Fletcher.....	Packard	17 minutes 30 seconds.
H. P. Bailey.......	Winton	18 minutes 30 seconds.
C. Y. Abbott.......	Pennsylvania	22 minutes.
F. Hardart........	Elmore	22 minutes.
Horace Allen......	Buick	32 minutes.
Ewing L. Miller...	Packard	52 minutes.
John D. Avil......	Pope-Hartford	71 minutes 30 seconds.

Commercial Notes.

The Reading Automobile Company, of Reading, Pa., have placed an order for six Franklin air cooled taxicabs of 18 horse power.

The Autovac Cleaner Company, of Allentown, Pa., have recently placed in service vacuum house cleaners mounted on a motor truck designed by Frank R. Addis, of Allentown.

An automobile hack service was established at Rutherford, N. J., on October 27. The hacks are stationed at the depot, and on the first day are said to have carried 1,000 passengers.

Fisher & Ferguson, New Albany, Ind., have recently received a sixteen passenger motor omnibus, and intend to establish a service between that city and Corydon, a distance of 20 miles. It is the intention to make two round trips daily.

The Auto Transit Company, of Philadelphia, has established three 5 cent fare zones, as follows: Diamond street between the Park and Broad street, Broad between Diamond and Chestnut, and Broad between Chestnut and League Island boulevard.

The Crawford Automobile Company, of Hagerstown, Md., recently shipped a first order of six landaulets to the New Amsterdam Motor Company, of New York, which operates an automobile service between New York city and a fashionable country club. The order calls for five more cars.

The City Council of Oshkosh, Wis., has decided to buy an automobile for Fire Chief A. R. Brauer, and bids will be called for at once. The car will be equipped with a battery of chemical extinguishers and two firemen, besides the chief and driver. It was necessary to replace the present horse and buggy outfit, and rather than spend $600 for another such outfit the Council thought it wise to secure the more up to date automobile equipment, even though the cost will be considerably more.

In spite of the objection of the Milwaukee comptroller to spending $3,600 for a motor car for the chief of police, on the ground that the fire chief's car costs only $1,200, the Milwaukee City Council unanimously passed a resolution calling for a car costing even more than this amount, viz., $4,600. The Board of Public Works will now advertise for bids for a seven or eight passenger car of 40 horse power, either steam or gasolene. The council has also decided to ask for a committee car, for the use of the various committees of the council.

MINOR MENTION

The Motor Buggy Company, of Fort Wayne, Ind., will shortly move to Joliet, Ill.

The B. F. Goodrich Company, of Akron, Ohio, have leased the building at 1728 Grand avenue, Kansas City, Mo., for a local branch.

The Pittsburg Auto Tire and Repair Company, corner Baum and Beatty streets, Pittsburg, Pa., have secured the exclusive agency for Michelin tires in that city.

The Southern Automobile Manufacturing Company, of 907 East Bay street, Jacksonville, Fla., are exhibiting their high wheeled car at the carnival exhibition in Jackson.

The Hyatt Roller Bearing Company, of Newark, N. J., has opened a branch office in the Majestic Building, Detroit, in charge of its secretary, Peter S. Steenstrup.

W. R. Dunkle, of Pana, Ill., has built a car with a four wheel drive of his invention. The machine is also fitted with a special safety lever of Mr. Dunkle's invention.

The National Retail Automobile Dealers' Association executive committee will hold its annual meeting in New York at the Grand Central Palace on Tuesday, January 5.

The new factory of the Velie Automobile Company, Moline, Ill., is nearing completion. It is of the latest fireproof construction, the interior being of reinforced concrete and the facing of vitrified brick.

The Alden Sampson Company, of Pittsfield, Mass., have recently completed a 4 ton truck, which is now being tested in actual service by the Byron Weston Company, of Dalton, Mass.

We have received a copy of a booklet issued by the West Side Y. M. C. A., New York city, containing particulars of the Y. M. C. A. automobile school, the winter term of which began October 26.

The Stevens-Britton-Maurel Company, 1783 Broadway, New York city, have taken the general sales agency for the automobile lamps and acetylene generators made by the Twentieth Century Manufacturing Company.

The Waldron Car Manufacturing Company, which is located near Kankakee, Ill., is contemplating a change of location, and a representative of the company was recently in Marseilles, Ill., investigating the advantages of that town.

The Hartford Suspension Company inform us that the cars which were classed first, second and third in the recent Vanderbilt Cup race were equipped with their shock absorbers; in fact, all of the starters, with one exception, carried these absorbers.

J. J. Mann, a director of the Delaunay-Belleville Automobile Company of Paris, and who was formerly connected with the Hotchkiss Company of the same city, has arrived in New York to place an American agency for the Delaunay-Belleville cars.

The Hartford Rubber Works Company has brought out a tire 31x4 inches to fit a 30x3½ inch rim, and a 33x4 inch tire to fit a 32x3½ inch rim, to enable owners of cars with too small tires to fit bigger tires without going to the expense of changing rims.

The Peerless Leather Tire Company, which was formerly located in San Francisco, has been removed to 719 East Pike street, Seattle, Wash. The company is in charge of W. B. and J. A. Roberts, and manufactures a steel studded chrome leather tire cover.

The Dewitt Motor Vehicle Company, of North Manchester, Ind., has been incorporated, with Virgil Dewitt, Mary J. Dewitt and James S. Rose as the principal stockholders. The purpose of the organization is to manufacture motor vehicles at North Manchester.

It is reported that W. H. Vandervoort, of the Moline Automobile Company, has written to Chairman F. B. Hower, of the touring board of the A. A. A., asking him to reserve Nos. 1, 2 and 3 in next year's contest for the Hower Trophy for three Moline cars.

The Pacific Coast Tire Company has been established with an office at 605-609 East Pike street, Seattle, Wash., to manufacture an internal puncture proof tire protector consisting of a flexible rubber and steel cushion, which is placed between the cover and inner tube.

The K-W Ignition Company, of Cleveland, Ohio, has recently doubled its floor space at 32 Power avenue, and is installing now equipment, including an impregnating plant for impregnating their magneto armatures and the spark coils which they will shortly bring out.

The Plymouth Motor Car Company, of Plymouth, Ohio, are negotiating with the Chamber of Commerce of Norwalk, Ohio, with the view of locating in that city. The Plymouth Company requires that Norwalk investors subscribe for $75,000 worth of the company's stock.

The Bendix Automobile Company, of Chicago, Ill., has finally decided to locate in Logansport, Ind., and has already established an office there. All but $3,500 of the $75,000 worth of stock which the Bendix Company wanted to place was subscribed for by local business men.

A movement is on foot to organize the chauffeurs of Omaha and of the whole State of Nebraska into what is to be known as the Nebraska Association of Automobile Drivers. A meeting was held at the Paxton & Mitchell garage, Twenty-fourth and Harney streets, Omaha, on October 24.

Carl G. Fisher, an Indianapolis automobile dealer, introduced an innovation in balloon ascensions a few days ago when he made an ascension with a Stoddard Dayton roadster weighing 1,500 pounds attached to the balloon. After going about 7 miles the balloon and automobile were lowered, the balloon rolled up and the trip to Indianapolis made in the automobile. The ascension proved successful and there were no accidents. Fisher believes that balloon ascensions will prove popular if the passengers are assured they can make a quick return in an automobile.

Motor buggies and surreys will be manufactured next season by the Cole Carriage Company of Indianapolis, making the seventeenth Indiana concern to engage in that branch of the automobile industry. The company is now experimenting with several models, but has not made the details of their construction public.

It has been decided to arrange for a number of special nights at the coming Grand Central Palace Show. Following the private view of the exhibition on the afternoon of Thursday, December 31, there will be a gala night on New Year's eve. Friday night will be for the army and navy, Saturday for students, Monday for engineers, Tuesday for society, Wednesday for merchants and Thursday for municipal officials.

The sanction for the hill climb on Fort George Hill, which the New York Trade Association expected to hold on Election Day, was not obtained, Mayor McClellan vetoing the bill passed by the aldermen on the ground that a voting booth was located along the course of the climb, and the event might interfere with the rights of the citizens in exercising their voting power there, in addition to which accidents might occur.

Club Notes.

Efforts are being made to organize an automobile club in New Orleans, where races are to be held on the Fair Grounds on November 7 and 8. The plan is to revive the old club and to affiliate it with the American Automobile Association.

The Motor League of Rhode Island inaugurated its new clubrooms at the Crown Hotel in Providence on October 30. Among the speakers at the function were to be Col. Wm. B. Sohier, of the Massachusetts State Highway Commission, and Francis Hurtubis, Jr., counsel of the Bay State A. A.

The Middlesex A. C. was formed at a meeting held at the Mansion House, New Brunswick, on October 26, the preliminary arrangements being made by two members of the New Jersey Automobile Club. L. A. Voorhees was chosen temporary chairman, Arthur W. Clark, temporary secretary, and Fred Schussler treasurer. A committee was named to draw up a constitution and by-laws.

The New Orleans (La.) A. C. was formally organized at a meeting held at the Tulane Hotel on October 26. A charter membership of twenty-five was secured, and the following officers were elected: President, Thomas C. Campbell; vice president, Theodore Grunewald; secretary and treasurer, Homer George; board of directors, Frederick I. Thompson, chairman; Ginder Abbott, W. P. Thompson, A. M. Cook and

H. A. Testard. It was decided to affiliate immediately with the American Automobile Association in order that a sanction can be obtained for the races on November 7 and 8.

At the annual meeting of the Milwaukee A. C. Dr. Louis Fuldner, president, James T. Drought, secretary, and Lee A. Dearholt were re-elected directors. On November 10 the club will meet again to consider the recommendation of increasing the board of directors from nine to fifteen and to hold an election of officers. The annual report showed the club to be in the most prosperous year of its six years' history. The treasury contains $1,500, not including $1,200 annual dues to be collected early in January.

Garage Notes.

John Hadsall will open a garage in Colfax, Ia.

Work will shortly be begun on a new garage for Fred Ellis in Macon, Ga.

A garage and repair shop will be erected in Watson, Minn., by Messrs. Iverson, Dvergsten and Odegard.

W. J. Friel, Portsmouth, Ohio, has moved his garage from Second street to a new building on Fifth street.

William Hilliard, manager of the Hol-Tan Boston branch, has established headquarters at 66 Hereford street.

Nate Frankel, Des Moines, Ia., is building a residence and private garage at Thirty-seventh street and Grand avenue.

The Columbia Garage, 2221 Montgomery avenue, Philadelphia, Pa., will be under new management after November 1.

The Schreiber Carriage Manufacturing Company, agents for Jackson and Mason cars at Chareton, Ia., are to build a garage.

The W. H. Kiblinger Co., of Auburn, Ind., have secured a building in Kansas City, Mo., for an agency there at 1730 Grand avenue.

The American Motor Car Co. will open a branch at 616 Walnut street, Des Moines, Ia. The company has the agency for the Cadillac.

The Salem Auto Garage and the Alman Machine Co., of Salem, Ohio, have been consolidated. The deal went into effect November 1.

Lester D. Moor, Jr., agent for Premier cars at Washington, D. C., recently moved into his new garage and salesroom at 829 Fourteenth street Northwest.

Charles Zoll is planning to open a garage and repair shop in the Manhattan Building, Alexandria, Ind. He also expects to represent a number of machines.

The Western Carolina Auto Co. has been organized at Asheville, with an office at 68 Patton avenue and a garage at 61 South Main street, to handle the Cadillac product.

The firm of Privett & Arbuckle, automobile dealers, of Greensburg, Ind., has been dissolved, Mr. Arbuckle retiring. The business will be continued by Roy C. Privett.

The Austin Auto Co., Austin, Tex., have opened a garage and repair shop at 116 and 118 Congress avenue. They are State agents for the Adams-Farwell and Acme cars.

Work has been begun on the garage building of West & Veail, in Mt. Pulaski, Ill. Part of the building will be used as a store for electric light fixtures, and part as an automobile repair shop.

The E. K. Ashby Co., Evansville, Ind., have leased the brick building at 210-214 Upper Third street, and will rebuild it into an automobile store. They have the agency for the Chalmers-Detroit.

The O. K. Auto Supply and Transit Co., of Asheville, N. C., will shortly occupy a new garage on South Main street. F. A. Mears, a member of the firm, recently left for New York to purchase a stock of supplies.

C. J. Monroe, an ex-alderman of Milwaukee, Wis., will shortly commence the construction of a two story concrete garage, 58x120 feet, on East North avenue, between Cambridge avenue and Newhall street.

The new garage of Chase & Ludington, Rambler agents in San Diego, Cal., was opened on Tuesday, November 3. The building is of concrete, with a frontage of 50 feet on Second street, and a depth of 100 feet.

The Gotfredson Brothers Co. will open a garage on Jefferson street, Green Bay, Wis., about January 1. The building will be entirely remodeled for the purpose. The line of cars to be handled has not yet been decided upon.

Dr. J. C. Quick, Muncie, Ind., plans to erect a three story garage of pressed brick and Bedford stone, at a cost of about $15,000. The building is to be located on South Mulberry street, opposite the Traction Terminal Station.

The American Motor Co. has been organized at Greensboro, S. C., with $25,000 capital stock, to engage in a garage and livery business. The members of the firm are H. L. Hopkins, L. B. Hopkins and Thos. S. Beale.

The American Motor Car Co. has leased a building at 918 West Walnut street, Des Moines, Ia., and will handle Cadillac cars in Des Moines and surrounding territory. Earl V. Schue, of Milwaukee, is in charge of the business.

The Buick Automobile Co., of New York city, have leased for a term of five years a four story building at No. 635 and 637 East Fifty-first street, running through to Fifty-second street. The building has a frontage of 50 feet on each street.

The Hokanson Automobile Co., of Madison, Wis., handling Buick, White and Ford cars in western Wisconsin, have decided to establish a branch garage and repair shop in Mineral Point, Wis., to cover the southwestern portion of the State.

A garage is being built for F. H. Veach, 1217 K street, Sacramento, Cal., and will be completed within a week or two. The building is 40x160 feet, constructed of brick and corrugated iron, and will be entirely fireproof. The cost of erection is said to be about $5,000.

William N. and Edward E. Gates and Edgar Updike have organized the Best Automobile Co. at Indianapolis, and have incorporated with $20,000 capital. They will handle the Pope Toledo in Indiana, succeeding the agency held for some time by F. A. Beck, who will discontinue the sale of automobiles.

The garage at the Sheldrake Springs, near Interlaken, N. Y., was destroyed by fire recently, as were also two Pope-Toledo cars belonging to J. B. Maltby, of Corning, which were stored in the building at the time. The loss is estimated at $7,000, and is nearly covered by insurance. The origin of the fire is unknown.

Nineteen automobile owners of Webb City, Mo., at a recent meeting formed the Webb City Automobile Co., which will be incorporated under the laws of Missouri to conduct a garage business. A two story, fireproof garage is to be erected in a central location, and the services of L. A. Scheibel have been secured to manage the business.

The Henry Auto Co., of Henry, Ill., composed of Clifford Haws and J. J. Gresser, have bought a building site on Edward and First streets, and have given a contract for the building of a 50x70 foot garage, which will be ready for occupancy about January 1, 1909. The company will engage in a general garage, supply and repair business.

The Maxwell-Briscoe Motor Co. will open a branch in St. Louis on December 1 at 5123-5125 Delmar avenue. An addition will be built to the American garage located at that address, in order to provide additional floor space. The branch is to be known as the Maxwell-Briscoe Motor Vehicle Co., and will take over the business of V. Heinrichs.

Charles H. Howard, of the Howard Automobile Co., Oakland, Cal., who has handled the Buick car in northern California during the last two seasons, has secured the State agency for that make, succeeding the Western Motor Car Co., of Los Angeles, as Buick representative in southern California. Mr. Howard expects to open a sales agency and garage in Los Angeles on November 1.

The Studebaker-Garford combination has taken over the garage of the Metropolitan Motor Car Co., on East Nineteenth street, near Euclid avenue, Cleveland. The location of the Garford sales office in the Whitney-Power Block will be discontinued, and from the new location, after suitable alterations are made, the Garford, Studebaker and E-M-F cars will be handled. A. R. Davis will be in charge of the garage.

Robert J. Randall and Harold Vorce, of the Minneapolis branch of H. Paulman & Co., of Chicago, have leased a building site on the corner of Tenth street South and First avenue for ninety-nine years, and a $25,000 one story garage is to be erected on the site. The property extends for 100 feet on First avenue South, and for 159 feet on Tenth street. Plans for the new building are being prepared.

New Incorporations.

Boone Automobile Co., Des Moines, Ia.—Capital, $10,000.

Huffman Automobile Co., Omaha, Neb.—Capital, $25,000. Incorporators: William Huffman and William R. Homan.

Safety Tire Co., Portland, Me.—Capital, $2,000. Incorporators: Clarence E. Eaton, T. L. Croteau and B. M. Maxwell.

Riverside Garage Co., New York, N. Y.—Capital, $10,000. Directors: Josiah G. Cloud, Chester M. Cloud and S. Marts Cloud.

Omar Motor Car Co., Rochester, N. Y.—Capital, $50,000. Directors: Samuel H. Mora, William W. Hibbard and Frank L. Sibley.

Universal Wind Shield Co., Chicago, Ill.—Capital, $10,000. Incorporators: M. J. Moran, George Remus and Charles Lynch, Jr.

Ideal Windshield Co., New York, N. Y.—Capital, $10,000. Directors: Lee Lewis Laman, Andrew Herman and Harriette Redmund.

Webb City Automobile Co., Webb City, Mo.—Capital, $5,000. Incorporators: Messrs. Beardsley, McCroskey, Moore and Caulkins.

Automobile School Supply and Publishing Co., New York, N. Y.—Capital, $5,000. Directors: F. W. Mills, H. M. Browne and E. J. Foshan.

Columbus Garage and Motor Co., New York, N. Y.—Capital, $15,000. Incorporators: Charles O. Farwell, G. Edward Shaw and George Schwegler.

Stevens-Britton-Maurel Co., New York, N. Y.—Capital, $10,000. Directors: Charles L. Stevens, Albert F. Britton and E. F. Maurel. Automobiles.

C. A. Coey Auto Co., Chicago, Ill.—Capital, $75,000. Incorporators: B. Levering, C. A. Coey and D. MacVichies. To manufacture automobiles and accessories.

Ford Automobile Equipment Co., Chicago, Ill.—Capital, $2,400. Incorporators: Philip Steele, Erwin Ford and Edward Gale. To manufacture, repair and deal in automobiles.

Herschede Motor Car Co., Cincinnati, Ohio.—Capital, $50,000. Incorporators: Lawrence B. Herschede, Walter J. Herschede, Alfred T. Herschede, Joseph Linn and Thomas H. Kelly.

The Miller Automobile Co., Windsor, Vt.—Capital, $5,000. Incorporators: H. R. Miller, H. J. Miller, H. R. Miller, Jr., John L. Bacon and G. B. Miller. To buy, sell and repair automobiles.

Campbell Motor Co., Wayzata, Minn.—Capital, $50,000. Incorporators, Royal C. Moore, William Moore and William H. Campbell. To manufacture automobiles, gasoline and steam engines and parts.

Trade Personals.

Edward M. Tierney and George W. Sweeney, hotel men, of New York, have been elected directors of the American Taxicab Co., of New York.

John E. Roper, Jr., formerly traveling representative for THE HORSELESS AGE in Ohio, has secured the position of sales manager for the Model Auto Co., Peru, Ind.

Charles M. Hall, for five years sales manager of the Badger Brass Co., Kenosha, Wis., has resigned to become general manager of the American Lamp Co., Detroit, Mich.

B. E. Server, of the Server-French Co., of San Francisco, recently sailed for Honolulu with the object of establishing a branch there for the sale of the company's parts and specialties.

H. C. Barnes, lately with the Dayton Motor Car Co., has associated himself with the Overland Automobile Co., of Indianapolis, Ind., and will take charge of the production end of their factory.

Marcus I. Brock, who for the second time became sales manager of the Autocar Co. in the early part of this year, has just handed in his resignation to that company, who have accepted it, to take effect November 30.

Theodore P. Bailey has resigned as general manager of the automobile department of the St. Louis Car Co., and has been succeeded by Walter J. Miller. H. H. McDonald has been appointed sales manager of the company.

Jos. Tracy, of New York city, has closed an agreement with the Diamond Rubber Co., of Akron, Ohio, to act as consulting engineer for them during the coming year, more particularly in connection with their participation in contests.

C. Arthur Benjamin, formerly sales manager for the H. H. Franklin Manufacturing Co., the Babcock Electric Vehicle Co. and the Aerocar Co., has gone into business for himself in Syracuse, where he will handle the Packard and E-M-F cars.

New Agencies.

Kenyon, Minn.—F. G. Held, E-M-F.

Mulford, Ill.—E. S. Crawford, Cadillac.

Sioux City, Ia.—Bennett Auto Co., Buick.

Grand Island, Neb.—Bischeld Auto Co., Buick.

Philadelphia, Pa.—Thomas M. Twining, Regal.

St. Louis, Mo.—Colonial Automobile Co., E. M. F.

Detroit, Mich.—Racine Boat Manufacturing Co., Richmond.

Watertown, S. Dak.—Watertown Automobile Co., Cadillac.

Rockport, Ill.—Standard Automobile Co., Charles street, Buick.

Wilmington, Del.—Bradford Automobile Co., Pennsylvania.

Chicago, Ill.—Harry P. Branstetter, 1337 Michigan avenue, Kisselkar.

Santa Rosa, Cal.—Burris & Peterson (Santa Rosa Garage), Buick.

Milwaukee, Wis.—W. F. Sanger, 572 and 574 Farwell avenue, Franklin.

Youngstown, Ohio.—Standard Auto Garage Co., 126 West Rayen avenue, Franklin.

Rutland, Vt.—Frenier Automobile Co., Buick, for Rutland and Addison counties.

Trade Literature Received.

Pettingell-Andrews Co., Boston, Mass.—Catalogue of ignition specialties.

S. R. Bailey & Co., Inc., Amesbury, Mass.—Catalogue of the Bailey electric vehicles.

Holsman Automobile Co., Monadnock Building, Chicago.—Catalogue of the Holsman Model H-15, the new four cylinder car.

Leather Tire Goods Co., Newton, Upper Falls, Mass.—Nineteen hundred and nine price list of Woodworth adjustable treads.

Readrite Meter Works, Bluffton, Ohio.—Circular of the Readrite pocket and miniature switchboard, volt and ampere meters.

The Standard Roller Bearing Co., Fiftieth street and Lancaster avenue, Philadelphia.—Official guide to the University of Pennsylvania.

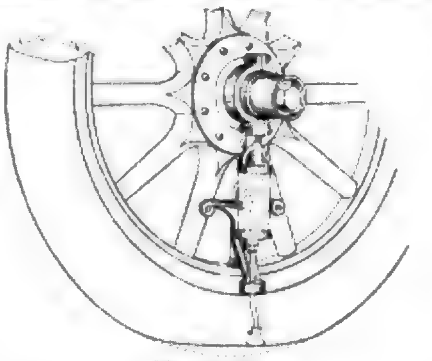
National Tube Co., Pittsburg, Pa.—Booklet on the exhibit of the company in Mechanical Hall, Pittsburg, Sesqui Centennial Exposition 1908.

H. W. Johns-Manville Co., 100 William street, New York City.—"What Radiation of Heat Means to You," a circular on heat insulating pipe coverings.

MOTOR VEHICLE PATENTS

897,811. Automatic Pneumatic Tire Inflator.—Robert C. Barrie, of Philadelphia, Pa. September 1, 1908. Filed June 18, 1907.

This automatic tire inflator is operated by a radial plunger supported on the wheel, whose end comes in contact with the road when the tire is partially deflated. Aside from this plunger the inflator comprises a pump and connections to the tire valve. The pump itself is provided with a frame which is attached to the wheel of the vehicle at the hub and at two or more spokes. The pump piston is provided with a plunger terminating at its outward end in a knob or pad, and is kept at the bottom of its stroke by means of a spiral spring within the pump barrel. The barrel is fitted with a flexible tube establishing communication with the tire valve. When the tire is deflated the pad comes in contact with the ground as the wheel revolves, forcing the piston upward and sending air into the tire, the spiral spring being compressed at the same time. As the wheel further revolves the piston and plunger are forced outward by the spring, and the operation is repeated when next the pad comes in contact with the ground, until the tire is inflated so that the wheel is correspondingly lifted and prevents the plunger from being operated.



No. 897,811.

Patents Issued September 22, 1908.

899,055. Speedometer.—Joseph W. Jones, New York, N. Y. Filed November 5, 1907.

899,056. Non-Skidding Device for Wheels or Vehicles.—Henry H. Kemshole, Ilford, England. Filed January 8, 1907.

899,061. Vehicle Tire.—Robert M. Merriman, Youngstown, Ohio. Filed March 13, 1907.

899,109. Carburetor.—Frank H. Heitger, Indianapolis, Ind. Filed May 16, 1906.

899,126. Spare Tire Holder.—Leo P. McKinney, Boston, Mass. Filed December 31, 1907.

899,130. Cushion Tire.—John G. Smith, Wahoo, Neb. Filed March 18, 1907.

899,186. Internal Combustion Engine.—William Rabsilber, New York, N. Y. Filed June 24, 1907.

899,216. Internal Combustion Engine.—Thomas W. Hendry, San Francisco, Cal. Filed November 6, 1906.

899,253. Vehicle Guiding Means.—Leslie S. Hackney, St. Paul, Minn. Filed August 9, 1907.

899,258. Transmission Gear for Motor Vehicles.—Emil A. Nelson, Detroit, Mich. Filed January 24, 1906.

899,331. Wheel for Vehicles.—William H. Scrymgour, London, England. Filed August 12, 1907.

899,332. Spring Wheel for Vehicles.—William H. Scrymgour, London, England. Filed September 30, 1907.

899,333. Vehicle Wheel.—Isaiah C. Scudder, New York, N. Y. Filed February 16, 1907.

899,396. Reversing Clutch Mechanism.—Frank E. Harthan, Trenton, N. J. Filed January 8, 1908.

899,425. Resilient Wheel.—James E. McQuilkin, Westmoreland County, Pa. Filed February 4, 1908.

899,430. Means for Raising Vehicle Bodies.—Arthur J. Pack, Brighton, England. Filed July 15, 1907.

Patents Issued September 29, 1908.

899,611. Wheel.—William H. Parham, Paducah, Ky. Filed May 15, 1907.

899,618. Starting Device for Gasoline Engines.—Frank Reynolds, Syracuse, N. Y. Filed February 17, 1904.

899,620. Tire Inflater for Automobiles.—Peter J. Ross, Trevor, Wis. Filed January 2, 1908.

899,625. Engine.—Fritz Schneider and George B. Conrath, Erie, Pa. Filed May 18, 1906.

899,699. Wheel for Vehicles.—William D. McNaull, Toledo, Ohio. Filed April 29, 1907.

899,698. Safety Reflector for Vehicles.—Robert K. McLean and William K. Gibson, Belfast, Ireland. Filed May 22, 1908.

899,715. Control and Fuel Feeding Device for Internal Combustion Engines.—James T. Dickson, Denver, Col. Filed September 28, 1907.

899,809. Acetylene Gas Generator.—Edwin M. Rosenbluth, Philadelphia, Pa. Filed January 24, 1907.

899,876. Automobile Wheel.—Joseph Laus, Jr., Oshkosh, Wis. Filed March 11, 1908.

899,891. Axle for Motor Road Vehicles.—Jules Niclausse and Albert Niclausse, Paris, France. Filed April 18, 1906.

899,934. Wheel.—George Wolke, Jacksonville, Ill. Filed February 17, 1908.

899,953. Clutch Mechanism for Automobiles and the Like.—Lee S. Chadwick, Philadelphia, Pa. Filed April 21, 1908.

899,974. Variable Speed and Reversing Mechanism.—Noah S. Harter, Waukegan, Ill. Filed December 2, 1907.

Patents Issued October 6, 1908.

900,083. Gas Engine.—Claude A. Clark, Syracuse, N. Y. Filed April 30, 1908.

900,098. Carburetor.—Frank H. Heitger, Indianapolis, Ind. Filed April 14, 1905.

900,111. Transmission Gear.—Robert J. Million, Jefferson Township, Carroll County, Ind. Filed June 12, 1906.

900,154. Lubricating Oil Distributor.—Louis Dubrulle, Paris, France. Filed January 2, 1907.

900,160. Motor Vehicle Truck.—Rodolphus Fuller, Detroit, Mich. Filed November 21, 1906.

900,342. Transmission of Power.—Frank M. Ashley, New York, N. Y. Filed November 26, 1902.

900,359. Changing Batteries in Electrically Propelled Vehicles.—Albert J. Doty, Mount Vernon, N. Y. Filed February 3, 1908.

900,388. Shock Absorbing Mechanism for Vehicle Springs.—Wellington P. Kidder, Boston, Mass. Filed January 11, 1907.

900,450. Variable Speed Driving Mechanism.—Marion E. Vaughn, Plainfield, Ind. Filed February 8, 1906.

900,498. Pneumatic Tire.—Horace W. Dover, Northampton, England. Filed April 8, 1907.

900,522. Picture Exhibition Device.—James H. Gravell, Philadelphia, Pa., and George D. Farwell, Bridgeport, Conn. Filed November 1, 1907.

900,604. Carburetor.—Howard Small, Chicago, Ill. Filed December 28, 1904.

900,634. Ball Bearing.—Frederick W. Witte, Chelmsford, England. Filed April 23, 1906.

900,635. Ball Bearing.—Frederick W. Witte, Leipzig-Plagwitz, Germany. Filed April 11, 1908.

900,638. Gasoline Strainer.—Oscar Zschoge, Brooklyn, N. Y. Filed April 15, 1908.

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Stresses in Brake Parts

By David Landau and Asher Golden.

The work which a brake band or a brake shoe has to do consists in the application of a sufficiently great retarding force to the revolving member in order to bring the car to a standstill in a reasonably short distance under the most adverse conditions. Most brakes can be designed to accomplish this continually during the life of the vehicle, but we find from observation that many designers are more or less at sea in regard to determining the stresses in the brake mechanism, especially the brake bands or brake shoes.

It will be shown later that some of these stresses are quite serious and may in some instances affect the size of the shafts as well as the bearings adjacent to the brake drum. Occasionally we hear of failure of the simple tension members, but this is due only to ignorance or neglect of fundamental principles.

The two classes of brakes most generally used in practice are (1) service brakes and (2) emergency brakes, so named from the purpose which they are supposed to serve. Considered from a mechanical point of view, we have (1) band brakes and (2) shoe or check brakes.

In order to determine the stresses in the various parts of the braking mechanism it is essential to start out with some fundamental and known conditions. For this purpose we will take the following average figures, as found from experiment:

Force exerted by pushing brake lever with the hand, 40-45 pounds.

Force exerted by pulling brake lever with the hand, 50-60 pounds.

Force exerted by pushing a vertical pedal, 60-75 pounds.

The following coefficients of friction of the materials in general use for braking surfaces will be considered sufficiently accurate for the calculation of the stresses:

"Camel's hair" against cast steel	.4
Cast iron against cast steel	.2
Steel against steel	.18
Bronze against steel	.16
Cork inserts against steel (about)	.35

The above table is correct only in a general way, for it is an established physical fact that coefficients of friction depend among other things on the nature of the surfaces in contact, the speed of rubbing, the specific pressure and the temperature. For our purposes, however, it is not necessary to consider the physical conditions mentioned.

The following notation will be used throughout this discussion; weights and pressures are given in pounds:

W = total weight of the car.
w = load on the rear wheels.
V = speed of the car in miles per hour.
v = speed of the car in feet per second.
D = diameter of wheel to which brakes are applied in inches.
d = diameter of the brake drum in inches.
L = distance in which the car is stopped, in feet.
u = coefficient of friction between the brake surfaces.
F = coefficient of friction between the tire and ground.
P = the friction on the brake drum expressed in pounds.
P_1 = the total brake friction necessary to prevent braked wheels from revolving.
θ = the angle of the grade in degrees.
R = gear reduction between the shaft to which the brake is applied and the braked wheel.
Q = force applied at the brake shoe.
ϕ = arc of contact of band in circular measure.
e = base of the system of natural logarithms.
T_1 = tension in the left hand side of the brake band.
T_2 = tension in the right hand side of the brake band.
g = acceleration due to gravity.

For emergency brakes the angular speed of the brake drum is the same as that of the wheels to which they are applied. Taking now the simplest case, as when the car is traveling on a level road, we have the following relation:

$$\frac{W v^2}{2 g} = P_1 L \frac{d}{D} \quad \ldots\ldots (1)$$

from which

$$L = \frac{W v^2 D}{2 g P_1 d} \quad \ldots\ldots (2)$$

In traveling on a grade the angle θ must be taken into consideration; for traveling up hill we have

$$\frac{W v^2}{2 g} - W L \sin\theta = P_1 L \frac{d}{D} \quad \ldots\ldots (3)$$

from which

$$L = \frac{\frac{W v^2}{2 g}}{W \sin\theta + P_1 \frac{d}{D}} \quad \ldots\ldots (4)$$

We find in an analogons way for travelling down hill

$$L = \frac{\frac{W v^2}{2 g}}{P_1 \frac{d}{D} - W \sin\theta} \quad \ldots\ldots (5)$$

For service brakes not applied to the road wheels it is evident that the angular speed of the brake drum is not the same as that of the road wheels, so that it is necessary to consider the reduction, R, between the drum and the wheels. This reduction is always less than unity. For these brakes we have:

On a level road

$$L = \frac{W v^2 D}{2 g P_1 d R} \quad \ldots\ldots (6)$$

For traveling uphill

$$L = \frac{\frac{W v^2}{2 g}}{W \sin\theta + \frac{P_1 d}{D R}} \quad \ldots\ldots (7)$$

For traveling downhill

$$L = \frac{\frac{W v^2}{2 g}}{\frac{P_1 d}{D R} - W \sin\theta} \quad \ldots\ldots (8)$$

As an example in the application of these formulas we will take equation (2) for an emergency brake and for a car traveling on a level road. The pressure P on the brake drum is half of the total pressure P_1, considering that there are two emergency brakes. Now, assuming the weight of the car to be 3,000 pounds; velocity of the car, 40 miles per hour (approximately 60 feet per second); the total pressure P_1 on the drums to be 2,000 pounds, and $D/d = 3$, we have:

$$L = \frac{3000 \times 60^2 \times 3}{2 \times 32.2 \times 2000} = 250 \text{ feet (about).}$$

LIMITING VALUE OF THE TOTAL PRESSURE ON THE BRAKE DRUM.

In the design of a brake we are concerned at the outset with the minimum friction between the brake surfaces which will be effective in stopping the car. We can determine this minimum value from the following considerations: The moment of friction of the road wheels is $F w D$, for the case in which the brakes are applied to the wheels; for the service brake, however, the braking force is applied at some point between the transmission and the road wheels, so that we have to consider the reduction R. The moment of friction of the road wheels is then $F w D/R$.

The moment of friction of the brake

drum, regardless of its location, is $P_t d$. From the above considerations it is evident that when the moment of friction of the road wheel is the same as that of the brake drum the effectiveness of the brake is a maximum; in other words, the wheels will just begin to slide. We then have:

For the emergency brake

$P_t d = F w D$

or $P_t = F w D/d$ .... (9)

For the service brake

$P_t d = F w D/R$

or $P_t = F w D/R d$ .... (10)

If $P_t d$ is less than $F w D$ (for the emergency brake), or less than $F w D/R$ (for the service brake), the brakes have not reached their maximum effectiveness; this condition obtains where insufficient pressure is put on the operating lever or pedal.

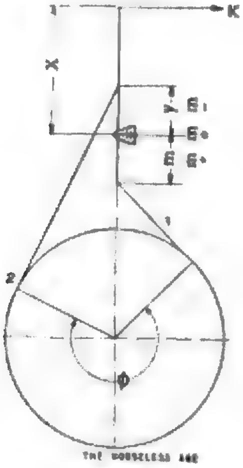


FIG. 1.

In the above discussion, by an emergency brake is meant one applied to the road wheels so that no gear reduction has to be considered. As stated above, the total pressure on the brake drums, P_t, is to be divided between both drums in the case of an emergency brake; $P_t = P$ in the case of a service brake.

STRESSES IN SIMPLE BAND BRAKES.

From the value of P, which we have shown above can be easily found, we can determine the stresses in the members of a simple band brake. Fig. 1 is a diagrammatic sketch of a simple band brake to which the following discussion will apply. The conditions that obtain in this case are almost similar to those of an ordinary belt, so that the same reasoning, with but slight modifications, may be applied to the case under consideration. Considering the tensions in the ends of the band, we have

$$T_1 = P \frac{e^{u\phi}}{e^{u\phi} - 1} \quad \text{.......................} (11)$$

$$T_2 = P \frac{1}{e^{u\phi} - 1} \quad \text{.......................} (12)$$

The tensions T_1 and T_2 as will be seen from the above, are never equal; the greater tension is in that member against which the drum is turning.

The manner in which equations (11) and (12) are derived may be found in a number of treatises on mechanics; a very clear exposition is to be found in Goodman's "Mechanics Applied to Engineering." To save calculation we give below values of $e^{u\phi}$. These values will be found to apply to practically all conditions.

TABLE OF VALUES OF $e^{u\phi}$.

Arc of Contact in Degrees.	Coefficients of Friction, u.					
	.14	.16	.18	.20	.22	.24
180	1.55	1.65	1.76	1.87	1.99	2.13
190	1.59	1.69	1.81	1.94	2.07	2.21
200	1.64	1.74	1.87	2.01	2.15	2.30
210	1.67	1.79	1.93	2.07	2.23	2.39
220	1.71	1.85	1.99	2.15	2.31	3.49
230	1.75	1.90	2.06	2.22	2.40	2.60
240	1.79	1.95	2.12	2.30	2.49	2.72
250	1.83	2.00	2.19	2.38	2.58	2.83
260	1.88	2.06	2.26	2.47	2.68	2.95
270	1.93	2.12	2.34	2.55	2.78	3.07
280	1.97	2.18	2.42	2.64	2.88	3.19
290	2.02	2.24	2.50	2.73	2.99	3.32
300	2.07	2.30	2.58	2.83	3.10	3.46
310	2.12	2.36	2.66	2.03	3.22	3.61
320	2.17	2.42	2.75	3.03	3.34	3.75
330	2.22	2.48	2.84	3.14	3.47	3.91
340	2.27	2.54	2.93	3.25	3.60	4.08

Considering the direction of rotation (see Fig. 1) as clockwise, the tension in the right hand band will be T_1, and the tension in the left hand band will be T_2. From the values of T_1 and T_2 given above we can readily determine the force necessary to be applied to the ends of the band to produce the desired friction; we then have:

$$Q x = T_1 m + T_2 y,$$

from which, taken in consideration with equations (11) and (12), we have

$$Q = P \frac{(m e^{u\phi} + y)}{x (e^{u\phi} - 1)} \quad \text{.......................} (13)$$

for m positive; when m is negative

$$Q = P \frac{(y - m e^{u\phi})}{x (e^{u\phi} - 1)}$$

When $m = O$

$$Q = \frac{P y}{x (e^{u\phi} - 1)}$$

When the direction of rotation is anti-clockwise, the tension in the right hand band will be T_2, and that in the left hand band will be T_1; we then have the following values of Q:

$$Q x = T_2 m + T_1 y,$$

from which, as before,

$$Q = P \frac{(m + y e^{u\phi})}{x(e^{u\phi} - 1)} \quad \text{..........} (14)$$

for positive values of m; when m is negative we have

$$Q = P \frac{(y e^{u\phi} - m)}{x - (e^{u\phi} - 1)}$$

When $m = O$

$$Q = \frac{P y e^{u\phi}}{x (e^{u\phi} - 1)}$$

When $m = O$ the brake is single acting in a practical sense; when m is negative the brake is double acting.

CHEEK OR SHOE BRAKES.

Under this heading we will deal with the stresses in brakes as at present commonly applied at points between the transmission and the road wheels. A particular brake of this type is represented in Fig. 2; Fig. 3 is a diagrammatic sketch of this brake showing the force diagrams.

Let m_1 and m_2, b_1 and b_2, c_1 and c_2 be lengths in inches; also let

B_1 = the bearing pressure due to applying shoe 1.

B_2 = the bearing pressure due to applying shoe 2.

B = the resultant effective bearing pressure.

We then have for the stresses in shoe 1:

$$Q_1 m_1 = B_1 b_1 + N_1 c_1,$$

where N_1 is the tangential pressure of the brake shoe against the drum; then

$N_1 = u B_1$ .... (15)

and

$$Q_1 = N_1 \frac{b_1}{m_1} \left(\frac{1}{u} + \frac{c_1}{b_1} \right) \quad \text{.......................} (16)$$

The bearing pressure due to shoe 1 is then

$$B_1 = Q_1 \frac{m_1}{b_1 + u c_1} \quad \text{.......................} (17)$$

When $c_1 = O$, we have

$$Q_1 = N_1 \frac{b_1}{u m_1} \quad \text{.......................} (18)$$

and

$$B_1 = Q_1 \frac{m_1}{b_1} \quad \text{.......................} (19)$$

Now, considering the stresses in band 2, we have

$$Q 2 m_2 = B_2 b_2 - N_2 c_2.$$

from which

$N_2 = u B_2$ .... (20)

and

$$Q_2 = N_2 \frac{b_2}{m_2} \left(\frac{1}{u} - \frac{c_2}{b_2} \right) \quad \text{.......................} (21)$$

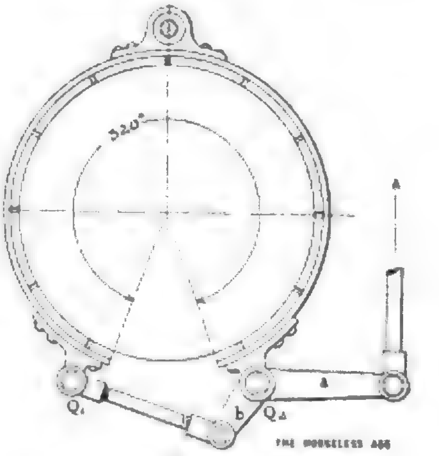


FIG. 2.

The bearing pressure due to shoe 1 is then

$$B_2 = Q_2 \frac{m_2}{b_2 - u c_2} \quad \text{.......................} (22)$$

When $c_2 = O$, we have

$$Q_2 = N_2 \frac{b_2}{u m_2} \quad \text{.......................} (23)$$

and

$$B_2 = Q_2 \frac{m_2}{b_2} \quad \text{.......................} (24)$$

We can now determine in another way the total friction P_t, which is

$$P_t = N_1 + N_2 \frac{Q_1 \frac{m_1}{b_1}}{\frac{1}{u} + \frac{c_1}{b_1}} + \frac{Q_2 \frac{m_2}{b_2}}{\frac{1}{u} - \frac{c_2}{b_2}} \ldots\ldots\ldots (25)$$

The effective bearing pressure B is

$$B = B_2 - B_1 = \frac{Q_2 m_2}{b_2 - u c_2} - \frac{Q_1 m_1}{b_1 + u c_1} \ldots\ldots (26)$$

We will now apply the above equations to the brake shown in Fig. 3, which is a type in actual use. The following data apply to this brake:

	Inches.
Diameter of brake drum	7.2
Width of brake band	1.875
Length of lever arm, *a*	2.5
Projected length of lever arm *b*	.835

The pressure at the lever *a*, which is exerted through the pedal, having a lever ratio of 5 to 1, will be 375 pounds; this assumes that the pressure of the foot on the pedal is 75 pounds.

Diameter of pin at Q_1	.31 inch.
Area of this pin	.0755 square inch.
Diameter of pin at Q_2	.5 inch.
Area of this pin	.1963 square inch.

Taking moments about these two pins we find that the pull at Q_1 is 1,006 pounds and the pull at Q_2 is 1,430 pounds. The pins Q_1 and Q_2 are made of cold rolled bar stock and case hardened for wear. It is safe to assume that their elastic limit is about 60,000 pounds per square inch. Owing to the shortness of these pins and the way in which the other parts operate on them, they are practically subjected only to shear. We therefore find that the shear at $Q_1 = \frac{1006}{.0755} = 14,000$ pounds per square inch; taking the elastic limit for shear to be $.8 \times 60,000 = 48,000$, we find the factor of safety to be $\frac{4,800}{1.4000} = 3.42$. For the pin Q_2 the shear is $\frac{1430}{.196} = 7,300$ pounds per square inch. Its factor of safety is 6.56. It will be seen that the pin Q_2 is twice as strong as pin Q_1, and so far as strength for shear is concerned the pin Q_2 is just about strong enough, considering general factors of safety in automobile construction. It may be said that pins in the braking mechanism fail, as a rule, through wear. The wearing surfaces of the pins are exposed to the abrasive action of grit and dust, and are seldom, if ever, lubricated. It is therefore of interest to determine the bearing pressures of these pins, and since the motion of the clevises or the brake shoe eye is relatively small, the pressures per square inch of projected area should be somewhat of the order of that used on piston pins, or possibly lower, considering the fact that these surfaces are seldom lubricated.

Taking the pressures on the pins as given above we find that the projected areas of the pins Q_1 and Q_2 are respectively .152 and .245 square inch; therefore the bearing pressures on the pins are $1,006/.152 = 6,980$ pounds for Q_1 and $1,430/.245 = 5,840$ pounds for Q_2. It is thus seen that the specific pressures on these pins is from five to seven times as high as that used for surfaces that are well lubricated and having relatively little motion. This is a point worthy of attention in regard to the refinement of motor car details. In looking for attempts in this direction we have observed that one maker at least (perhaps the only one) has given this matter attention. We do not know of any particular case where bearing pressures are so high and yet lubrication is the worst that can be imagined. This is one of the causes of brake failure after short service.

We will now determine the pressures on the rear bearing when this brake is applied. From the drawing we find the distances $m_1 = m_2 = 8.875$ inches; $c_1 = c_2 = 3.6$ inches; $b_1 = b_2 = 4.7$ inches. Substituting in equation (17) we can determine the pressure on the bearing caused by applying the right hand shoe:

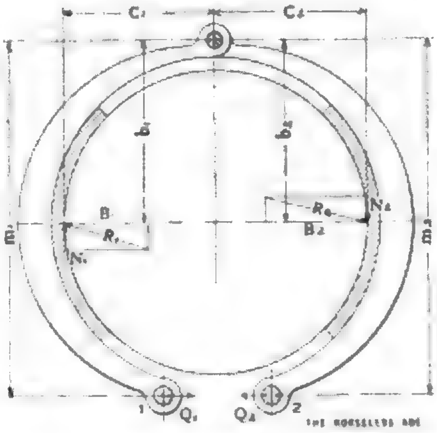


FIG. 3.

$$B_1 = \frac{1006 \times 8.875}{4.7 + (.18 \times 3.6)} = 1710 \text{ pounds.}$$

and the pressure due to applying the left hand shoe:

$$B_2 = \frac{1430 \times 8.875}{4.7 - (.18 \times 3.6)} = 3140 \text{ pounds}$$

The coefficient of friction between the drum and shoes is here assumed to be .18. The effective bearing pressure can now be found from equation (26):

$$B = 3140 - 1710 = 1430 \text{ pounds}$$

This pressure is taken on a bearing which is designed to carry 1,100 pounds quiescent load. It may be readily inferred that this bearing is stressed to its rated carrying capacity by a load which can hardly be called quiescent.

We can now determine the normal pressure of the brake shoes against the brake drum by substituting in equation (15); this pressure is

$$N_1 = .18 \times 1710 = 307 \text{ pounds}$$

for the right hand shoe, and substituting in equation (20)

$$N_2 = .18 \times 3140 = 565 \text{ pounds}$$

for the left hand shoe.

The value of P is found by substituting in equation (25) and is

$$P = 307 + 565 = 872 \text{ pounds.}$$

The value of P may also be found from equation (10); for purposes of substitution, the following additional data is given:

Weight on rear wheels (measured)	1,500	pounds
Diameter of brake drum	7.2	inches
Diameter of rear wheels	34	inches
Gear reduction	2.125	to 1

Making the substitution, we have (assuming F = .6)

$$P = \frac{.6 \times 1500 \times 34}{2.125 \times 7.2} = 2000 \text{ pounds.}$$

It will be seen from this that in order to prevent the rear wheels from rotating it is necessary to make a change in the leverages between the pedal and the brake or to increase the foot pressure; the coefficient of friction of the brake surfaces must be increased.

The brake band in Fig. 2 is found to have an arc of contact of 320°; the materials used for the brake blocks have a coefficient of friction of .18. Referring to the table of values of $\epsilon^{u\phi}$, under the coefficient of .18, and opposite 320°, we find the value 2.75. Considering the brake drum as having clockwise rotation, we have by substitution in equation (11)

$$T_1 = \frac{2.75}{1.75} \times 307 = 482 \text{ pounds}$$

From equation (12), we have

$$T_2 = \frac{1}{1.75} \times 565 = 323 \text{ pounds}$$

Now, considering the brake as having anti-clockwise rotation, the tensions in the bands will be

$$T_2 = \frac{1}{1.75} \times 307 = 175 \text{ pounds}$$

$$T_1 = \frac{2.75}{1.75} \times 565 = 885 \text{ pounds}$$

October Registrations in Illinois.

During October the number of automobiles registered with Secretary of State Rose at Springfield, Ill., naturally showed a considerable decline as compared with the previous month, for the simple reason that the delivery season had reached its end. During June, July and August the registrations were very heavy, but in September there was a marked decline, to 725 cars. In October the number registered was only 480. Western makes of low priced cars, Buick, Rambler, Ford and Mitchell, lead in point of numbers. Of the cars registered twenty-seven, or 6 per cent., were motor buggies and seventeen, or less than 4 per cent., electrics. The following list contains all the makes of which four or more were registered: Buick, 44; Rambler, 33; Ford, 28; Mitchell, 27; Thomas, 24; Packard, 19; Cadillac, 17; Olds, 15; Woods, 14; Maxwell, 11; Peerless, 11; Winton, 11; Reo, 10; Chalmers, 8; International Harvester Company, 8; White, 8; Autocar, 7; Locomobile, 7; Overland, 6; Pope, 6; Wayne, 6; Renault, 5; Reliable-Dayton, 5; Black, 4; Northern, 4; Pierce, 4; Schacht, 4; Stoddard-Dayton, 4.

Maintenance and Repairs

New Life for a Veteran.

By Experimenter.

This is the story of what has been done with an old car. I bought it from a dealer in second hand automobiles in the winter of 1904, after a demonstration which indicated that a little work and the expenditure of perhaps $25 for some new bearings, piston rings and other small parts would put it in good condition. I had had two years' experience with a small automobile, which I cared for and operated myself, and thought I was a fair judge of a car's strong and weak points. But that "demonstrator," I must now conclude, was a wonder in his way, and my confidence got something of a shock when, after three days spent in taking my new purchase apart, I discovered that nearly everything about it needed to be replaced, repaired or refitted. But I was in for it, and so I set to work.

The car was fitted with a tonneau, had a wheel base of 84 inches, and weighed, with tanks filled and lamps on, 2,470 pounds. It was driven by double chains, through a four speed and reverse sliding gear transmission by a four cylinder motor, 3½x5 inches, rated at 12 horse power. It came from the workshops of one of the best known foreign makers, was built honestly and intelligently of the best materials, and was, at the time I bought it, four years old. In other words, it was one of the earliest of imported cars to be run on American roads. But even at that it certainly had been cruelly abused, and it took me just three weeks, working in the evenings, as well as Saturday afternoons and all day Sundays, to put it into what seemed should be serviceable shape. I say *seemed*, for, at the end of that first job of overhauling, my real work of getting the car into its present condition—which *is* satisfactory—only just began. When I succeeded in making the car run without frightening nearby horses into convulsions with the clashing and grinding of gears, explosions in the muffler or through the intake pipe and various and fearful other manifestations of its unfitness for polite appearance in public, I began to find out things which just had to be remedied if the driver and his passengers were to have any steady comfort on their side.

But these things, while apparently small in themselves, were exceedingly difficult to trace down to their cause, and would, as I suspected, probably be more difficult to correct. So one evening I sat down and thought it all out. Should I give up the task, try to forget the money I had already sunk and sell the car for whatever I could get, which certainly would be a good deal less than I had paid for it? Or should I refuse to acknowledge myself beaten, and give over perhaps the rest of my life and a good many more dollars than I liked to estimate to the job of trying to make the car do what I felt almost sure it might be made to do? My engineering skill was slight, and my private opinion of my knowledge of the automobile (as revised) was decidedly unflattering. But, on the other hand, I did have almost unlimited patience, and the remnants of my pride were touched. I decided to go ahead and either reduce the car to an unmerchantable junk heap with my "improvements" or make it worthy of its maker's name and its good design and materials. Also I decided, there and then, to do for myself every bit of experimenting and work on it, except such as required machine tools, which I did not have. This resolve, I may add, I have kept with very occasional exceptions, those exceptions, be it noted, resulting in some very crude and careless fitting and assembling, which gave me further complications that puzzled me for a long period.

What follows represents in time many off hours during four years of theorizing and experimenting—much of it too foolish even for me in my humbled state of mind to mention—and I touch only on a few points at which I succeeded. But I look back on it as time not altogether illy spent. The general result has been to give me a reliable and satisfactory car, within the limitations of its power and design, and, besides, I now have some very definite ideas of what should be and can be had in a modern car for the man who cares for and runs a car for himself and his family.

OVERHEATING GREATEST TROUBLE.

The greatest and most obvious trouble with my car, from the start, was overheating. It steamed at the slightest provocation, and, after 15 miles of running on a level road, got so hot that it would pull a moderate load only on its two lower gears, and even then with an exhaust pipe that was red hot. Various "experts" suggested changes in timing as a remedy, and the various changes I tried with varying results, finally achieving some improvement. But still the engine overheated ferociously. So I decided the water piping was too small and had too many bends in it. Accordingly I enlarged and simplified it (the idea that a larger initial supply of water was needed I put aside at the beginning, as the tank at the rear of the car held 15 gallons). But the change in piping had little effect, and, after cleansing the radiator pipes and water passages in the cylinders with a soda solution and being assured by everyone that the radiator was of ample size to do its part, I settled upon the pump as the real source of trouble. It was of the centrifugal type, friction driven by a leather faced wheel, pressed by a spring against the flywheel, and I thought of getting a larger pump. But first I tried the trick of driving the old one faster. Between two discs of sheet steel, two-thirds the size of the old discs, I placed two thicknesses of leather cut slightly larger in diameter, clamping the whole with small through bolts to the flange of the original pump hub, which I reduced to size on the lathe. I do not know what is the difference in capacity between my old pump and my new one, allowing for the probably greater slip of the latter, but I do know the change materially reduced the overheating.

ENGINE MISSED WHEN PULLED DOWN.

Encouraged by this, I turned to my second greatest trouble—an unreasonable tendency on the part of the engine to miss whenever the speed of the motor was reduced by a heavy grade or a very bad road surface.

The motor is of the low compression type, and would turn over evenly on a full throttle and advanced spark, under a light load. But, retard the spark and it would miss under no load at all; while, fix the spark and throttle where you might, it missed badly on one cylinder or another without partiality, if not able to turn over at what, for its type, was nearly high speed. This made hill climbing of even the common or garden species an affair of shame and torture to the driver and of burning thoughts, visually and audibly expressed, on the part of the motor. As the compression was excellent, the spark itself all that could be desired, and the mixture, as indicated by its odor at the muffler outlet and by the color of the flame from the priming cocks, as near right as carburetor jet adjustment would make it, it looked as if a long inlet pipe, with two bends in it, was the cause of poor suction, and this the cause of the miss. To change the inlet pipe was practically impossible, on account of the position of the inlet ports on the cylinder heads. Therefore the carburetor was taken down and studied with a view to its possible improvement.

SUPPLEMENTARY AIR CONTROL PROVIDED.

This carburetor is of foreign make since abandoned, I believe, and in shape is something like a lean barrel laid horizontally. It is about 10 inches long and 2½ inches through at its thickest part, the mixing chamber. The float chamber, which is integral with and at one side of the barrel, supplies gasoline through a jet whose orifice is to be reduced only by tapping it with a light piece of metal and enlarged by boring it out very cautiously with a steel needle. The carburetor took its air from a pipe which curved up close under the exhaust manifold, and so was warmed. Its supplementary air is obtained from two openings at its extreme rear, which register with two similar holes on a revolving sleeve that admitted of being set at any point with a spring catch. But this supplementary air valve could only be adjusted by opening the hood and reaching in, an operation obviously impossible when under way on the road. So, with a small bell crank, I linked the sleeve to a five-eighth inch brass rod carried on simple bearings through the floor of the car parallel to the steering post. To this rod I fastened, at right angles to its top, a short arm, which revolved over a notched sector of brass, fixed immovably to the steering post immediately under the wheel. With the new arrangement I was able, while running, to lessen or increase the supplementary air supply as needed, or to shut it off entirely when the motor slowed down and the lack of suction seemed to demand less air. This device, which, of course, is not in any way original with me, helped decidedly, and I am by no means certain, after giving it long and thorough trial, that it has not definite advantages over the spring controlled poppet air valve which is the regular carburetor equipment nowadays. At least I have determined to my own satisfaction that when suction in an inlet pipe is poor at its best the hand controlled supplementary air valve does away with that annoying "chattering" which usually accompanies the action of the spring poppet valve, and which, when the inlet valves are automatic, as is the case with my car, is so marked as to make the poppet air valve often worse than useless.

Yet, even the hand controlled valve did not entirely solve the suction difficulty, for unless the engine were run at fairly high speed the valve had to be closed so far to produce even suction as to enrich the mixture too heavily, and no amount of adjustment of the gasoline nozzle gave the desired balance under all conditions between air and gasoline. A shield of sheet brass fitted to the upper end of pipe supplying air regularly and curved slightly over the exhaust manifold was tried, and helped somewhat by increasing the temperature of the incoming air, and so creating a more homogeneous mixture. Also, by slightly throttling the regular air supply by means of a copper washer inside this air pipe I got more decided suction at low motor speeds.

CARBURETOR RECONSTRUCTED.

But the final solution of the problem was accomplished by reconstruction of the interior of the carburetor itself. The short passages immediately on either side of the nozzle I found were of almost uniform diameter throughout their length, and it struck me that the inclination to miss, resulting from an impoverished mixture, was probably due to the opportunity these passages afforded to a flow of air on either side and above the vent of the nozzle—an air movement which performed little or no service in pulling the gasoline out of the jet, and which consequently "killed" the charge. The remedy was an adaptation of the principle of the Venturi tube. A piece of light sheet brass furnished two funnel shaped sections which were introduced into the passage on either side of the nozzle, the smaller end toward the nozzle in each case. They were held in position by springing their small ends inside the flange extremities of a short tube that was a close fit for the passage. The effect of this contraction of the passage was to centre both the suction from the cylinders and the incoming air (whether from the regular supply or from the supplementary pipe) almost directly upon the tip of the nozzle, with the result that gasoline had to spray from the latter, however slight the suction. The concentration of the suction and incoming air supply upon the nozzle made necessary a finer adjustment of the jet, and some experiment was made before exactly the right pitch for the funnel sections was arrived at. But the result, as compared with previous conditions, was remarkable. The engine pulled evenly and with greater strength on all motor speeds, except, perhaps, when running under light load at its top speed; it was less extravagant in the use of gasoline, and was more flexible and quieter. Also the car now rides more comfortably, because the engine no longer bucks and labors when nearing its limit of operation on a high gear pull uphill. But the most surprising result, and to me particularly gratifying, was the total disappearance of the tendency to overheat, which I can only attribute to the even firing of the motor on a properly mixed and sufficient charge (which, of course, means less running on the lower gears), and also to the more efficient driving of the pump.

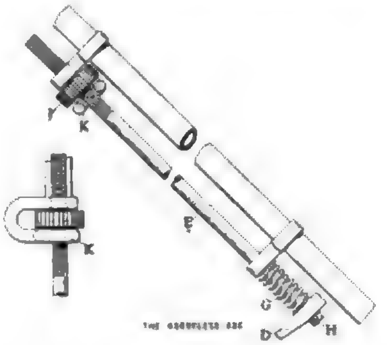
Obviously, the time and labor given to reconstruction of the pump and carburetor could have been saved by installing at the start a larger pump and a new carburetor of modern design. Be that as it may, I am satisfied with the present arrangement and would not change. Whatever this old veteran of 1900 was able to do when first turned out of the shop, it is not put to shame today by most cars of its power on long trips over rolling country. I have done away with the tonneau, because it was unsightly, added materially to the weight and was uncomfortable on account of the short wheel base and stiff springs. A box for the tools, spare tubes and a rubber blanket, carrying a seat on its top, has taken the tonneau's place. The car now weighs, equipped and with tanks full, 2,200 pounds. It has been timed at 32 miles an hour on an exceptionally fine piece of road. It will do its 25 miles an hour right along on good roads, and it is quiet and fairly easy to ride. It is eight years old. So far as I can foresee it should, with intelligent care and the repair or replacement of bearings and small moving parts, as demanded by average continuous use, be running as well eight years hence as it is running now.

Changes Made in Converting a Touring Car to a Runabout.

The writer was recently called upon to convert a 1906 model side entrance touring car of foreign manufacture to a runabout. The changes necessary consisted in giving the steering post additional rake, adjusting the change gear and brake levers, and applying a new form of control. The ignition was also changed from a high tension magneto with hand control to one of the same type with fixed point of ignition.

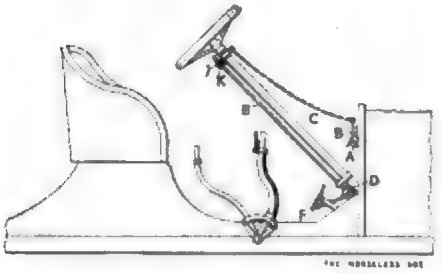
The original control arrangement consisted of two long levers for the spark and throttle, working over quadrants fastened to the dash. These were not very convenient to operate when the car was bought, and the owner always claimed that they were the cause of considerable extra exertion in driving. When the steering post was reset the levers were impossible to reach. They were therefore removed, and the following control was fitted instead (see figure). An accelerator pedal F was fastened to one end of a short shaft on the footboard, the other end being attached to the linkage to the throttle valve which had formerly been connected to the lever on the dash. The owner preferred to drive with the accelerator pedal, but at the same time desired to be able to set the throttle at any desired minimum, and accordingly two clips were fitted to the steering pillar to act as bearings for a rod E. This rod was threaded at its upper end, and fitted with a foot D at its other end, the accelerator pedal F resting against this foot when the pedal was released. The upper clip was provided with a fork K, which was bent around on the rod so as to prevent any longitudinal movement of the nut J. This nut fitted over the upper end of the rod and bore against the upper bracket on one side and the fork K on the other. The foot D was loose on rod E, but was prevented from coming off by a pin H in the lower part of the rod. A spring G, interposed between the foot and the bracket, damped any shocks from the accelerator pedal flying upward under the influence of the throttle spring when released. The magneto, having a fixed sparking point, needed no control, so that only the pedal and connection to the throttle were fitted.

By turning nut J, rod E is pushed downward, foot D pressing on the accelerator pedal, and preventing it from rising beyond that point, and in turn preventing the throttle from closing any further. When the accelerator pedal is operated, the foot D is pushed down the rod by spring G until it strikes the pin H. The rod, however, remains stationary. When the operator releases the pedal it flies up, and striking the foot D forces it upward on the rod, but the spring G takes up the shock and prevents the transmission of shock to the rod or the nut J. The spring G is of slightly less strength than that of the throttle spring, so that there is little or no vibra-



tion of the pedal when it strikes the foot D.

While the magneto was changed from a variable to a fixed point of ignition, the shortcircuiting device was retained, it being identical in both magnetos. This device was operated by pushing on a knob projecting from the dash shown at A in the figure. It being very difficult to operate this knob with the fingers from the seat, a bell crank B was fitted on the dash, and a chain C fastened to one arm of this bell crank, and to the upper clip on the steering post. When it is desired to short circuit the magneto the chain C is pulled whereupon the bell crank arm pushes the knob A, which short circuits the magneto. For ready starting a battery, coil and distributor were retained on the car, being part of the original installation.



The change gear and brake levers were placed quite far forward in relation to the relatively high seat of the touring body, and consequently had to be bent backward, or moved further back, so that the driver could reach them with ease, when the lower runabout seat was fitted. The latter alternative being out of the question, the levers were bent as shown, the change gear lever being shown in one of the slots at the rear of the selective quadrant, and the brake lever in its "off" position. The whole arrangement was quite satisfactory, everything being within reach and comfortable to operate. The lubricator, coil boxes and side doors have been omitted from the drawing in order to show up the parts changed more clearly.

Disc Clutch Lubrication.

Disc clutches are run either dry or in oil, those of the multiple disc type invariably running in oil, while those of the three disc or plate type usually run dry. As a rule the driver of a car fitted with a "wet" disc clutch, in his fear that the clutch will "fire" through lack of lubricant, fills the clutch casing too full. It will be found in such cases that the gears of the first speed are very difficult to mesh when the car is stationary, owing to the fact that the discs do not separate. The instruction book gives or should give the amount of oil to be put into the clutch casing, this varying from a pint to a pint and one-half in most cases. The old oil should be drawn off periodically, and replaced by fresh oil, depending on the mileage made by the car, time in service, etc.

Some Advantages of the High Wheeler.

By J. J. Kidder, M. D.

Probably every country physician has, since the advent of motor propelled vehicles, looked forward anxiously to the time when old "Dobbin" would be supplanted, or at least greatly aided by the personal acquisition of such a convenient, speedy mode of transportation. Lives to be saved, emergency calls quickly answered, less time on the road, more leisure at office and greater entrance into the home life, more sleep, more rest—all these are possibilities that appeal. But a $1,500 to $3,000 investment, enormous repair bills, large gasoline and oil consumption, with no one in the village to make repairs—appalled. An income of $2,000 per year prohibited the purchase of a car. The situation was frequently reviewed and the advent of cheaper and less complicated machines was gladly hailed. I noted the introduction of the high wheeled buggy type with solid rubber tires and evidently much lower repair cost. I investigated several makes, and on May 28 I purchased a 900 pound, two cylinder, air cooled, four cycle, 12 horse power motor buggy, with 38 inch wheels and 1¼ inch solid rubber tires. With this I am ready to go at the turn of a crank and with a speed of from 2 to 20 miles per hour. The average speed under all conditions of road here will be about 14 miles. The gasoline consumption varies with road conditions, the average being a gallon for 20 miles.

For such conditions as confront us in this vicinity I believe a machine along this line of construction is best. Low tire maintenance, high road clearance, such simple design that any blacksmith can make most repairs, small fuel consumption and air cooling simplicity all meet our purpose. Another point that will be taken note of by the motorist who has regard for the safety of his fellow men and also wishes to avoid the incurring of expensive damage suits is the fact that horses will not frighten nearly so readily at such vehicles as they will at the ponderous, shining, brass bound, locomotive like car.

Now, as to my personal experience, I will say that the running cost will average one cent per mile, including gasoline, oil and tire maintenance. I would explain that I use an expensive high grade oil. I have had two breaks. One of the connecting rod big end bushings broke, and another time four teeth broke out of the sprocket on differential. Both were replaced by the factory. The bushing I had adjusted by a local repair shop and the sprocket wheel I replaced myself. So up to date my repair bills do not count.

Changes in a Well Known English Light Car.

The Rover Company of England have recently brought out a four cylinder light car which embodies a number of changes as compared with their former practice. The transverse single semi-elliptic front spring has been discarded for two longitudinally placed semi-elliptics. The ball bearings on the crank shaft main journals have been discarded and plain bronze and anti-friction metal bearings substituted. The motor is still used as a brake, and a refinement in the mechanism, by means of which it is caused to act as a brake, consists in placing the connection for moving the cam shaft longitudinally at the middle of the latter instead of at the end thereof. The valve springs and push rods, which are all on the left hand side of the engine, are closed in by two readily removable covers, in order to deaden the noise of the valve mechanism and also to give the motor an appearance of simplicity. In the design of the push rod special effort has been made to render the operation as quiet as possible. The push rod is made in two parts, the upper one telescoping within the lower one. The upper part is provided with a flange against which is forced a substantial washer of hard fibre. The two parts of the push rod are forced apart by a light coiled spring inside the lower one, so that the necessary clearance in the valve operating mechanism always occurs between the upper and lower parts. The "hammer," therefore, occurs always between a metal and a fibre surface and never between two metallic surfaces.

The unit construction of engine base, change gear box and cradle for the clutch is retained. The engine lubricating system comprises a positively driven gear pump, which takes the oil from a well at the bottom of the crank chamber and delivers it to the three main bearings of the engine, from which the oil finds its way through drill holes in the crank shaft to the connecting rod bearings. A sight feed lubricator is provided for feeding oil to the crank case to maintain the oil therein at a given level. The oil in the crank case in draining into the well at the bottom thereof has to pass through a gauze strainer. A peculiarity of the water cooling system consists of a flange with three nozzles turned in different directions, which is bolted to the side of the engine cylinder jacket. The object of the three nozzles is to divide the stream of water so as to distribute the cooling effect as much as possible.

At Cambridge University, England, the authorities have found it necessary to issue regulations regarding the use of automobiles by students. Hereafter students will not be allowed to keep motor cars or motorcycles within the precincts of the university without a license from the senior proctor, nor to hire a motor vehicle without signing their name in a book provided by the university. The cause of these drastic provisions is said to be that the rules of university discipline had been infringed by students using cars at a considerable distance from the university. There are also said to have been a considerable number of complaints regarding furious driving by students.

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The House Organ.

A Cleveland manufacturer having business relations with the automobile industry recently announced that thereafter he would not place any advertising in trade papers, but would seek to gain the necessary publicity by means of a house organ. He also expressed the view that the house organ was a cheaper and more effective method of advertising than advertising in trade papers, and advised other manufacturers to follow his example. His argument was based mainly on the conditions obtaining in the automobile paper field, and while many of his strictures are true, his conclusions, at least in their generalized form, are absolutely fallacious.

The manufacturer referred to states that in the automobile field there are about twenty-five papers, while less than half a dozen could cover every phase of the subject. Quite so. But there will be less in a few years, defections having already begun. Manufacturers who believe that the great multiplicity of papers in the business is an evil can hasten this development by confining their advertising to the papers of unquestioned merit (as advertising mediums), because it is a foregone conclusion that these will win out in the end, and by so doing they will be helping along the natural course of events instead of opposing it.

That the general establishment of house organs is not the best remedy for the existing evil, nor, indeed, a remedy at all, will be obvious on a moment's reflection. Taking the automobile and accessories industries, there are at least two hundred firms who must do considerable advertising of some sort in order to dispose of their products, and if each of these were to establish a house organ there would be two hundred automobile publications instead of twenty-five, or the evil would be multiplied eight times. The manufacturer referred to says substantially: "What chance is there for your advertisement to be seen when it is hidden among a hundred others?" To which it may be replied, "What chance is there for your house organ to be stripped of its wrapper when it forms one of two hundred that reach a business man's desk regularly?" The trade paper of the better class is never sent regularly free, except to advertisers. This at least applies to THE HORSELESS AGE, which goes only to regular subscribers and to firms or individuals with whom we have advertising contracts. The paper which is subscribed for is naturally a much better advertising medium than the one which is sent free. The very fact that the man who receives it is willing to pay for it shows that he is interested in the subject to which it relates, and an assurance that every copy will be opened and scanned through at least. Now, the house organ is, in the majority of cases, sent free, and it is therefore likely to share the fate of the "give away" trade papers and pass into the waste basket without being opened.

There is, of course, a legitimate field for the house organ. In the case of very large firms having agents in almost every city in the country and employing a large number of traveling salesmen, demonstrators, etc., every one of whom is in a sense a representative of the company, the house organ is a very convenient means for their instruction and to keep them informed of all new developments in connection with the company's business, in so far as it is of interest to these men, and such a medium is of particular value in a new industry, where one innovation follows another at short intervals. We have in the automobile industry a number of such house organs, intended solely for the staff of the companies, and some of them are gotten up in a very practical manner. By this means the firm's employees or agents who deal directly with the public are kept informed of the achievements of the company's cars in competition in various parts of the country, of changes in construction, and of the advantages of the new features or their talking points, and in some instances regular essays on salesmanship and "demonstratorship" are given. The manufacturers issuing these house organs do not count on them for finding new customers, but for increasing the efficiency of their staff in dealing with customers once they have been found.

As a medium for finding new customers the house organ must always remain inferior to the trade paper, generally speaking. The average house organ of the present day, designed for the general public, is simply an advertisement from cover to cover, and is treated accordingly by the recipient. There are one or two house organs that we know of which have an editorial section containing original matter of general interest, and are gotten up in imitation of the better class of trade papers. Undoubtedly this class of house organ is more successful than the more common class referred to above, but that such house organs can be made more attractive and interesting than a good trade paper is a statement that will not bear investigation. It is equivalent to the assertion that better machines can be turned out by a job shop than by a well organized factory. The fewer the number of publications in any given industry the better each one can be made, and (in general) the better it will be made, as long as competition is not eliminated.

Is It Wise to Purchase a New Model?

The belief is quite widespread among the automobile buying public that it is a very unwise proceeding to purchase any model of car during its first season on the market. There is, or at least was, considerable justification for this view in the fact that the longer a certain model is manufactured the greater the opportunity afforded to its manufacturer to overcome weak points and make refinements and minor improvements therein. A car of a new model which has never been in the hands of the general public has never withstood the extreme practical test. However, there is at present very much less ground for this distrust of new models than there formerly was.

In the early days of the industry, before standardization had made itself felt as now, a new model usually meant something radically different from those which had preceded it, while now it generally means hardly more than a change in horse power, wheel base and body, and a modification along more or less well tried lines of the various parts. A few years ago there was no well defined body of engineering data arrived at through experience and calculation, covering automobile motors, change speed gears, running gears and the like. Now, on the other hand, the note books of engineers, factory records, and the columns of the technical press, contain a wealth of available information covering the design of all essential parts of a car.

This abundant data enables the automobile designer to predict with a reasonable degree of accuracy the characteristics of a new model as regards its road performance, and even to determine in advance the factors of safety which are being allowed in its various parts. Slowly, but surely, automobile engineering is gaining a position on a par with steam and electrical engineering, so far as its ability to build cars closely conforming to predetermined specifications as to performance is concerned.

The new model is now not so much a step in the dark as a definite advance performed in the light of exact engineering knowledge. When the industry was young automobile factories were generally unprovided with testing apparatus for checking step by step the work of the engineer. Now, on the contrary, every factory of importance tests drastically not only each mechanical part of its cars, but all the material used therein.

The manufacturer of some years ago, in order to supply the impatient public with cars, was forced to place his new model upon the market as soon as it could "turn a wheel." The business was so badly organized that production delays were excessive, and new models were often rushed out into the users' hands with practically no extended road tests. Since almost any car that could run was reasonably sure of a sale, this practice was not generally fatal to the manufacturer's reputation. Today cars are built in numbers easily sufficient to meet the demand, the competition is very close, and the buying public highly critical. No manufacturer can afford to lose his reputation by putting out a car before it has been tested out by extended and arduous road usage. Manufacturers now keep their new models "up their sleeves" for many months before they announce them.

It must not be forgotten that each new model is the embodiment of an attempt to furnish something better for the money than has ever before been produced, and its designer has all the past of the automobile industry to draw upon. As a rule an advance is actually to be noted in each succeeding model, and its purchaser is likely to obtain in buying it an improvement upon preceding types. While a slightly conservative spirit may be warranted in the buyers' attitude toward the new model, it must be plain that it is less justified than ever before, and will be still less warranted as time goes on.

Is the Automobile a Carriage?

It would naturally be supposed that there could be no question as to whether the automobile is or is not a "carriage." The motor vehicle is nothing more or less than a carriage with a motor attached and moved by mechanical power instead of by muscular power. We would, however, hesitate to call an ordinary old fashioned horse drawn vehicle a "car," although the automobile is frequently so designated.

The highest judicial authority tells us that an automobile may or may not be considered a carriage, according to the facts and circumstances surrounding the use of the word. Drivers of "carriages" are not allowed to do certain things. Are chauffeurs or automobile drivers included in the prohibition? Towns are compelled to keep their roads and highways in reasonably safe repair and condition for the safety of "carriages." This legal requirement was enacted a hundred years ago, long before automobiles were heard of. Must the avenues of travel be kept in a safe condition for automobile travel? The answer to the last question depends upon whether the term "carriages" shall be held to include automobiles. The Supreme Judicial Court of Massachusetts has held that automobiles are not carriages within the meaning of such a requirement as the last mentioned.

The decision of the Massachusetts court is not in harmony with the prevailing judicial opinion of authority on the subject. There have been many judicial expressions to the effect that an automobile is a carriage, and it is the common sense view to include in the term the new means of highway travel.

That the automobile is a "carriage" has just been held by the New Jersey Court of Chancery, in the case of Diocese of Trenton vs. Toman, 70 Atl. Rep., 606. The court in this case had before it a covenant in a deed reserving a strip of land for a carriageway forever. Vice Chancellor Walker, in the court's opinion, says:

> No particular kind of carriage or wagon is mentioned. Although automobiles had not been invented at the time the easement was created, yet the language of the grant is unrestricted, and must be held to include any vehicle on wheels then *or thereafter to be used.*

Here we find the courts of New Jersey and Massachusetts diametrically opposed, the latter courts holding that an automobile is not a carriage and the former that the term includes the automobile. The circumstances in each case were very similar. The term was used long before the invention of the motor vehicle, only in the Massachusetts case a State law was under consideration, while in New Jersey a covenant between two persons was being construed. The opinion of the New Jersey court further states as follows:

> A case entirely in point, on principle, is that of Taylor B. Goodwin, 4 Q. B. 228, in which it was held that a person riding a bicycle on a highway at such a pace as to be dangerous to the passers-by might be convicted of furiously driving a "carriage" under the Eng. St. 5 and 6 Wm. IV, C. 50, Sec. 72. Lush, J., concurring with Mellor, J., made the following observations: "The mischief intended to be guarded against was the propulsion of any vehicle so as to endanger the lives or limbs of the passers-by. It is quite immaterial what the motive power may be. Although bicycles were unknown when the act was passed, it is clear that the intention was to use words large enough to comprehend any kind of vehicles which might be propelled at such a speed as to be dangerous." Mr. Huddy, in his "Law of Automobiles" (page 3), speaking of the machines which he calls automobiles, or self moving carriages, says that the only definition he has been able to find of them is that in English's Law Dic., p. 78, which states that the term means "all motor traction vehicles capable of being propelled on ordinary roads. Specifically, horseless carriages."

The court in the New Jersey case also held that an automobile garage is not a nuisance *per se.*

Needed Protection for Vulnerable Parts.

There is one feature in connection with the general layout of cars that seems not to have received the attention it deserves, namely, the safe location of the more vulnerable parts. These parts include, among others, the lamps, the cooler and the fuel tank. In considering the choice between gravity and pressure fuel feed systems, for instance, do designers generally take into account the fact that the gravity feed tank in the front seat is much better protected from mechanical injury than the pressure feed tank at the rear of the car? That this is so is obvious, and the fire hazard always connected with any injury to the fuel system lends importance to the matter. That the rear fuel tank of the pressure feed system involves a certain amount of danger, especially when the car is used at night, was well illustrated in an accident which occurred in Los Angeles recently. There was a rear end collision between two cars in the dark, and one of the spring horns of the following car tore a hole in the gasoline tank of the leading one. The fuel escaped, and the vapors rising from it were ignited by the lamps, which were smashed in the collision, so that their flame was even more accessible to the gasoline vapor than it would otherwise have been. A sharp explosion occurred, but, fortunately, no one was seriously injured.

Of course it is impossible to build automobiles so they cannot be injured by collisions, but they can be designed so the relatively delicate parts and those whose injury involves personal danger or great cost of repairs are relatively safe. In the front seat of the car of conventional design, with front motor, the fuel tank is at the greatest distance from the lamps and from parts of the motor which might possibly ignite its vapors, and is thus better protected than in any other location.

Mechanical injury to the lamps or radiator by collisions is a relatively less serious matter than a fuel tank explosion, but is, on the other hand, of far more frequent occurrence. Especially in the city where the danger of collision is ever present, numerous cars can be seen with radiators bruised and dented; the radiators of the red taxicabs plying in New York bear many a mark reminiscent of the recent strike, when they were driven by green drivers and made a target for the missiles of the rioting strikers. Enough front lamps are smashed in collisions in the course of a year to keep one good sized lamp factory busy.

The rear fuel tank and pressure feed system was introduced by a prominent German firm, and was highly fashionable at one time. It is clearly apparent, however, that a return movement to the front seat tank and gravity feed system has set in, and there is really no reason why this arrangement should not be universally used, as the one difficulty, of cessation of feed on steep up grades, can be met by the provision of small auxiliary tanks near the motor. The practice of locating the radiator back of the engine is also gaining adherents, and has notably been adopted on the latest foreign taxicabs introduced on the streets of New York. For some time care has been taken by a certain number of manufacturers to so locate their lamps that they will not act as bumpers in case of a collision, for which purpose they are poorly adapted, and other manufacturers are following in the footsteps of these leaders.

The Expansion of the Garage Business.

It will have been observed from our Garage Notes that numerous new garages are being established this fall, especially in the smaller cities of the West and Middle West. Sales of cars have been comparatively good in these sections during the past several years. As there is naturally less demand for storage facilities in these medium sized, not closely built cities, where most owners keep their cars on their own premises, the development of the garage business lagged somewhat at first. But as the cars in any particular city increase in number a considerable demand arises for a local repair shop and supply store where any repairs beyond the skill of the owner can be promptly made and where supplies can be obtained without delay.

Most of these newly established garages in small Western cities will, no doubt, be conducted as general automobile establishments. The owners will have the agency for one or more lines of cars, and will, besides, conduct a repair, supply and storage business. It is to be expected that the majority of these garages will endeavor to get along with a minimum of equipment, yet it is to be noted that where new buildings are specially erected for the purpose the design generally provides for numerous modern features, such as cement floors, vulcanizing plants, battery charging equipment, etc. There can be no doubt that this activity in the establishment of new garages has a very beneficial influence on some branches of the accessories industry. For instance, it should provide a good demand for such necessary garage equipment as gasoline and oil storage and pumping outfits, vulcanizers, washers, caster trucks, compressed air outfits, etc. The movement should also have a healthy stimulus on the small tool industry, because many of these garages will have to depend mainly on repairs for their income, and a good repair shop equipment is, therefore, a prime necessity. A small screw cutting lathe, a drill press, a grinder and a forge, together with the necessary hand tools, usually make up the equipment of these repair shops, the power being derived either from an electric motor or from a small gas or gasoline engine. To be sure, the general business depression has caused much machinery of this class to lie idle, and a good deal of equipment is, no doubt, purchased second hand, but where a new building is specially erected for the purpose the owners would usually consider it poor policy to install old equipment. This activity in garage construction should therefore prove a blessing to a section of the machine tool industry.

Our Coming Engineering Number.

For the Engineering Number which we expect to publish on December 2 quite an array of articles has already been promised on many different subjects by writers in America, England, Germany and France. We wish, however, to make this number as broad and comprehensive a treatise of recent advances in automobiling engineering as it is within our power to do, and to this end we solicit further contributions from any competent source. One subject around which we find a great deal of interest centring is that of direct fuel injection into engine cylinders, particularly two cycle cylinders, and anyone having had experience along this line would certainly find an interested circle of readers if he would undertake to contribute the details of his experiments and the results. Another subject which has not yet received much attention in the automobile technical press, but which is becoming of considerable importance with the growth of repetition manufacturing methods, is that of jigs and special tools for manufacturing automobile parts. Many of our readers must know of contrivances for turning out particular auto parts quicker and more accurately and economically than by the methods in common use, and a description of these would interest others who have to solve the problems of economical factory methods. Even a single such appliance might furnish the subject for an article, for the value or importance attaching to an article is not always measured by the space it covers.

It is unnecessary to specifically mention other subjects, because we want articles on *every* subject connected with automobile engineering, in so far as the information offered is not already common knowledge.

Hills and Cold Make Conditions Difficult in Montreal.

By B. R. W. Deacon.

It might be supposed that in Montreal, a city perched on the side of a steep hill, and with the ground covered for four months of the year with from 2 to 5 feet of snow, the automobile would be of little use for practical purposes. Montrealers are learning, however, that the automobile, particularly the light runabout, is something more than a pleasure vehicle. They have discovered that they can use it to replace the horse and save money on the deal in spite of the fact that climatic conditions compel them to fall back on the horse for a short time each year. All of the local agents who handle runabouts say that there has been a surprising demand for this class of car during the past season, and that a large percentage of the cars which they have sold will be used for practical purposes. Many Montreal doctors are now using the runabout to make their daily round of visits, while business men are beginning to see its value, and it is being used by a number of collectors, agents and contractors' superintendents.

MOTORING DOCTORS NUMEROUS.

As is probably the case everywhere, the medical men are the most enthusiastic runaboutists of the lot. They find it very convenient and more economical than the horse. There are quite a number of prominent doctors in Montreal—doctors who have large practices in the best residential sections of the city—who have taken to the car, as well as many of the younger practitioners. Among the most prominent is Dr. Austin Irving, who has used a runabout for two years now, and is loud in the praises of his little car. He also has a big six cylinder car for outings, but he relies on the runabout for making his professional calls. Dr. Anderson, of Park avenue, is also an enthusiast, and he is out in his car on his rounds in all kinds of weather and until the winter has covered the streets deep with snow. Dr. J. A. Cormier, of Sherbrooke street, was one of the pioneers among the medical men who make use of the car.

"Find it convenient?" he exclaimed in answer to a query. "Why, it is ever so much more convenient than a horse. It is always ready for an emergency call without any delay necessary for harnessing up. It is speedier. I can make much faster time than I could with a horse if I have an urgent call. Then, too, when I am in a patient's house I am not worrying about my horse. The automobile is sure to stand still, but the horse very often is not.

"The winter? Ah, that is the only drawback. I must hire a horse for the winter months; but even at that the runabout is cheaper than using a horse the year round. I expect some time to run my car all winter, too. Each year I have kept it out longer than the previous year. Last year I ran it until the 12th of December, and had it out again on the first of March."

All of the other men who were asked about the relative merits of the car and the horse tell the same story. All are enthusiastic over the runabout, and all declare that having used it in their profession they would never go back to the horse days.

A CONTRACTOR'S CONVEYANCE.

Probably the most prominet business man in Montreal who makes practical use of the runabout is C. E. Deakin, one of the largest contractors in the city. Mr. Deakin often has men at work on a score of buildings scattered about the city. He has two cars, and he makes use of them to visit the superintendents of the different operations, and with the aid of a car can make the complete round in half the time that it would require to drive the same distance. Several other contractors are making use of the automobile, including Hyde & Company, another large firm, who, in addition to having a light car for the use of their superintendent, have a number of large motor trucks for use on construction work.

Only one man could be found in all Montreal who had tried the runabout in his business and who declared that it was not a success. He was A. L. Caron, of the firm of Caron Brothers, the large manufacturing jewelers.

"No, I don't use the runabout for business purposes," Mr. Caron declared when questioned. "We used to have it standing in front of the office, and I and my brothers used to employ it for what we called business. We found that it didn't work, however. I would get started out to go three blocks down Craig street to see a man. This little spin would just serve to whet my appetite for a longer run, and I would suddenly discover that I must run out to Westmount to see a man. I would find that he was not in, and I would immediately think of some man at the other end of the town and whirl away to visit him.

"No, it wasn't exactly a success. You see, I was so fond of driving the car that I used to find excuses for myself, and then suddenly I would awaken to the fact that I had been away from the office for two or three hours and that there was a pile of correspondence waiting for me on my desk all the time. So we decided not to use the car any more for 'business purposes'."

There are a great many hills in Montreal, and some of them are very steep, but they make but little difference to the runabout men. They sail up Beaver Hall Hill or rush up the long incline of Bleury street without any apparent effort, while those who are driving are crawling up at a snail's pace. This is one reason why the car is of such great advantage to the medical men.

WINTER DIFFICULTIES.

As to the drawback of winter with its deep snow and bleak, cold days, it has been proven that it is possible to run a car all winter long, although, of course, few would care to do so for pleasure alone.

Frank B. Stockwell, of the Eastern Automobile Company, just to prove that it could be done, ran one of his cars every day last winter, and some interesting experiences had Mr. Stockwell. He went through all sections of the city, and even ventured out occassionally into the wintry wilds of the furthermost suburbs, but he met with no serious mishap. With his back tires shod so as to grip the slippery surface of the roads, he negotiated the steepest of Montreal's steep hills successfully. His only disasters were from running into big piles of snow that border some of the residential streets. This occurred a couple of times, but a couple of minutes' work with a shovel cleared the car and left him free to proceed on his way.

Springfield A. C. Determined to Stop Speeding.

At a recent meeting of the board of directors of the Automobile Club of Springfield it was decided to have suitable cards printed, which will be displayed in all of the hotels and garages in Springfield and vicinity, and leading through the popular routes into the adjoining States. These cards will call upon the automobilists to use the roads in a safe and sane manner, and if they fail to comply with the club's request the directors have decided that there is but one alternative, the establishment of official club speed traps. The Springfield Club is determined that the speed laws in its vicinity shall be properly observed, the local motorists feeling morally responsible for the acts of the motorists from other States, and they will not hesitate to establish traps if it is deemed necessary.

New Automobile Club for San Francisco.

A new automobile club, with rules and laws similar to those governing the Chicago Motor Club, is about to be organized in San Francisco. The club will devote its attention to the social and sporting sides of automobilism, and will hold a road race, an endurance contest, a reliability run and a hill climb each year. The club's quarters in San Francisco will be so located as to be convenient for the members for luncheon, and a clubhouse within easy reach of the city will also be secured. The events given by the new organization will take place in the open, so that they may be witnessed by all who are interested in them. It is not the intention of the new club to interfere in any way with the activities of the Automobile Club of California, the California State Automobile Association or the Automobile Dealers' Association of California, but to fill a new field.

The Runabout in Arkansas.

Less than a decade marks the advent of the automobile in Arkansas, and the runabout or light auto for business purposes came only fully half a dozen years later. It is probably the experience of nearly all manufacturers of automobiles that it is more difficult to open up a market in Arkansas than in any other State in the Union. The reasons are found in the slow and almost impossible development of country roads in this mountainous country and the long entertained belief that the automobile could not be run over the hills and rocky roads of the country districts. It is not more than four years ago that the first business man of Arkansas was brave hearted enough to purchase an all purpose business automobile for professional purposes. Just who this pioneer was cannot be learned.

The runabout business is yet in its infancy in Arkansas, and the manufacturer who demonstrates beyond a reasonable doubt that he has a rugged, all business and no show machine, which possesses good hill climbing ability and the stamina to stand the wear and tear occasioned on the practically unimproved roads of this State, will find a ready market for his product, for the business man of this State who finds it necessary to travel much is just now in a receptive mood, and if "shown" he will, no doubt, loosen his purse strings and possess himself of a machine as a business asset.

The few users of runabouts in Arkansas who have given the machines a thorough and practical test are agreed that the auto is preferable to the horse, or even to the time honored Arkansas mule, as a means of speedy, safe and sure locomotion. It is true the users of the runabout in this section of the country are demanding some improvements to meet the requirements of this section, but aside from an "imperishable" tire their demands are not unreasonable.

While there are a number of good county and State roads, or "pikes," as they are called here, the average road located off the section lines and "ridge roads" are not exactly of the kind that appeals to the heart of the autoist. Of the good roads in Arkansas there are two classes, the macadamized road and what is known as the "chert" road. Both are constructed on a bed of crushed stone. The macadam road is covered with a facing of gravel or other hard pebbles, while the "chert" road is covered with a sort of crushed porous limestone, which is designed to become powdered and eventually form a sort of cement. In both cases the constant wear and tear causes the facing to beat down into the crushed rock below, with the result that jagged edges of crushed rock appear. Besides this, there are real rocks in the roads—rocks which are a terror to tires and also to the framework of the machine.

It is thus no wonder that the Arkansan is hoping and praying for the solving of the tire problem with an "imperishable" tire, one which will inspire confidence and tempt the business man to extend the use of his machine. Aside from the tire problem, the consensus of opinion is that a few minor changes in the general make of light machines would result in a practical machine for hill country use.

A longer wheel base to reduce the vibration and racking of the machine, and also to add to the ease in riding; a wood frame for the same reasons, and an altogether sturdy, rugged machine, designed for hard usage and not for show purposes, with sufficient reserve horse power to carry it over the mountains and hills and through the sandy roads of the valleys, these are the improvements which have been suggested.

In this southern climate it is the opinion of the majority of users that the water cooler is preferable to the air cooler. There is no danger from freezing in this latitude. It can be truthfully said that the automobile market in this State has hardly been touched, and especially is this true with regard to runabouts or light autos for business purposes.

The following well known business men have had success with the use of the business automobile:

By Dr. Mahlon D. Ogden, Little Rock, Ark.

"I have used a high wheel, 16 horse power, friction drive, water cooled motor buggy for five months, and while comparatively new in the use of the machine, I find that it has decided advantages over the horse in practical business. The principal advantages are the great saving in time and reduced cost for the same mileage and speed. The country in which I practice medicine is hilly and rocky, and from the standpoint of endurance alone, in making trips of considerable distance, the auto is the best means of locomotion. The cost of operating my single seated runabout for five months has averaged about $30 per month. I am my own chauffeur, however, which considerably lightens the expense.

"I find that a 16 horse power runabout weighing 1,000 pounds is good for practical service on all kinds of roads except in deep sand, when the machine pulls heavily. Water cooling, I think, possesses advantages over the air cooling for this climate. My repairs during the five months have been of a general nature only, consisting of grinding valves, repairing a broken steering gear, replacing a main bearing, sprockets, and the friction wheel and disc, and keeping bolts tightened in the running gear. In this country there is a great tendency for bolts in the running gear to loosen on account of the vibration.

"There are a few suggestions which I might offer as to the character of machine best adapted to this hilly and rough country. My machine has a 65 inch wheel base, and I think is should be fully 75 inch for easy riding. I would also suggest the use of side wire solid tires instead of centre wire. For practical service in this country a machine should have some reserve power, as the low powered runabout is not rugged enough nor possessed of the power to enable it to climb the hilly roads. However, the 16 horse power machine has never 'gone back on me' in any emergency. I favor the wood frame, as it absorbs the vibration to a greater extent than the iron frame, not only adding to the ease of riding, but also serving to neutralize the vibration and lessen the tendency to rack the machine and loosen bolts. I also favor a mechanical instead of an automatic inlet valve.

"While it is true that the country roads of Arkansas and the streets of the cities are not so well adapted to automobiling as some of the flatter sections of the country, still there are many good roads in this section of the country. While I do not have a large country practice I have found the machine available for all calls, and have used it continually. In the five months I have used my machine I have covered more than 2,000 miles, and have suffered but few inconveniences."

By Dr. J. W. Bush, Hot Springs, Ark.

"I have been using a runabout in my practice at Hot Springs for a number of months, and find it now indispensable. I simply could not get along without an automobile, a light weight machine with some reserve power and hill climbing capacity, for there are hills in Arkansas, not only in the country but in the city as well.

"The whole world bathes at the famous Hot Springs in Arkansas, and during the busy season of the fall and winter it would be impossible for me to make the daily rounds of my patients without the use of a runabout. For the same mileage I think the runabout is cheaper in the long run than a horse. The 'keep,' of course, is greater, but on the other hand the service is much better. Like many other physicians in this section of the country I operate my own machine. Taken as a whole, the runabout has great advantages over the horse, especially in a rough, broken country, where speed with a horse and buggy is impossible without sapping the vitality of the animal."

By E. J. Bodman, Little Rock, Ark.

"We are using in our business a 1907 model, 12 horse power machine, weighing 1,600 pounds, which we have been using for over a year. We have found that the automobile is a great economizer of time, and makes it possible to cover distances that would not have been attempted with the horse. This is a very hilly country and much of it rocky. There are a number of good 'pikes,' but generally speaking the roads are considered rough.

"We have used the automobile in our real estate, insurance and other departments, in all kinds of weather. We find the upkeep to be heavy. Perhaps it would average $100 per month, but this is largely due to the rough nature of the roads and the continuous use of the car. In fact, only a high grade make could stand the great strain put upon it.

"If we were to purchase again we would buy the same class of machine, but a higher powered one. Twelve horse power is too little for the heavy usage demanded in this section. Owing to the fact that the motor is under strain most of the time it requires repairing quite often. We advocate the light weight, wood sill constructed car for rough roads, and from our experience the air cooled feature has no disadvantages that we know of, but rather an advantage, as there is less complication, less machinery to keep up and less weight to carry. The average owner in this country makes the fatal mistake of purchasing light, low powered runabouts and light power cars, only to find that had he put a little more money into the machine and gotten some reserve power he would have less annoyance, less expense and the machine would have given generally more satisfaction. The ideal machine for this section, in my estimation, would be a 20 or 25 horse power one."

By R. E. Chambers, Little Rock, Ark.

"I have used an 18 horse power, three passenger automobile in our real estate business for the last three months for all business purposes and some pleasure trips, and I think I have established a record for care and repair of machines. My expenses for keeping and operating the auto are about $15 per month, and my total expense for repairs has been $1.75. I am my own chauffeur and caretaker of course, but I only took one lesson in handling and caring for the machine, and then took the task upon myself. I keep the machine at my own home in a specially constructed shed, and up to this time I have done practically all the work required on it.

"Like everyone else who has given the automobile a thorough business test, I find it a great advantage over the horse as a means of quick, safe and sure locomotion. But I do hope some gifted inventor will soon patent a device that will do away with cranking the machine. Recently I had occasion to visit a village 10 miles distant, on a good pike for this section of the country. I made the trip over in twenty minutes, and the return trip in twenty-two minutes, stopping en route to talk with a party for a few moments. No accident or the slightest delay marred this trip, which for Arkansas roads is certainly a good record. I have taken good care of my machine. As a rule I use it only for business purposes and keep it always ready for use. I do not rack it to pieces in pleasure riding and racing, but use it to bring in dollars. So you see my machine is a business proposition, pure and simple. A lower horse power machine than mine would hardly do good city and country service here, as there are hills, rocks and sand roads to contend with. I recently drove through a long stretch of sandy road without difficulty, but with less horse power I would have stalled."

Automobiles in South American States.

The following consular reports on the automobile situation in their respective districts have recently been received from United States consuls located in South America:

URUGUAY.

From Consul F. W. Goding, of Montevideo: "Three years ago not a motor car was to be found in Uruguay, but according to the official inspector of vehicles there are now 138 in use. With the exception of perhaps four none are American. There is a very strong prejudice against American manufactured motor cars, owing to the dissatisfaction created about twelve years ago by the sale of some 300 inferior grade bicycles, which were sold as high grade machines. These wheels were of the cheapest class, and proved wholly unfit for the roads and pavements of this republic. The man who sold them brought the wheels with him, advertised them largely, and represented them as being equal to the best foreign makes. The rough pavements made short work of the tires and ruined the gearing, so that at the present time not an American made wheel is to be seen.

"Three years ago two American made motor cars were landed here. Although every effort was made to sell them, the people merely said 'They are like the bicycles,' and refused to buy. Eventually one, a $2,500 machine, was auctioned off for $700, the other, a smaller car, brought $150, there being but one bidder for each.

"There is a good field here for the sale of motor cars, but before American cars can gain an entrance the prejudice against them must be overcome. This can be done only by sending the best cars here, with first class chauffeurs to drive them and keep them running by the side of those made in Europe for at least one year. If they can prove their equality with other makes, business doubtless will follow."

COLOMBIA.

From Consul General Jay White, of Bogotá: "Six automobiles only are known to be in Colombia, and of these six machines but three are at present in commission; two of the six are in stock not sold. Gasoline costs $1 per gallon. It is claimed that at the altitude of Bogotá, over 8,500 feet above the sea, at least 25 per cent. of the power of a machine is lost, owing to the diminished atmospheric pressure.

"A concession has been granted to a citizen of Bogotá giving him the exclusive right to operate freight automobiles on all cart roads now constructed in Colombia. The total mileage of these roads is not extensive, however, being confined largely to the vicinity of the cities and towns. A French citizen has a concession to use motor freight wagons on the Cambao cart road now building. The addresses of possible importers are transmitted. Merchants ask six months' credit. Automobiles are classed in the second class of the Colombian tariff, and pay 1 cent per kilo (2.2 pounds)." [The addresses mentioned are on file in the Bureau of Manufactures.]

ARGENTINA.

From Consul General Alban G. Snyder of Buenos Aires: "New ordinances controlling the operation of automobiles have recently been adopted in the capital of Argentina, which were rendered necessary by the increasing number of motor cars, both for private conveyance and public transport, which are more noticeable here than in other cities, owing to the narrow streets and congested state of traffic. Experienced drivers are given a fairly free hand as to speed, but must satisfy the authorities that they are competent by passing a suitable examination. They are also required to carry a duplicate pass book, containing their license, and blank pages, on which any accident or carelessness is to be recorded by the police. Persons under eighteen years of age are only permitted to run cars up to 12 horse power, and this only after passing a satisfactory examination.

"No mention is made of this regulation being applicable to private owners driving their own cars, it being assumed, for the present, that they will naturally avoid taking any risks tending to damage their own persons or property. As to the cars themselves, they must be provided with nonslipping tires. The acetylene searchlight is prohibited in the centre of the city. Efficient brakes must be used, and are to be tested at regular periods, and the automatic and similar whistles are absolutely prohibited, the usual horn alone being compulsory."

Wisconsin Good Roads Amendment.

The so called "good roads amendment" to the State constitution of Wisconsin was overwhelmingly adopted at the general election on November 3, and the State is now required to give aid to highway improvement and construction work. This is the best news Wisconsin automobile owners have had in a long time. The State Geological Survey has already started work on laying out an elaborate system of State highways, which when completed will form a chain of drives and courses throughout the State. Just before the election opponents of the amendment started a campaign story that the whole matter was a plot of automobile owners to get speedways at the expense of the people. The overwhelming vote showed the fallacy of the argument. The first work under the new amendment is the 5 mile boulevard from the city limits of Milwaukee, an extension of Grand avenue to the county limits, which eventually will form a boulevard halfway across the State in nearly an air line to the capital, Madison. The distance is 85 miles. The cry of "plot" was raised by persons through whose property the road will eventually cut. Evidently it was not considered that such a thoroughfare would enhance the value of the property.

Liquid Tachometers—Operation, Construction and Method of Testing.

Paper read before the American Society of Mechanical Engineers, by Amasa Trowbridge, Hartford, Conn.

In any instrument designed for measuring the speed of a revolving wheel or shaft, the centrifugal force developed by the revolution of some part of the measuring instrument is almost universally used to give the indications. This centrifugal force should be so applied as to eliminate, as far as possible, the errors due to friction or wear. This cannot be attained by the use of a solid body, as the flying balls in a ball governor or the moving weights of a shaft governor. The Veeder tachometer, described in this paper, makes use of a liquid in a device similar to a centrifugal pump. By careful experiments extending over nearly eight years several forms embodying this principle have been perfected. As the paddle of the pump does not touch the case in which it revolves, there is no wear between the revolving paddle and stationary case. The bearings are so constructed that the wear is slight and does not affect the readings. The liquid does not change its character appreciably under any circumstances, and, consequently, the indications of the instrument will be correct after it has once been properly graduated.

The principle on which the liquid tachometer acts is that the pressure developed by the centrifugal force of the liquid, when the instrument is running at a certain speed, is a definite quantity. This pressure forces liquid up the indicating tube A, Fig. 1, and is balanced by the pressure due to the height of the column of liquid in the tube.

Referring to the formula for centrifugal force, which is $F = \frac{W v^2}{r g}$, we notice in this formula that there is but one variable, when r, the radius of the paddle, and W, the weight of the liquid, are fixed. Hence the indications of the instrument depend entirely on the velocity and do not change if wear is eliminated. The friction of the pump, generally speaking, need not be considered, nor its efficiency. If there be no flow of the liquid, the force F is expended in maintaining a pressure P, and this is equal to the pressure Wh due to the height of the liquid column. When the column is at rest, that is, when the speed is constant, F equals P, hence $\frac{W v^2}{r g} = Wh$. It is obvious from this that W may be varied at will without materially affecting the height of the column. This is found to be the case and it makes little difference in a liquid tachometer whether the liquid employed be something heavy like mercury, or light as alcohol. The indications are essentially the same for both liquids.

It is of course highly important that a suitable liquid should be chosen for such an instrument. In the first place it is necessary to choose a liquid which will not freeze at any temperature commonly encountered. It should be also as safe as possible in regard to fire, because it may frequently be used in the neighborhod of an internal combustion engine, where inflammable vapors would be dangerous if allowed to escape. Also it should be readily obtainable, and such that its viscosity will not be materially altered by the ordinary change of temperature. The viscosity of the liquid makes a slight difference in the height of the indicating column.

EFFECT OF VISCOSITY ON REVOLUTIONS REQUIRED.

Material.	Kerosene.	Water.	Alcohol.	Benzine.	Sperm Oil.	Paraffin Oil.	Valvoline Oil No 2.	Glycerin.
Revolutions required......	852	851	850	849	807	792	788	779

A series of experiments was conducted to determine the relative viscosities of various liquids. The more commonly used liquids were tested in the following manner: An instrument having a long tube was put on the testing machine filled with one liquid and run at such speed as to give a fixed height of column. The first liquid tested being alcohol, a height of column corresponding to 850 r. p. m. was taken. The other liquids were each in turn put into the same instrument, and the revolutions of the instrument required to maintain the same height of column were taken, as shown in above table.

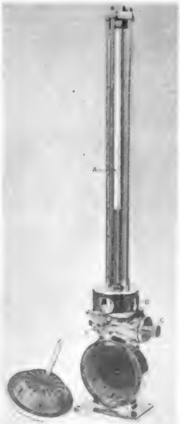


FIG. 1.

It is surprising to find that benzine is more viscous than kerosene. Experiments are still being conducted on this point, the results of which are not ready for publication. Other points which must be considered are the lubricating qualities of the liquid and its liability to corrode the metal of which the instrument is made.

The Veeder tachometer, in one of its present forms, is shown in Fig. 1, with paddle removed. This instrument embodies all of the necessary points enumerated above. The only moving part of the instrument is the paddle, which imparts the necessary centrifugal force to the liquid contained in the body of the instrument. A small reservoir B is located directly above the paddle case. In the centre of this reservoir is a glass tube through which the liquid flows to the glass indicating tube A. A suitable zero mark is provided around this small tube in the centre of the reservoir. The liquid rises by capillary attraction in this small central tube somewhat above the level of the liquid in the reservoir. This enables the instrument to be at zero very handily, a displacement plug operated by a small thumb nut shown at C enabling the operator to raise or lower the height of the surface of the liquid to exactly the zero mark. The glass indicating tube is about 12 inches high, although a scale fully 3 feet high can be used where extreme accuracy is necessary.

Free passage is provided from the reservoir to the centre of the paddle wheel, allowing the liquid to flow freely to the paddle wheel, from which it is thrown out through very small orifices in the periphery of the paddle case. At the front of the instrument is a small handle D, which operates a valve to choke the passage from the pump to the indicating column. This prevents the dancing or vibration of the liquid column, due to any sudden fluctuation in the speed of the revolving body whose revolutions are being indicated. The liquid used in this instrument is alcohol colored with an aniline dye. This liquid has been found extremely satisfactory, although other liquids may be used in place of it for certain cases.

It is evident that the graduations in this instrument will not be evenly spaced from zero up to the maximum. The height of the liquid column depends on the centrifugal force, which varies with the square of the speed of the paddle; hence, the graduations will be more open at the top of the scale for the high speeds, than at the bottom, where the low speeds are measured. This is an advantage in some ways, especially on

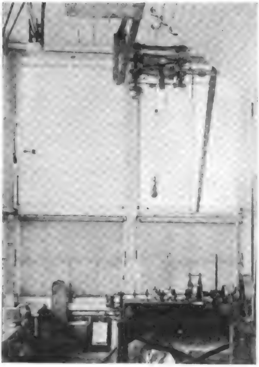


FIG. 2.

automobiles, since the graduations are large at high speeds when the vibration is greatest. Of course it necessitates a number of different instruments to cover the ordinary ranges of speed because the readings from zero up to about one-third of the maximum reading of the instrument are of no value, the graduations being so close that they are entirely omitted.

The liquid is admitted to the paddle case from the reservoir by passages on both sides. When the liquid is admitted from one side only a slight change in the position of the paddle axially makes a change in the indications. This is not found to be the case where the balanced admission opening is used.

The blades of the paddle are radial, for the purpose of making the instrument reversible. The radial blade is, of course, not the most efficient, but, as stated above, the efficiency need not be considered. A ball thrust bearing is provided for the paddle shaft, thus eliminating any wear that would prove injurious.

The outlet for the liquid consists of a number of small radial holes, equally spaced around the periphery of the paddle case. With a single discharge opening it is found that if through wear of the bearings the paddle becomes eccentric with the case, then reversing the instrument changes the indications. The diameter of these outlet holes is very small, to check any surging of the liquid. They discharge into an annular groove extending around the paddle case, and this annular groove is connected by a single hole to the indicating tube.

One of the greatest difficulties encountered in making this instrument has been to get the entrained air out of the liquid. The small passages used in the pressure side offer little opportunity for it to escape, hence it stays in the paddle case. The trouble has been eliminated by so shaping the paddle that as soon as the paddle revolves this air is forced to the centre of the paddle and is discharged through the centre openings. If the air is allowed to stay in the paddle case it furnishes a compressible cushion for the column of liquid, and materially reduces the effective area of the blades, especially in the small diameter paddles. A slight change in the temperature of this air also affects its density to such an extent as to alter the reading of the instrument. Some instruments having glass sides were built for the purpose of studying the action of this air to determine ways for eliminating it.

The sensitiveness of the instrument is such that at the maximum speed for which it has been made commercially, namely, 2,500 r. p. m., a difference of one or two revolutions is very noticeable. This shows that the instrument can be made to indicate within less than one-tenth of 1 per cent. Under ordinary circumstances the indications will be correct within one-fourth of 1 per cent.

The instrument is portable, and can be readily handled, and there is no difficulty in holding the column practically vertical. It may be used either by holding it in the hand, the paddle wheel shaft being driven by a short flexible shaft pressed against the end of the revolving member whose revolutions are to be measured, or it may be fastened down and driven by gears, as in Fig. 3. This latter is the preferable method because the instrument is then held very steadily, and the entire attention of the operator can be given to reading the indications.

To carry on the experiments of these instruments Mr. Veeder built the testing machine shown in Figs. 2 and 3. This testing machine is run by an alternating current motor used exclusively for this purpose. The motor is connected to the testing machine through an Evans friction cone, A in Fig. 2, which gives a ready means of changing the speed of the machine through a certain limited range.

To keep the speed of the testing machine constant a mercury tachometer B, Fig. 3, having a tube about 3 feet high, is placed at the driving end of the machine. This tachometer controls an electrically operated brake, which bears against the periphery of the heavy flywheel as shown at C, in Fig. 3. Because the inertia of this wheel is very great in proportion to the force applied by the brake, there are no sudden fluctuations of speed. The mercury tachometer is an extremely delicate instrument and either makes or breaks the circuit which operates the friction brake. An insulated rod is carried through the top of it and connected, as shown by the diagram, Fig. 4, to the brake magnet. By adjusting the vertical rod the tachometer will control the testing machine through a considerable range of speed. The action of the brake is clearly shown in the diagram. A condenser is used to avoid oxidation of the mercury at the point of contact.

To check the testing machine the shaft of the machine is connected to a revolution counter as shown at D, Fig. 3. The con-

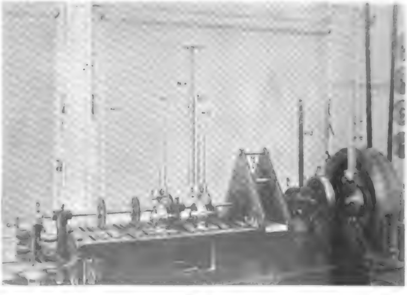


FIG. 3.

nection between this counter and the shaft is automatically made at the beginning of a minute by the master clock E, Fig. 2. At the end of a minute this connection is automatically broken by the same clock, and the difference in indications of the counter shows the number of revolutions made by the shaft of the testing machine in the minute. Slight changes in the speed of the spindle of the testing machine will of course be very evident from this method of checking.

The diagram Fig. 5 shows the method of connecting the clock to the revolution counter which is driven by the end of the shaft of the testing machine. Special attention is called to the fact that the connection is made by the clock for one single beat, or half period, of the pendulum only; that is, while the pendulum swings from left to right. This necessitates that the time during which there is a complete circuit is a small fraction of a second, namely, while the point of the pendulum passes through the mercury cup at the middle of the clock, hence at that point which the pendulum passes with its greatest velocity. This arrangement determines that exactly one minute shall be the time between the throwing in of the revolution counter and its disconnection. It was found necessary to insert a condenser in this electric circuit for the purpose of preventing an arc, as in the case of the mercury tachometer.

At F, Fig. 3, there is seen the hand switch by which the circuit is made ready for the clock to throw the revolution counter into or out of gear. By throwing the switch one way the clock will throw the counter into gear. If thrown over on to the other side, the counter is thrown out of gear at the end of that minute. By usink this hand switch it is possible to make the count extend over as many minutes as may be desired. The shaft of the revolution counter is carried by the lever G, Fig. 3, and has on its end a key which engages positively in one of a number of slots on the end of the testing machine shaft. This counter has been safely operated at as high a speed as 5,000 r. p. m., and this method of registering is such that it is absolutely reliable.

In Fig. 3 there is shown at H a friction clutch, the outer part of which is driven by the flywheel shaft. Between the bevel gears K and L is a jaw clutch, keyed to the shaft carrying the inner part of the friction clutch. This is operated by the lever J. The first part of the motion of the lever engages the jaw clutch with one or the other of the beveled gears. Its remaining throw engages the friction clutch. By throwing the lever one way or the other the direction of rotation of the main shaft of the machine may be changed.

For calibrating any particular instrument the flywheel end of the shaft is operated at a constant speed, usually 1,000 r. p. m. Under ordinary circumstances, with a speed of 1,000 r. p. m. the variation will be less than half a revolution either way from the standard. With special care this can be reduced to one-quarter of a revolution, or a total variation of one-twentieth of 1 per cent. This speed is transmitted to that part of the shaft which directly drives the instruments through the back gearing shown at M. By means of the changes accomplished by these back gears the speed of the flywheel need not be changed during the calibration of the instrument.

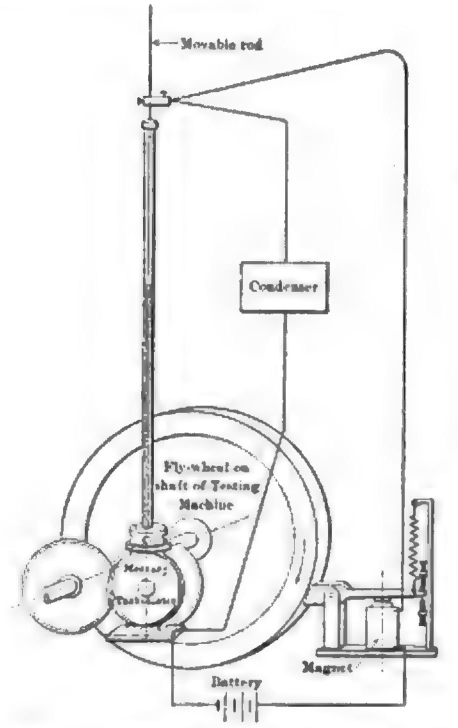


Fig. 4.—Automatic Speed Controller for Testing Machine.

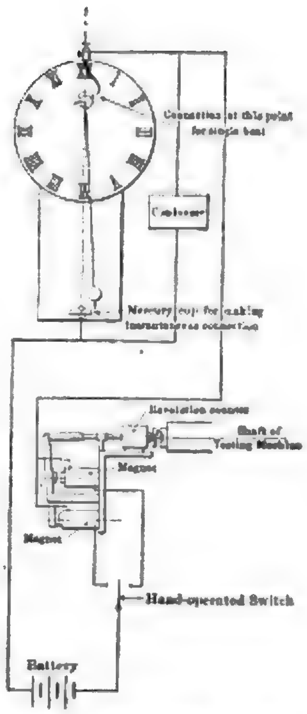


Fig. 5.—Connections for Speed Counter.

The device shown at N in Fig. 3 is used for calibrating the instruments. The screw in this device has a very accurately cut thread with fourteen threads to the inch. At the top of this device is seen a plate with 100 graduations equally spaced. From this it is seen that a vertical adjustment of the sighting piece shown at O, Fig. 3, amounting to about 0.0007 inch, can be measured.

A number of instruments of a given size are set on the testing machine at once. The height of the liquid column in these instruments is then measured, a record being kept for each instrument. The average of these readings is then taken for establishing a suitable scale to be used on instruments of that size. The calibrating device is removable and can be shifted from instrument to instrument without changing its setting. In this way very small variations in the different instruments can be noted and any errors due to bad workmanship or imperfections in the parts can be readily detected.

Among the many applications to which this tachometer has been adapted the first has been for laboratory service in testing dynamos, engines and other machines having revolving members. The instruments have also been adapted for switchboards, grouped with the other instruments. Here they give a continuous indication of the r. p. m. of either the engine or generator. Another use to which these instruments have been adapted is as a speed indicator for automobile and locomotive service. The type commonly used on automobiles has a double paddle, the larger diameter being used for low speeds, the smaller for high. To make use of this a double scale is put on the instrument, one reading to about 30 miles per hour, the other twice as high, and the instrument is arranged to use either of these by simply shifting a small lever, which turns a three-way valve. If the lever is pulled toward the operator a valve closes the passage from the large diameter paddle to the indicating tube and opens the passage from the small diameter paddle, and the instrument is set for the high speed scale.

If the lever is pushed back the opening from the small paddle is closed and the one from the large paddle opened. There is no harm done if the liquid flows over the top of the instrument, as it is returned to the reservoir. In this instrument there is a reservoir on each side of the indicating tube, so that the major portion of the indicating tube is nearly over the centre of gravity of the free surface of the liquid. When the car is running at low speeds, however, the column of liquid in the indicating tube is not directly over the centre of gravity of the free surface, with the result that any acceleration of the car makes the liquid indicate somewhat higher than it should, while any retardation has the opposite effect, this being due to the inertia of the liquid. For automobile service these errors are not great enough to make any particular difference.

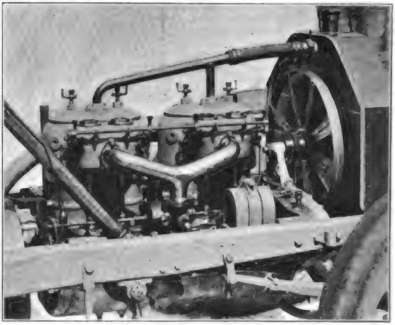
These speed indicators have ball bearings throughout to make a permanently accurate instrument.

NEW VEHICLES AND PARTS

The Locomobile Shaft Driven Model.

The Locomobile Company of America, of Bridgeport, Conn., are manufacturing a shaft driven model for 1909, which is known as the "30" model. Ever since the establishment of this company only chain driven cars have been manufactured, but this year the company has made a concession to the popular demand for the shaft drive in small cars. In addition to this new shaft driven car it will manufacture a chain driven model of somewhat higher power.

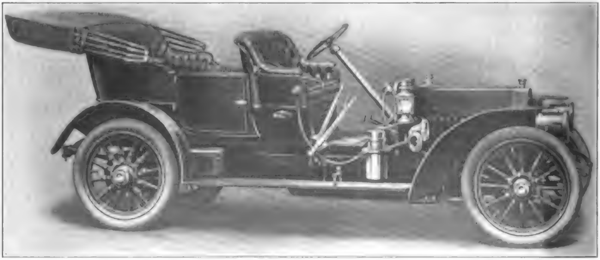
The four cylinder motor is of the T type, the cylinders being cast in pairs with large openings in the water jacket heads covered with bronze plates. The cylinders receive three boring cuts, and are then finished by grinding. The bore and stroke are both 4½ inches, the motor being rated conservatively at 30 horse power. The motor follows regular Locomobile practice throughout, in having a bronze crank case, low tension ignition by magneto, circulation by rotary pump, honeycomb radiator, etc. The cone clutch used in Locomobile chain driven models is retained, but springs are now placed under the clutch leather, which permit of gradual engagement. A complete description and illustrations of the Locomobile motor and clutch were printed in The Horseless Age for July 24, 1907.



Locomobile 4½x4½ Inch Engine.

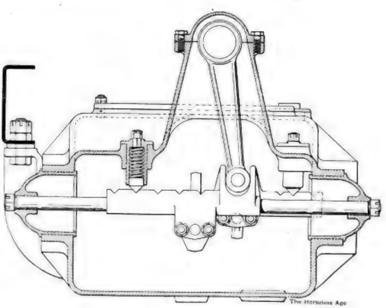
The change speed gear, like that used in former chain driven models, is of the selective type, giving four speeds forward and one reverse, with direct drive upon the fourth speed. Only two sliding trains are used, one giving the direct fourth and the third, while the other gives the second, first and reverse speeds progressively. A constructural feature in the change gear is that the shifter shafts do not project from a selector box, as in ordinary selective type gears, but are contained within the gear box itself, and are stationary therein, cylindrical "sliders" working along the shafts under the action of the rockers. The shifting forks are bolted to these sliders, and the retaining latches engage in grooves in the upper part of the sliders. Annular ball bearings of the H.-B. type are fitted throughout the entire change gear. The gear box is of bronze.

The tail shaft of the change gear projects rearwardly beyond the gear box, and to it is keyed one yoke of a universal joint, the other yoke being keyed to the drive shaft. The drive shaft is of circular section and terminates in a slip universal joint at its rear end, this latter compensating for any change in distance between the rear axle centre and the gear box. When the car contains its full complement of passengers the drive shaft is horizontal, or nearly so, and the joints absorb little or no power. A straight line drive is thus obtained. The joints run in grease, which is retained by metal casings surrounding them. The rear axle is of the floating type, the half axles running on ball bearings within alloy steel tubes, whose inner ends are forced into the openings of the differential housing, abutting against a shoulder, and are riveted in place. A strut rod with turnbuckle adjustment braces the axle, ball shaped heads being provided on the rod and seating in the axle tubes near their ends. The final drive is by bevel gears,, giving a ratio of 3.24 to 1, both thrust and load being taken on ball bearings. The differential is of the bevel type and works in its own casing, but is pierced to allow the lubricant from the differential housing to



The New Locomobile Shaft Driven Car.

flow within it. Each half axle has a driving dog A (see section of rear axle), forged integral therewith, and is squared at its inner end to fit into the differential gear. The road wheel has dog teeth on the exterior face of the hub, which mesh with the teeth of A when the half axle is in position. The hub is hollowed out to accommodate two ball bearings, C, D, which are fitted to the axle tubes and on which the road wheel revolves. Ball bearing D is held from lateral movement by means of a bronze collar, which holds it against a shoulder on the axle tube, and this collar in its turn is held in place by the bearing C, whose lower race is retained by a nut and lock nut B. The upper race of this bearing is not rigidly held, but allows such lateral movement as its construction permits of. The hub cap retains the half axle in place and ensures the drive of the road wheel, while the nuts B, acting through the bronze collar and ball bearings C and D, prevent the road wheel from coming off. This arrangement renders the removal of a road wheel easy, this being accomplished by taking off the hub cap, pulling out the half axle and removing nuts B, when the wheel can be pulled clear.

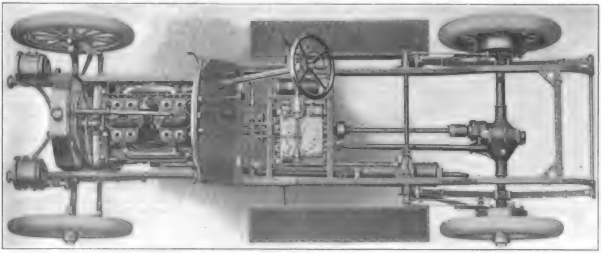


Locomobile Gear Shifting Mechanism.

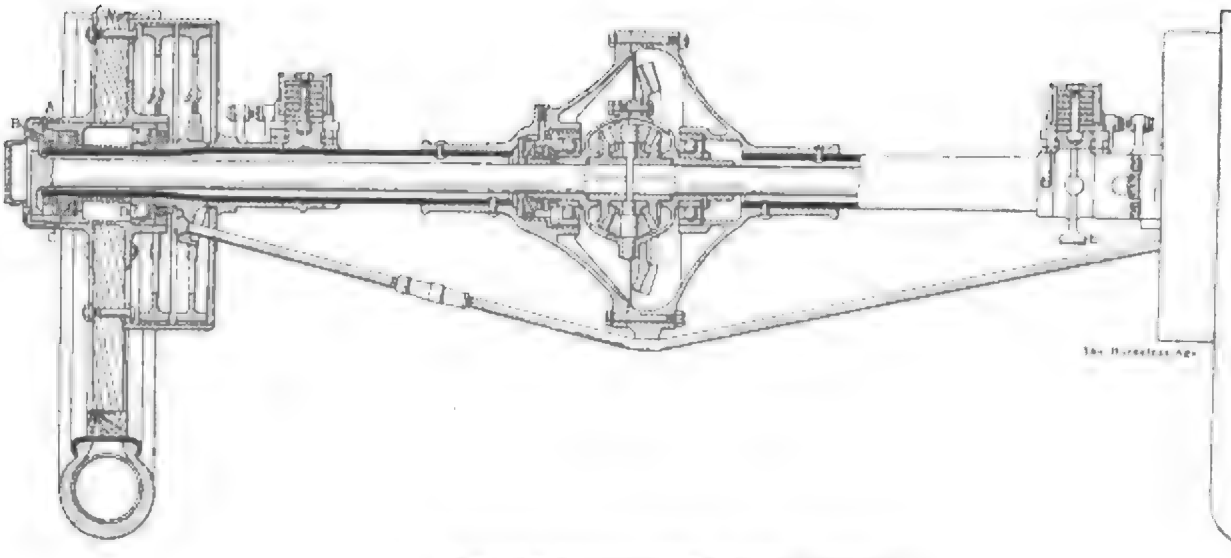
Distance rods similar to those used on the chain driven models are fitted, transmitting the driving effort to the frame and maintaining the front and rear axles parallel. These distance rods have ball front ends and work in sockets on brackets fastened to the side members of the frame. The rear ends of these rods form collars, which turn freely on the axle tubes and carry brackets which support the internal expanding brakes and their rigging. The brake drums are simply hollow cylinders bolted to the spokes of the road wheels. The brakes are completely enclosed and protected from dust. A torque rod is fitted, its rear end being fastened in the differential housing and its front end connected to a cross member by a spring suspension. The spring saddles work freely on the axle tubes, and are provided with a jack foot E, against which the head of the jack bears when tire changes, etc., are being made. This wrinkle in construction prevents the axle from slipping off the jack, as frequently happens when no such foot is provided, and prevents marring the paint or the axle itself.

The frame is of pressed steel, channel section, and is given a "rise" toward the rear to get the "straight line" drive. The cross members are also of channel section and bind the longitudinals by means of gusset plates. The front axle is a drop forging of I beam section, the knuckles, steering pivots and connections following the company's regular practice. Semi-elliptic springs are fitted all around. Wheels are of the artillery type, of 34 inches diameter, and 4 inch tires are fitted in front and 4½ inch tires at the rear. The control is like that of the chain driven models, except that in addition to the brake and clutch pedals and accelerator plunger on the footboard, a muffler cut-out plunger is fitted. The pressure pump for the oil feed from the auxiliary tank to the mechanical lubricator projects through the footboard, where it can be operated by the driver from his seat. Both brakes act on the drums on the hubs of the road wheels, the brakes lying side by side, as will be seen by referring to the rear axle and brake cuts. Balancers are provided to equalize the braking action. The inner pair of brakes are actuated by the usual pedal, and the outer pair by the "pull back" hand brake lever. The wheel base is 120 inches and the tread standard. Owing to the great angle of lock the car may be turned in a 38 foot circle.

Lubrication is extensively provided for on



Plan of Chassis of Locomobile Shaft Driven Car.



REAR AXLE OF LOCOMOBILE SHAFT DRIVEN CAR.

this chassis. In addition to the motor, gear box and differential, all spring shackles and eyes, the distance rod collars, spring saddle collars, steering connections and brake rockers, have each an individual pressure grease cup, there being twenty of these cups fitted in all. The car can be fitted with runabout, tonneau or closed bodies, and is provided with a peculiar form of front mudguard, having a downwardly projecting curved lip at the front end, which prevents the dust from rising beyond the mudguard and blowing backward.

In addition to this shaft driven model, the 40 horse power chain driven model of the 1908 season will be continued in 1909.

The Murphy Rectifier.

The Murphy Electricity Rectifier Company, Rochester, N. Y., has brought out a device for rectifying alternating into direct current which is decidedly novel. Its construction will be understood by reference to the accompanying diagram. In the figure, 3 is a transformer of the type usually employed in rectifying apparatus, the primary of which is connected to the a. c. line voltage at 1 and 2, and the secondary of which delivers the charging current to the storage battery or other d. c. load 11 through the central secondary tap 12. The particular wave which accomplishes the charging operation passes through conductors 5 and 6 alternately, as in all types of rectifier. The novelty of this apparatus lies in the method of phase selection, which, in the apparatus hitherto employed, has depended upon so called electric valve action. Here phase selection is brought about by recourse to the following principle: When an electric spark is produced between two slightly separated terminals, between which an electromotive force insufficient to bridge the gap is acting, the passage of the spark will determine the passage of a current in the form of an arc, under the action of the beforementioned electromotive force. The function of the Murphy apparatus is correctly to determine, by means of the initial spark, the passage of current through the instantaneously appropriate alternative paths 5 and 6, and thus secure a unidirectional current in the load branch 12.

In order to operate the selective apparatus a small synchronous motor is used. It is brought up to speed by a crank, and then runs in synchronism with the a. c. line voltage. On the shaft of this motor are carried the contact device 24, and also the two pairs of rotating arcing contacts 7, 9 and 8, 10. The metallic segment of 24 runs in close proximity to the two pairs of stationary points 22, 23 and 18, 19. These four points are carried upon a yoke capable of rotary adjustment by hand, much as are the stationary contacts of an ignition timer.

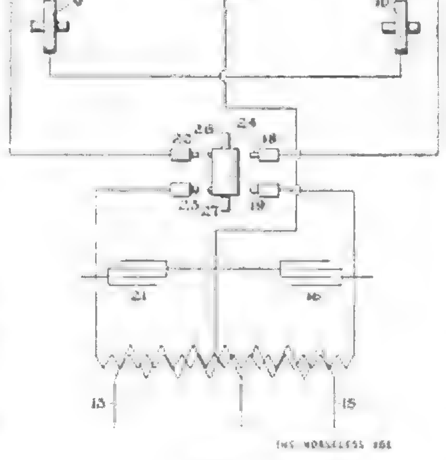


FIG. 1.

The sparks, which determine the correctly timed passage of the working current, are produced in the following manner: A voltage raising transformer is used, which is supplied, as all other auxiliary elements of the apparatus, from the regular a. c. circuit. Its primary is shown at 13, 15, and its high tension secondary terminals and neutral point are connected to the condensers 21 and 16, and the former terminals are connected to the contact points 23 and 19 of the timing portions of the apparatus. The operation of rectification is as follows: Suppose that at a particular instant the voltage phase in the alternative path 5 is such as to furnish current to the load in the right direction, and the contact points 26 and 27 on the rotary timer 24 are in juxtaposition to the fixed contacts 22 and 23. The line voltage having already built up the condenser 21 to the discharge point, a spark occurs between 23 and 27, also passing in series through the gaps 26, 22 and 7, 9, the discharge returning from 9, by the wires shown, to the other side of the condenser 21, and to the neutral point of the sparking transformer. The presence of a spark at the gap 7, 9 allows the load current to flow through conductor 5, the gap 7, 9 to the common point of the alternative working circuits, and through the battery to be charged back to the neutral point 3 of the load transformer. It is to be noted that the load current does not arc between the contacts of the timing device, but only between the rotating plates 7 and 9. These being in rapid motion, the tendency is to attenuate and break the arc as soon as the zero point of the phase is approached, the back e. m. f. of the cells under charge assisting in the action. As the arc is continually acting upon new surface of these arcing plates, they should not wear away rapidly through volatilization. By the time the charging current has been interrupted by the extinction of the arc at 7, 9, the phase has reversed, so that conductor 6 furnishes an e. m. f. in the proper direction. Since the synchronous motor carrying the timing cylinder 24 is in exact step with the line curent, its contact points are now in juxtaposition to the fixed contacts 18 and 19. The sparking transformer has also passed its zero point, and the condenser 16 is built up for a discharge. When the spark occurs it passes in series through gaps 19, 27, 26, 18 and 8, 10, allowing the working current to pass through conductor 6, the arc gap 8, 10, to the common connection, and through the battery in the same direction as before. This action goes on ad infinitum, the spark determining the passage of current through alternative paths 5 and 6 at the correct instants, when their e. m. f.'s are so poled as to give a unidirectional current in the battery to be charged.

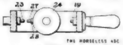


FIG. 2.

The effective voltage is varied to suit different loads, by varying the angular set of the yoke carrying the contacts 22, 23 and 18, 19. This causes the spark and accompanying useful passage of current to occur earlier or later in the phase of the working current. The effective voltage applied to the battery will be the mean of the instantaneous voltages acting during the remainder of the phase after the working current has begun to pass. If the passage of current begins early in the phase, the mean impressed voltage will be high, while, if the discharge commences late in the period on the decreasing portion of the curve, the mean voltage will be comparatively small.

The efficiency of this rectifier is said to be excellent, the chief losses being the energy in the arcs at 7, 9 and 6, 8, the transformer losses and the energy used to drive the small synchronous motor. It is claimed that the losses are nearly constant, and that the efficiency increases with the voltage developed. Among the advantages claimed for this apparatus are its ready adaptability to furnishing a charging current at any desired voltage and its simplicity and freedom from easily breakable parts or parts containing liquids.

The apparatus is put up on the back of a neat panel upon the front of which are the necessary switches, etc., and through the face of which extends the starting crank of the motor. It is built for all commercial voltages.

The P. N. S. Timer.

The Philadelphia Novelty Supply Company, of 2031 North Twenty-ninth street, Philadelphia, Pa., is bringing out the P. N. S. timer for two and four cylinder motors. The timer is of the roller type, with a hardened steel roller. The contact blocks are of tool steel and are adjustable by means of thumb nuts, so that each cylinder is fired at exactly the proper time in relation to the other cylinders, thus eliminating the "early" or "late" cylinders so common with motors using a timer with fixed contacts. The contact blocks have convex faces, and each block is movable longitudinally, it being retained in the desired position by means of a nut and washer. A thumb nut, working in a curved plate on the outside of the fibre timer body, allows of the contact being moved either in or out, as desired. By referring to the figure it will be readily seen that if the contact be moved away from the centre a smaller wiping surface will be presented to the roller, and this surface will be passed over by the roller a trifle later than when the ends of the convex face of the contact are flush with the interior face of the fibre ring. This gives a retardation of the time of firing. If the contact be brought toward the centre the roller will make contact earlier, and the time of firing will be correspondingly advanced.

The timer as adapted to the two cylinder Buick cars is also shown. A small pinion is put on the timer shaft of the motor, and the timer bracket is bolted to the crank case cover in a vertical position. The lever seen at the left is fitted to attach to the regular spark linkage.

International Harvester Company Compromise on Types.

The International Harvester Company, of Chicago, will announce a new model about the first of the year. It will be a compromise between the high and low wheel types, with specifications somewhat as follows: Four cylinder, 3¾x3¾ inch, air cooled engine, con clutch, two speeds and reverse sliding change gear; about 92 inch wheel base; option of 38 or 40 inch by 2 inch solid tires, or 34x3½ inch pneumatics. Shaft drive, with possibly a double reduction when the large wheels are used.

Leak-No, a Compound for Repairing Iron and Steel.

The H. W. Johns-Manville Company, 100 William street, New York, are placing on the market a new compound resembling powdered iron, under the trade name Leak-No Metallic Compound. When mixed with water this compound may be applied like putty to defects in iron and steel articles, and the manufacturers claim that it "metalizes" and becomes a permanent part of the article to which it is applied. When hard it closely resembles iron in color. It is claimed that a leak thus repaired in anything made of iron or steel will be proof against any pressure of oil, steam, gas, air, ammonia or water, and that the compound will stand any heat or chemicals that iron will stand.

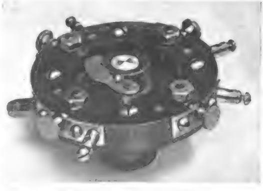
Few Changes in Reliable-Dayton Models.

The Reliable-Dayton Motor Car Company, of Chicago, will continue their line practically unchanged for 1909. The wheel felloes will be somewhat heavier and the tire sections increased from 1¼ to 1½ inches. The delivery wagon will be supplied with a closed body for the trade which requires that style.

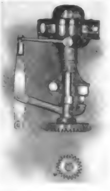
Automobiles in the Campaign in Indiana.

Automobiles played an important part in the political campaign in Indiana, and it is interesting to note that a majority of the candidates who used automobiles were successful. The candidates were able to cover more territory in less time, and thus meet a larger number of people. Charles Korbly, the successful candidate for Congress from the district in which Indianapolis is located, made his whole campaign in a small gasoline runabout. James Zion, Independent candidate for Governor, toured the State in a touring car, and while, of course, he was not elected, he polled a far larger number of votes than had been estimated. In the big demonstrations in Indianapolis automobiles displaced carriages. When W. H. Taft was in the city for one night he was taken to the various meetings in an automobile, whereas he could not have kept all of his speaking engagements had a carriage been employed. As a result of the success of the automobile, it is predicted that in future campaigns in Indiana automobiles will largely displace special trains.

The President of the French Republic, as has come to be the custom, will attend the opening ceremonies of the Paris Automobile Show on November 28.



P. N. S. FOUR CYLINDER TIMER.



SPECIAL TIMER FOR BUICKS.

COMMUNICATIONS

Self Lubricating Bearing Linings.

Editor Horseless Age:

As a constant reader of your paper I have taken great interest in the various technical articles. I have not, as I remember, any recollection of any articles on the subject of bearings, alloys for same and tests on various combinations under similar conditions. We find coefficients of friction in the handbooks like Kent, but it seems to the writer that there is little that will at a glance tell the reader how the various metals and alloys act under similar conditions of temperature, speed, pressure, lubrication, etc.; the relative wear of different metals and alloys in contact and their life for certain standard purposes.

I fully realize that to obtain information covering the above would constitute an enormous amount of work if all possible combinations were to be included, but it seems to the writer that it offers a very interesting subject for discussion by someone familiar with it. The automobile has a large number of bearings besides ball bearings, and so an article on this subject seems to be warranted.

Curves plotted so that conditions can be read at once are always interesting and valuable to the reader. The writer at the present time is especially interested in the subject since he is working on a high speed generator for use on automobiles for furnishing power for ignition. The subject of bearings suitable for this application is of particular moment for the reason that the design of the generator is unique in some of its features. For example, it is desirable, though not essential, that the bearings be of such a nature that they can be run without lubrication, such as oils. The absence of such lubrication will increase the capacity of the machine and incidentally remove the worry and obviate attention to the bearings. A dry lubricant that stays where it is put, such as graphite inserts, is better, and such alloys or inserted materials of the "Metaline" type might be well suited to the purpose.

I mention these things because I am not familiar with the subject of bearings of the special type, and would feel much gratified to see an article in your paper on the subject. The more comprehensive it is without being weighty the better. Curves are especially interesting to all, as they tell their story in a nutshell.

Can you advise me where I may obtain information on the use of solid graphite linings and any alloys or inserts of the Metaline type? I will consider it a great favor if you can give such references.

J. G. Zimmerman.

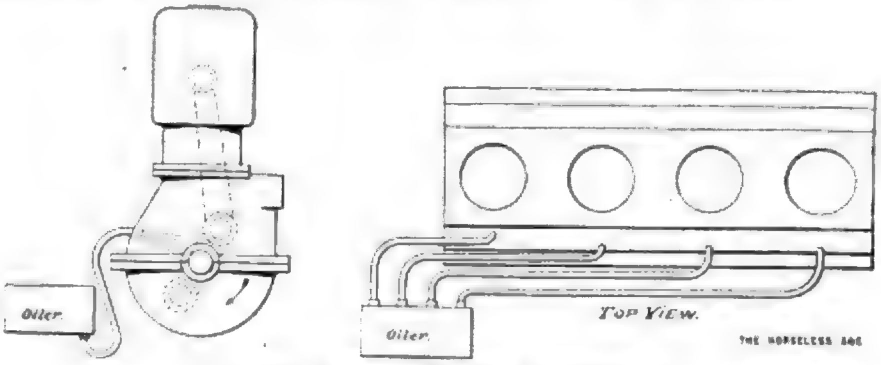
[An article on the above subject is solicited for our coming Engineering Number, and we shall be pleased to hear from anyone familiar with this subject of special self lubricating bearing linings. Perhaps some reader can furnish the names of manufacturers of the linings and inserts referred to.—Ed.]

A Substitute for the Splash Lubricating System.

Editor Horseless Age:

I have an engine with four cylinders, with 3¼x3¼ inch valves in the head. When set up ready to run the base will not be level, and I may say at once that splash lubrication is out of the question. I desire to lubricate this engine by squirting the oil in through four small pipes, which will, of course, run through the upper half of the base. The oil will be squirted directly onto the cranks and connecting rods, which in turn will throw up any surplus into the cylinders and so lubricate them.

A company I have written to are getting out an oiler with four feeds, which is to throw the oil 5 feet to 8 feet. The pump of this lubricator seems to be of about one-quarter inch bore and about five-sixteenth inch stroke, and the reduction between the worm and worm gear seems to be 20 to 1, so you will see that the quantity of oil thrown will not be very large. I want to use four feeds only, and would like to know if this will work.



Sketch of Proposed Oiler Arrangement.

Failing in this, how would it do to use a gear pump and circulate the oil through the pipes the same as water is circulated? I would choke down the outlets to enable me to get enough pressure to throw it the 8 or 10 inches necessary to reach the cranks. Of course, the oil in the base will be drained from the crank case continuously, so there will be no accumulation to be thrown up into the rear cylinder.

H. B. Greening.

[We do not believe that the ordinary mechanical oiler will feed sufficient oil to insure copious lubrication of the cylinders in this way, and if it did it would have to be refilled so frequently as to be a nusance. To us it seems that the best plan would be to provide a mechancial oiler with a lead to each of the cylinders and one lead to each of the crank shaft bearings, and provide means whereby the surplus oil working out through the ends of the crank shaft bearings is caught (in a hollow ring secured to the crank arm, for instance) and conducted to the crank pin bearing through a hole in the crank pin. It would not be necessary to carry the leads all the way to the crank shaft bearings, as you could undoubtedly provide these bearings with pockets or funnels and inject the oil into these, but we believe the former method to be better.—Ed.]

Engine Bearings.

Editor Horseless Age:

I should like to see a good article on "engine bearings." Very few prospective purchasers know what material is best and what will be the easiest to replace. Some cars, as you probably know, can be run 10,000 miles without showing great wear on bearings. Others must have bearings replaced every 2,000 miles. I have one of the latter kind, and as it has no provision for taking up wear, the whole engine and transmission must be taken apart to rebabbitt the bearings. There seems also quite a difference of opinion among automobile makers as to the best material for bearings. Some use phosphor bronze, some Parsons white bronze, others babbitt. What material is best, and why? I suggest that this subject be treated by an expert in your Engineering Number. In my opinion it has been sadly neglected. Paul P. Frank.

[That the bearings wear out prematurely is not a positive proof that the bearing metal is no good. The best bearing metal will not last if the bearing surface is too small for the load supported or if the supply of oil to the bearing is not dependable. The softer bearing metals, like babbitt, are used a good deal because all the wear comes on them and none on the shaft, and it is much cheaper to replace the babbitt linings than the crank shaft. There are a great many different alloys parading under the trade name of babbitt, some of them compounded with a special view to cheapness, and these latter should be scrupulously avoided in automobile work. Babbitt metal linings can be replaced much cheaper than bronze bushings if the babbitt is simply poured into the hubs. Some manufacturers who take great pains to produce durable bearings use die cast babbitt bushings compressed. We will endeavor to get an article on this subject for our Engineering Number.—Ed.]

Non-Freezing Cooling Fluids.

Editor HORSELESS AGE:

Your issue of October 21 contains a short editorial, "Cold Weather Precautions," in which a 20 per cent. salt solution is recommended. Discussing the matter, none of your subscribers present remembered having ever read the formula, and did not know how much sal soda to use. Will sal soda counteract the tendency of strong brine to eat (rust) iron?

A party using wood alcohol last winter claims his radiator was badly pitted and became very leaky. Do you think wood alcohol would have that effect?

E. F. KUNY.

[Only a very small amount of sal soda is required to render the solution alkaline. Get a few red litmus papers from a drug store. Introduce a small amount, say a spoonful, into the solution and stir it thoroughly. Then introduce the litmus paper, and if it turns blue the solution is alkaline. If it does not turn blue add some more sal soda and test again. The object of the sal soda is to take out any possible acidity of the solution, which is the cause of pitting of the metal.

Pure wood alcohol will not pit metal.—ED.]

Denatured Alcohol Solution for the Radiator.

Editor HORSELES AGE:

Will you kindly answer in your valued journal the following queries:

1. Is denatured alcohol equally good as an anti-freezing fluid as wool alcohol?

2. Would there be any danger or other objection in mixing denatured and wood alcohol in the radiator?

A. O.

[The freezing points of denatured alcohol solutions and wood alcohol solutions are substantially the same. There is no danger in mixing denatured alcohol and wood alcohol; in fact denatured alcohol is sometimes simply a mixture of grain alcohol and wood alcohol, while sometimes other denaturizing agents are used.—ED.]

To Make a New Cam Shaft.

Editor HORSELESS AGE:

I am interested in the design of a cam shaft for a 60 horse power foreign car that now is somewhat old and has, according to the usual practice at that time, too much play between the end of the push rod and the end of the valve. Be kind enough to give me references to all of the best articles on the design of cam shafts you have published in recent numbers. Do you know whether a good job can be made by turning off the old cams and fitting a new split cam in some manner to the same shaft? The desire is to make use of the inlet cams which are satisfactory and on the same shaft.

I desire also to cut some new piston rings and I would thank you to refer to the best articles on this subject in your recent issues.

E. MALLINCKRODT.

[Articles on cams and cam shafts were published in THE HORSELESS AGE of October 2, 1907, and February 19, 1908. It seems to us that if the cams are not worn and the only trouble is that there was originally too much clearance between the cams and the push rods, the proper remedy would be to lengthen the push rods, which is a rather easy matter, as compared with the construction of new cams and their proper spacing on the cam shaft. Instead of turning off the old exhaust cams and fitting new split cams, we would have the old cams "built up" with additional metal by some concern making a specialty of autogenous welding, and then recut and hardened in cyanide or by another suitable process.

We have not published any articles on piston ring manufacture recently, but in our issue of June 18, 1902, two different methods were described.—ED.]

Short Tire Valve Stems and Square Dry Cells.

Editor HORSELESS AGE:

I want to acknowledge my appreciation of your recent "Runabout Number." An occasional number of special interest is evidence that the publishers are cognizant of the real needs of the autoist, whether he be a beginner or a professional driver of an automobile.

Two suggestions were made in the "Runabout Number" and recent numbers that I think are of sufficient value to justify the notice of makers of those parts. First, the long valve stem, and, second, the square dry battery cell instead of the round one. A 2x2 inch square cell, 8 inches high, will require a 4x8 inch box for eight cells, as compared with a 5x10 inch box for eight 2½x2½ inch round cells. Where one is pinched for suitable battery room this saving in space is an item worth looking after.

J. V. BLOSE, M. D.

Searchlight Car of British War Office.

Editor HORSELESS AGE:

We enclose herewith photograph of a special 24 horse power Stevens car recently equipped with one of our standard 14 inch electric projectors by our London branch for the British War Office. The chassis is equipped with a 5 kilowatt dynamo with separate clutch, so that it may be connected or disconnected from the engine. The arrangement has been found very successful in manœuvring at night. We believe that a number of similar equipments will soon be purchased for the British Army.

RUSHMORE DYNAMO WORKS,
S. W. Rushmore.

A. L. A. M. Formula for Horse Power.

Editor HORSELESS AGE:

Will you kindly let me know through the columns of your paper whether the A. L. A. M. formula for horse power is based on 1,000 revolutions per minute or 1,000 feet piston speed per minute? I have seen it stated both ways in reputable papers.

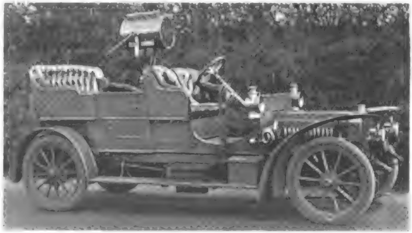
SUBSCRIBER.

[It is based on 1,000 feet piston speed per minute.—ED.]

Leather Treads.

Editor HORSELESS AGE:

I see that C. F. Smith wants to know something about the leather treads, and he might like to hear of my experience with them. I have one of my cars shod all around with a well known leather steel studded tread. The nice thing about them is that they are practically puncture-proof, and they will also brace up a weak casing. The principal fault they have is that they require frequent adjustment, until the stretch is out of the leather, and that is quite a little job if it is properly done. This I consider their greatest fault. They must be tight on the tire to exclude dirt and prevent creeping, or you will find when you go up hill that everything is working but "nothing doing." Of course, three or four small straps under the spokes of each wheel will prevent this, but it is better to have them on tight and not use the straps. A car fitted with them runs slightly harder and they make some noise on paved streets, but



SEARCHLIGHT CAR OF BRITISH WAR OFFICE.

everything considered they are a pretty good thing.

Regarding tire fillings I can say that I have used the composition for making printers' rollers in single tube motor tires and bicycle tires with some success. It must be forced in the tire as thick as possible. Remove the valve, get your stuff good and hot and with an extra large grease gun force in the liquid. UNO.

Table Salt Solutions.

Editor HORSELESS AGE:

In an editorial in issue of October 21 you speak of two non-freezing solutions, one alcohol and water and the other a solution of common salt.

The latter, you state, should be a 20 per cent. solution of salt, the solution to be rendered slightly alkaline with sal soda.

This, according to the statements made in the Runabout Number, is scarcely correct.

The solution made in this way would require 96 grains of salt to the ounce of water.

One of your correspondents uses 40 grains to the ounce, and the other, whose figures you apparently had in mind when writing the editorial, makes it up with one-fifth, or 20 per cent., of a saturated solution of salt and four-fifths water. A saturated solution of sodium chloride or common salt will go 128 grains to the ounce, consequently the last mentioned solution would contain about 26 grains to the ounce of salt instead of 96, as your solution would. One grain of sal soda to the ounce will render it slightly alkaline. A simple formula, and one easy to remember, is 30 grains of salt and 1 grain of washing soda to the ounce. The specific gravity of this mixture, with an ordinary urinometer, such as most physicians have, is about 1.035. C. F. SMITH.

[In order to clear this matter up we have looked up references on the freezing points of salt solutions of various densities. Louis M. Schmidt in his work on "Refrigeration" gives the following table:

Per Cent. of Salt by Weight.	Degrees Baumé.	Specific Gravity at 60° F.	Pounds Salt to Gallon.	Freezing Point. Degrees F.
0	0	1.000	0.000	32.
1	1.	1.007	0.084	31.8
5	5.	1.037	0.432	25.4
10	10.	1.073	0.895	18.6
15	15.	1.115	1.395	12.2
20	19.	1.150	1.92	6.86
25	23.	1.191	2.485	1.00

This information agrees pretty closely with the results of Rüdorff, quoted by Ostwald in his work on "Solutions," from which we extract the following table, in which the conversion to the Fahrenheit scale has been made by ourselves:

Per Cent. of Salt.	Freezing Temperature. Centigrade.	Freezing Temperature. Fahrenheit.
1	0.6	30.9
2	1.2	29.8
4	2.4	27.7
6	3.6	25.5
8	4.8	23.4
12	7.2	19.
14	8.4	16.9
15	9.2	15.4
16	9.9	14.2
17	10.6	12.9
18	11.4	11.5
19	12.1	10.2
20	12.8	9.0

At 60° Fahr. a saturated salt solution contains 25 per cent. by weight of salt. If we were to make a saturated salt solution and dilute this with five times its volume of water we would have a 5 per cent. solution, which will not stand any lower temperature than 26° Fahr. This also corresponds with our correspondent's statements, who says that the density of such a solution is 1.035, while that of a 5 per cent. solution is given as 1.037 in the Schmidt table, and this solution has a freezing temperature of 25.4° Fahr., according to that table. But such a freezing point is certainly not low enough for most parts of the country. We believe that the 20 per cent. solution will be required for the sake of safety. We can see that difficulty is likely to be encountered with such a strong solution from precipitation due to the lowering of the solubility with the temperature and also as a result of evaporation. Where very low temperatures must be provided against the denatured alcohol solution is to be recommended, of which a 35 per cent. solution will stand approximately 15° Fahr. —ED.]

The Taxicab Strike.

An effort to arbitrate the differences between the New York Taxicab Company and its striking chauffeurs was made last week by the State Board of Arbitration. A meeting of the company's officers, a committee of strikers and the Board of Arbitration was held at the company's offices on Friday. The company refused to recognize the Teamsters' Union and Liberty Dawn Association, but offered to take back the strikers under the following conditions:

Gasoline to be charged at cost; twelve hours to constitute a day's work; all time over twelve hours to be deducted from the following day's work; men to pay for their uniforms at the rate of 10 cents per day, but in no case must the uniform be more than $36 a year. The charge of 10 cents a day for cleaning machines to be abolished; company to clean all machines in future; extra men to receive steady employment according to length of service with the company; no discrimination against any man for his connection with the union and the men taken back on their individual applications for work. No man is to be discharged for any active part taken in union affairs or for unavoidable illness; no charge to be made by the company to try out competent men; no charge for any repairs except those made necessary through negligence of the chauffeur.

It was at first thought that the strikers would agree to these terms, and that the strike would end, but it soon became evident that reports to this effect were premature. Another assault on a strike breaking driver occurred on the same day the meeting had been held, and the special detectives stationed in Forty-seventh street in the vicinity of the company's garage were not called off.

Business Opportunity.

An American consul in the Far East reports that he has received a special inquiry from a local business man, who is desirous of purchasing motor omnibuses for use in that territory. It is his intention to extend his business as a carrier of passengers and also to deal in motor cars and fixtures of all kinds. For this purpose he desires to obtain full information in the form of illustrated catalogues, lists of net prices, and other data from American manufacturers of this class of goods. When addressing the Bureau of Manufactures refer to No. 2,710.

Dealers Will Try to Break Down the Exclusive Dealers' Policy.

In line with our remarks in a recent issue that secession of the Buick and Olds companies from the Licensed Association left the association practically without manufacturers of low priced runabouts, which would likely cause trouble with agents in districts where there is a strong demand for such cars, comes the report from Joliet, Ill., that the National Retail Automobile Dealers' Association, whose president, C. F. Jensen, is located in that city, is endeavoring to bring about an understanding between the licensed and unlicensed factions of the industry, to drop their exclusive agency policies and sell cars to all dealers who can pay for them. The association also will urge the adoption of standard screw threads by the whole industry, which would considerably facilitate repair work. President Jensen was in New York last week to make the preliminary arrangements for the annual meeting of the association, which is to be held here January 4.

Buick Motor Company Not Expelled.

The A. L. A. M. take exception to our statement regarding the expulsion of the Buick and Olds companies from the association, stating that only the Olds Motor Works has been expelled. On Oct. 10 notice was served on the last mentioned company that the then existing agreement between it and the association would be null and void at the end of thirty days, so that the Olds Motor Works ceased to be a member of the "Licensed" Association on November 10. The Buick Motor Company, however, are still considered a member of the association, though they are not in good standing, and it has been decided to bring suit against them for overdue royalties. While the Licensed Association refuses space at the Madison Square Garden Show to the Buick Motor Company—this being one of the penalties provided to insure payment of royalties—it evidently does not object to having Buick cars handled by "licensed" dealers.

LEGISLATIVE and LEGAL

Recent Important Court Decisions.

Compiled by Xenophon P. Huddy, LL. B.

JURISDICTION OF NEW YORK COURTS.

Courts of Special Sessions in the State of New York outside of New York County can fine automobilists for speeding up to $50 only, notwithstanding the fact that the motor vehicle law permits a greater fine and compels a minimum payment of at least $250 for a third offense. In a case which occurred in Rensselaer County the Court of Special Sessions fined an automobilist $100. This was set aside upon appeal to the county court. The decision in this case is of considerable importance, especially considering the fact that the motor vehicle law of the State of New York did not expressly incorporate the misdemeanor of speeding into the Penal Code.—People vs. De Graff, 56 Misc. Rep., 429.

ACTIONABLE NEGLIGENCE.

In the case of Seaman vs. Mott, 110 N. Y. Supp., 1040, it was held that in an action for injuries to a pedestrian in a collision with a motor car the evidence did not prove actionable negligence.

PEDESTRIAN'S RIGHT TO USE HIGHWAYS.

Ordinarily a pedestrian has no right of way superior to that of a driver of a vehicle, but each may continue in his own course with relative regard for the other's right of travel.—Seaman vs. Mott, 110 N. Y. Supp., 1040.

STOPPING AUTOMOBILE.

A driver of an automobile was not bound to bring his car to a stop in the absence of proof authorizing an inference that in the exercise of due care he had reason to believe that if he proceeded a pedestrian would come in contact with the car, and where it did not appear that after such contact was inevitable the driver of the motor omitted anything to prevent that contact. There was no liability.—Seaman vs. Mott, 110 N. Y. Supp., 1040.

EVIDENCE OF EXCESSIVE SPEED.

In an action to recover for an injury resulting from being struck by an automobile alleged to have been running at an excessive speed, it was held to be competent to show what was done by those in charge of the machine, and what, if any, noise it made as it approached, as affecting the question of an alleged negligent rate of speed.—New York Transportation Co. vs. Garside, 157 Fed. Rep., 521.

CARE IN OPERATING AUTOMOBILE—RIGHT SIDE OF STREET.

Where an ordinance as well as general custom required vehicles to keep to the right hand side of the street, and the plaintiff was struck and injured by the defendant's automobile, which had crossed the street and was proceeding on the left hand side, it was not error for the court to charge the jury that the driver was bound to the exercise of greater care on that side to avoid injuring pedestrians than would be required if he had been on the other side.—New York Transportation Co. vs. Garside, 157 Fed. Rep., 521.

DUTY TO STOP.

If the driver of defendant's automobile saw or could have seen that another automobile was approaching from the oposite direction and that between the two plaintiff, who was on foot, would be placed in a dangerous position, it was the automobilist's duty to stop until the danger was passed, and his failure to do so rendered him liable, even though in keeping out of the way of the other machine the plaintiff inadvertently stepped back too far and in front of the defendant's vehicle.—New York Transportation Co. vs. Garside, 157 Fed. Rep., 521.

CONTRIBUTORY NEGLIGENCE—LOOKING.

Where a person walking from a street car near the centre of a street to the curb was charged with contributory negligence, which would prevent a recovery for an injury resulting from being struck by a passing automobile because of a failure to look in both directions before starting across, it is a question for the jury, to be determined under the particular facts and circumstances of the case, whether there existed contributory negligence.—New York Transportation Co. vs. Garside, 157 Fed. Rep., 521.

DUTY TO LOOK OUT FOR STREET CAR PASSENGERS.

If the driver of an automobile sees a street car standing still at a point on the street where passengers customarily get on and off, it is the driver's duty to apprehend that persons might be passing between the car and the curb, and to exercise care accordingly.—New York Transportation Co. vs. Garside, 157 Fed. Rep., 521.

AGENCY CONTRACTS.

A contract granting to the plaintiff the right to sell the defendant's automobiles in a designated territory, and whereby the defendant agreed to refer to the plaintiff all inquiries received from this territory as to automobiles of its manufacture, does not entitle the plaintiff to commissions, profits or damages because of a sale of automobiles in the plaintiff's territory by another agent having a like contract, except as to territory where such other agent did not disclose to the defendant any purpose to sell in the plaintiff's territory, and it does not appear that the defendant had any notice that such other agent intended to sell them outside of his own territory.—Cedar Rapids Auto and Supply Company vs. Thomas B. Jeffery & Co., 116 N. W., 1054.

Even if a contract granting to the plaintiff the right to sell the defendant's automobiles in a designated territory, and requiring $25 deposit with each order, be interpreted as only requiring a $25 deposit with each order and not on each automobile, it simply shows that the plaintiff in making a deposit of $25 on a single order for twenty-five automobiles, chose to make a larger advance payment than it had agreed to make, and does not entitle it to a return of at least $600, for as to such automobiles the plaintiff stands in the relation of a buyer who has paid part of the purchase price in advance of delivery, and cannot, without good cause, refuse to consummate the deal and demand a return of the deposit.

NEGLIGENT DRIVING.

Where the driver of a vehicle drives up to a sidewalk across a bicycle path, and then discovering that he has made a mistake in the place turns back across the path toward the centre of the street without looking to see if anybody is approaching, and strikes a bicyclist coming in the oposite direction on the path, he is negligent.—Wistrom vs. Redlick Brothers, 92 Pac. Rep., 1048.

TURNING TO THE RIGHT.

Under the customary and common law, also under the various States' statutes, drivers of vehicles must turn seasonably to the right of the centre of the highways so as to pass other vehicles without interference.—Wistrom vs. Redlick Brothers, 92 Pac. Rep., 1048.

The law of the road requiring vehicles to turn seasonably to the right of the centre of the highway upon meeting and passing applies not only to horse drawn vehicles, but to bicycles and automobiles.—Wistrom vs. Redlick Brothers, 92 Pac. Rep., 1048.

IGNORANCE OF DRIVERS.

The fact that the driver of a vehicle is ignorant of the approach of another vehicle can afford no shield against his liability, if the ignorance is the result of a want of ordinary care.—Wistrom vs. Redlick Brothers, 92 Pac. Rep., 1048.

EXERCISE OF REASONABLE CARE.

One who uses the public highway with an automobile must exercise reasonable care to prevent injury to others using the thoroughfare.—Fletcher vs. Dixon, 68 At. Rep., 875.

AUTOMOBILES HAVE THE RIGHT TO USE THE HIGHWAY.

New modes of using the highway being allowable whenever the general benefit requires them, the use of automobiles on the public avenues of travel is allowable, if ordinary care, as determined by the circumstances, is exercised, and their use may be regulated by law.—Fletcher vs. Dixon, 68 At. Rep., 875.

FRIGHTENING ANIMALS.

For a construction and interpretation of the Maryland automobile law concerning the frightening of horses, see Fletcher vs. Dixon, 68 At. Rep., 875.

RIGHTS OF AUTOMOBILISTS ON THE HIGHWAYS NOT STRICTLY EQUAL.

It is not strictly true that automobilists possess the same right on the public highways as all other vehicles, since there are statutory regulations controlling motoring which must be complied with by motor car drivers and owners.—Fletcher vs. Dixon, 68 At. Rep., 875.

EVIDENCE OF SPEED.

In an action for injuries resulting from the plaintiff's horse becoming frightened by the defendant's automobile, testimony that the automobile made more noise than any other that the witness had ever heard was held to be admissible.—Fletcher vs. Dixon, 68 At. Rep., 875.

CHARACTER OF HORSE FRIGHTENED.

In an action for injuries resulting from the plaintiff's horse becoming frightened by the defendant's automobile, the opinion of persons who had been in the livery business for a long time and had known the plaintiff's horse for a number of years, as to whether the horse was fit for a lady to drive, is inadmissible, since the jury could determine this question.—Fletcher vs. Dixon, 68 At. Rep., 875.

NEGLIGENCE OF DRIVER.

In an action for injuries to the plaintiff caused by being struck by the defendant's vehicle while driven by a hired driver, the burden was upon the plaintiff to prove that the driver was negligent and that his negligence caused the injury.—Geiselman vs. Schmidt, 68 At. Rep., 202.

EXERCISE OF CARE.

The driver of a vehicle is bound to use reasonable care and to anticipate the presence on the street of other persons having an equal right with himself to be there.—Geiselman vs. Schmidt, 68 At. Rep., 202.

MASTER AND SERVANT.

Where the plaintiff introduced evidence tending to prove that a horse and wagon which ran into and injured him belonged to the defendant, the court held that the jury might reasonably conclude that the driver of the wagon was the defendant's agent. This holding is important as bearing upon the relation between chauffeurs and owners of automobiles.—Geiselman vs. Schmidt, 68 At. Rep., 202.

LIABILITY OF FATHER FOR SON'S DRIVING.

The owner of a motor vehicle is not liable for injuries resulting from the negligent driving of a car by his son, merely because of the father's ownership, or because he permitted his son to drive the car, or because the driver was his son. The defendant is not liable for injuries resulting from the negligent driving of his motor car by his son, where the son was at the time engaged in delivering presents on his own account and had taken the car out without the defendant's knowledge or consent, since the relation of master and servant did not exist between them at the time of the accident.—Maher vs. Benedict, 108 N. Y. Supp., 228.

MUNICIPAL ORDINANCES.

Buffalo City Charter, Laws 1891, p. 137, Chap. 105, par. 17, subd. 6, as amended by laws 1904, p 83, Chap. 31, empowering the city to enact an ordinance imposing a "tax" on automobiles "for the privilege" of operating the same on its streets, and to prohibit such use in case of non-payment of the tax, and to provide a penalty for violation of the ordinance, is repealed by a later act, the motor vehicle law, Laws 1904, 1316, Chap. 538, par. 4, subd. 3, providing that the city shall have no power to pass, maintain or enforce ordinances requiring from owners of automobiles the "licenses" or permits to use the streets, or prohibit them from the free use thereof, a tax for the privilege of operating automobiles on the streets being but a license.—108 N. Y. Supp., 450.

RIGHTS OF TRAVELERS ON HIGHWAY.

The traveler on the public highway has a right to assume within reasonable limits that others using it will exercise reasonable care.—Indianapolis Street Railway vs. Hoffman, 82 N. E. Rep., 543.

Charlotte (N. C.) Garage Men Win Their Fight.

When a license was recently solicited for conducting a garage in the Auditorium Building, Charlotte, N. C., a storm of protests arose that it would be inimical to public safety, and it was even proposed to bar all garages from within the fire limits of the city. The matter was taken up by the city council, and Alderman Chambers was appointed a committee of one to investigate the dangers involved. He got opinions from several insurance men, and also collected a series of newspaper clippings on garage fires, and then set about to draft an ordinance which prohibited the establishment of garages inside the fire limits. Meanwhile the garage interests of the city had not been idle, and at the meeting of the council on November 2, at which the proposed garage ordinance came up for a hearing, they were ably represented by counsel. The latter claimed that it would be foolish to run the Mecklenburg Auto Company, which had already established a garage in the Auditorium, out of business. He said that no gasoline was kept in the place except what was in the tanks of the cars. Someone inquired whether the tanks could not be emptied of gasoline before the cars were run into the garage, to which it was correctly replied that this would involve greater fire danger than leaving it in the tanks. The general opinion of the aldermen was that no drastic ordinance should be passed barring automobile garages from the fire district, and that instead an ordinance regulating the storage of gasoline should be framed. The matter was referred to the ordinance committee.

Reckless Autoist Is Sent to Jail for Thirty Days by a Californian Justice.

Peyton W. Metcalf, of San José, Cal., a nephew of the Secretary of the Navy, recently ran down with his automobile a boy named Bud Aylesworth, fourteen years old, of East San José. Aylesworth's foot was injured and his bicycle damaged badly. The number of Metcalf's machine was ascertained and he was arrested in a drunken condition. This not being his first offense, Justice Brown sentenced Metcalf to thirty days in the County Jail, without the option of a fine. Metcalf's attorney gave notice of an appeal.

Taxes on Philadelphia's Motor Buses Overdue.

The Auto Transit Company, of Philadelphia, which operates a number of motor buses on Broad and Diamond streets, has been a bit slow in paying its taxes, and the city officials have threatened to stop the service if the amount due the city was not forthcoming. In July, 1907, the company paid to the City License Bureau the sum of $2,500 for licenses for twenty-five motor omnibuses for 1907. At the beginning of 1908 new licenses should have been taken out, and Chief Benson, of the Bureau of Highways, called the attention of City Solicitor Gendell to the matter. The company was notified repeatedly, it is said, but paid absolutely no attention to the notices, until Assistant Solicitor Alcorn gave notice that unless the company paid its taxes he would stop the running of the omnibuses.

The whole amount due the city from the company is about $6,500. Of this amount $2,500 is for annual licenses, at the rate of $100 for each omnibus. In addition, the company under the provisions of the ordinance of July, 1907, is required to pay 2 cents per square yard for each square of paved street used in the running of the buses. This will amount to about $8,000 for the current year if the tax were to be paid for the whole width of the streets, but the transit company officials claim it should be calculated on the basis of that portion of the width of the street which is actually used by the buses, which would bring it down to $4,000.

Legal Note.

The town of Pittston, Pa., has passed an ordinance limiting the speed of automobiles to 1 mile in six minutes, and requiring all automobiles to be equipped with an alarm signal, which must be operated every time a street crossing is approached.

It appears that the residents of Connecticut are dissatisfied with their present liberal automobile law, on the ground that it has made the State a favorite speeding ground for non-resident motorists. A new bill will be introduced at the coming session of the Legislature, and it is not unlikely that a return will be made to the former speed limits.

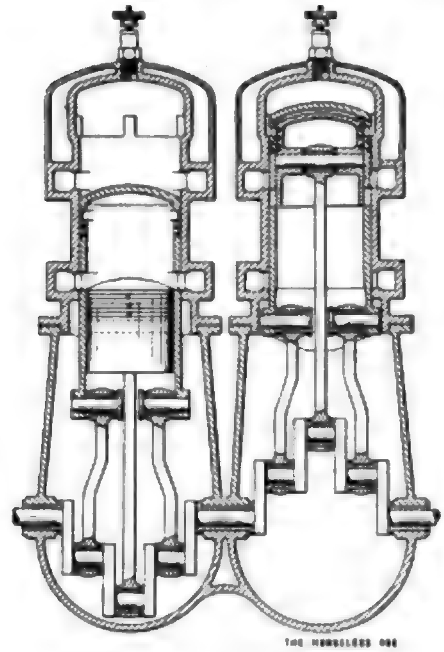
A petition is being circulated for signatures in Hamburg, Germany, which is to be presented to the senate of that city to ask it to more strictly enforce the police regulations regarding automobile traffic, so as to better safeguard the public.

The motorists of France paid into the public treasury during the past year the sum of 7,200,162 francs in the way of taxes and fees for car registration and drivers' examinations. In this sum are not included the moneys derived from the taxes on gasoline, alcohol, rubber, etc.

OUR FOREIGN EXCHANGES

Some New European Two Cycle Motors.

That European inventors and manufacturers are paying increased attention to the two cycle motor is evidenced by the fact that descriptions of new constructions of this type of motor are making their appearance in the press. Thus we find in a recent issue of *l'Auto d'Italia* a description of the Da Costa motor with concentric pistons of unequal stroke, which is being manufactured by the Cohendet Works in France. The inventor, with the modesty (?) which characterizes so large a proportion of his class, claims that this design "systematically eliminates all the defects which have so far limited the use of two cycle motors." The charge is not pumped into the explosion chamber by using the crank chamber of a pump, as is customary with this type of engine, but by the differential action of the two pistons. There can be no impoverishment of the gaseous mixture by the lubricating oil in the crank chamber, and no loss of charge from the crank chamber through the end crank shaft bearings.



Da Costa Two Cycle Motor.

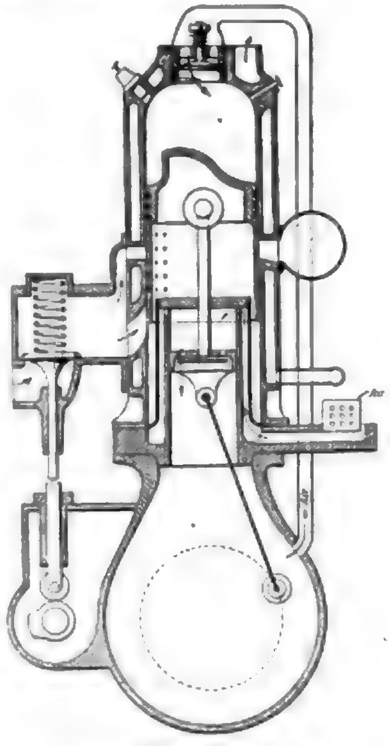
The mode of action of this engine will be readily understood from the sectional view. It will be seen that the inner piston has substantially twice the stroke of the outer one, and travels therefore in relation to the latter the same distance this outer piston travels with relation to the stationary cylinder. When the two pistons are at the bottom of their stroke, ports in the outer piston register with inlet ports in the cylinder wall, and the void which has been formed between the two pistons during their downward stroke fills with fresh charge. This charge is compressed between the two pistons during their upward stroke, during which the two piston heads constantly approach toward each other, and toward the end of this stroke, when the top part of the outer piston enters an enlargement of the cylinder, the compressed charge escapes through ports near the top end of the outer piston into the explosion chamber. This upper enlarged portion of the working cylinder is formed with internal longitudinal ribs to prevent the piston rings from expanding and "catching" when the piston begins to move downward again.

The exhaust takes place through ports in the cylinder wall at the bottom end of the stroke, as in the ordinary two cycle engine, but the scavenging is effected by means of pure air instead of by combustible mixture. Where this pure air is taken from is not stated in the description, but we presume that it is taken from the crank chamber. At the end of the downward stroke, or rather as soon thereafter as the exhaust port is closed, the working cylinder is filled with substantially pure air, which is compressed during the upward stroke. When the transfer port in the upper end of the outer piston is opened, toward the end of the upward stroke, the charge of mixture compressed between the two pistons is forced into the combustion chamber and mingles with the charge of compressed air therein. For this reason the charge fed to the compressor is extra rich, so it will be of the right fuel density after being diluted with the charge of pure air compressed in the working cylinder. As the inner piston practically bottoms in the outer one at the end of the upward stroke, nearly all of the combustible charge compressed between the two pistons is transferred to the combustion chamber. It will thus be seen that about twice the charge is introduced into the combustion chamber, per stroke, in this engine as in an ordinary engine of the same bore and effective stroke. The compression may be carried as high as possible without running the risk of preignition. A rather serious disadvantage would seem to be that the burning gases are expanded only half as much as in the ordinary engine, which would tend to reduce the fuel efficiency and to make muffling difficult on account of the high initial exhaust pressure. The chief advantage of the design is that there is no possibility of contact between the hot exhaust gases and the new charge.

THE COLMANT MOTOR.

This motor has been given an actual test at the laboratory of the A. C. of France, and its possibilities in the way of power developed are therefore fairly well known. A single cylinder motor of 99 mm. bore and 120 mm. stroke (4x4.8 inches) developed 8.8 horse power at 1,560 r. p. m., 9.2 horse power at 1,380 r. p. m., and 9.1 horse power at 1,286 r. p. m. While this motor works on the two stroke cycle, it is by no means valveless, there being no less than four valves for the single cylinder. In fact, the whole construction is marked by complication. The charge is here compressed between the working piston and a lower cylinder head, which extends up inside the piston when the latter is in its lowest position. During the upward stroke of the piston the charge is drawn into the transfer chamber through the mechanically operated valve seen at the right of the engine; part of it enters the space inside the piston through ports in the cylinder wall and a large number of small holes in the piston wall. During the downward stroke of the piston the charge is compressed, the transfer chamber or passage and the interior of the piston remaining in communication during the entire stroke. At the end of the downward stroke the charge is transferred to the combustion chamber in the usual manner. Here, however, it does not come in contact with the burning gases; at least not according to the theory of the inventor, as these gases have already been swept out of the cylinder by a charge of fresh air compressed in the crank chamber and transferred to the combustion chamber through a transfer pipe entering the latter chamber centrally on top. This scavenging system requires no less than three automatic valves, as indicated in the drawing. The mechanically operated inlet valve opens in the lower dead centre and closes 17 degrees after the upper dead centre. The compression in the crank chamber reaches about 5 pounds per square inch.

The entry lists for the alcohol motor contest of the A. C. of France closed on November 1. This contest has attached to it two cash prizes, one of 5,000 francs, given by S. M. Rice, of the American Distilleries Company, and one of 2,000 francs given by the French "League Against Alcoholism."



Colmant Two Cycle Motor.

MINOR MENTION

Bergmann Brothers, implement dealers, Newton, Ia., are to take an auto agency next year.

Gray & Davis, Amesbury, Mass., have opened a store at 749 Boylston street, Boston, Mass.

The Penn Square Auto Company has taken the Philadelphia agency for the Thomas shock absorber.

The De Luxe Motor Car Company, Detroit, Mich., have opened a branch at 1663 Broadway, New York.

In our recent article on closed cars we referred to the six cylinder Franklin closed car as an 18 horse power. It should have been 42 horse power.

S. Kellinger, Clinton, Ia., is giving the final test to a combination spring wheel (pistons operating through hollow spokes) and puncture-proof tire.

It is reported that Western motorcycle dealers and manufacturers will shortly meet to form an organization to encourage the promotion of motorcycle events in the West.

The building of the Motor Storage Company, on South Walnut street, Chillicothe, Ohio, belonging to the Logan Construction Company, bankrupt, has been sold for $2,350.

A new model brought out by the Olds Motor Works will be fitted with 42 inch wheels for customers having to travel through much sand or requiring a high road clearance.

The Chicago headquarters of the Moline Automobile Company have been moved from their old location on Automobile Row to 1220 Michigan avenue. W. J. Boone is in charge.

The Brush Runabout Company, of Detroit, Mich., expect to exhibit at the Grand Central Palace Show in New York one of their cars which is now making a trip across the continent.

The Lozier Motor Company, Plattsburg, N. Y., is reported to have placed orders for parts for 200 cars, and is asking for bids for a number of new buildings to be erected in Plattsburg.

The Model Automobile Company, of Peru, Ind., has taken a five year lease on a two story building at 1706-1708 Main street, Kansas City, Mo., where it intends to establish a selling branch.

The Association of Licensed Automobile Manufacturers has consented to the transfer of the license of the Northern Motor Car Company to the Everitt-Metzger-Flanders Company, of Detroit.

A series of short distance straightaway races against time will be held on the Long Island Motor Parkway on December 5. The distances will be 2 miles, 1 mile and 1 kilometer. Efforts are being made to induce the foreign drivers participating in the Grand Prize Race at Savannah to stop in New York on their return from the South and take part in these straightaway races.

The Lemke-Briggs Electric Company, of Milwaukee, are bringing out a new ignition apparatus which they call the "Magno." It is a self contained device for supplying a spark from battery current.

The Perfection Spring Company, of Cleveland, Ohio, have opened a branch office in the Oliver Building, Boston, Mass., from which their export trade and extreme Eastern business will be handled.

The Chalmers-Detroit Motor Company on Election Day had more than 100 of its agents in different parts of the country make runs of 200 miles each, thus covering an aggregate mileage of 20,000.

The American Motor Car Company, of Indianapolis, Ind., plans to build for the season of 1909 200 of its 50-60 horse power, four cylinder models, which are fitted with either roadster or touring car bodies.

The Jacobson-Brandow Company, of Pittsfield, Mass., have secured the contract for spark coils for the 1909 Cadillac output, calling for 10,000 coils and representing an amount between $150,000 and $200,000.

We are informed that the F. B. Stearn Company, of Cleveland, Ohio, will use the Hele-Shaw clutches, manufactured by Merchant & Evans Company, of Philadelphia, Pa., on their new 25 horse power shaft drive car.

At the recent annual meeting of the Diamond Rubber Company, Akron, Ohio, the following directors were elected for the coming year: C. A. Lake, Chicago; O. C. Barber, Akron; W. B. Miller, Akron, and O. S. Hart, Akron.

At the annual meeting of the Olds Motor Works held in Lansing, Mich., on October 29, it was shown that the volume of last year's business amounted to more than $3,000,000. It was stated that the company now employs 850 men.

The Bendix Automobile Company, which recently decided to locate in Logansport, Ind., has secured a 13 acre factory site from the Logansport Land and Improvement Company, and is now drawing up plans for a 400x50 feet brick building.

The Firestone Tire and Rubber Company, Akron, Ohio, bought the adjoining plant of the Globe Foundry and Machine Company. In addition to the buildings already on the site, a new structure of large dimensions will probably be erected there next spring.

Several Indiana cities are taking advantake of the 3 mile road law for the purpose of obtaining improved streets at the expense of the whole county in which they are located. At present a movement is on for brick pavements extending into the country, to be built under the law. Under the law such improvements can he ordered, provided they will connect at each end with an improved road or street. Plans are under way to improve about 6 miles of the national road with a brick pavement out of Indianapolis.

Pantus Lindstrom, a Swedish mechanical engineer, is now in this country and negotiating with the George N. Pierce Company regarding a Pierce six cylinder, 60 horse power car which he intends to enter in the Swedish Midwinter Reliability run.

The company recently incorporated at Council Bluffs, Ia., and of which J. P. Bertschy is the active manager, plans to erect a building at a cost of from $10,000 to $15,000 on South Sixth street in that city for the manufacture and repair of automobiles.

A 40 horse power Pierce landaulet has been presented to Archbishop O'Connell by the Catholic laity of Boston. The car is a seven passenger one, with whipcord upholstery for the inside seats, with driver's signal, speaking tube and other modern comforts.

The endurance run which was to be held by the Detroit Dealers' Association the first week in November had to be called off on account of lack of entries. The reason given for the apathy of the local trade is that not enough of the new models for 1909 had arrived in Detroit.

The Apperson Brothers Automobile Company, of Kokomo, Ind., has recently been formed into a stock company with a capital stock of $400,000 and been incorporated under the laws of the State of Indiana. No changes of officers have been made, the staff remaining the same as before.

In addition to the new Goodrich branch in Kansas City, to which we referred in our last issue, the B. F. Goodrich Company have decided to establish three other branches, in Minneapolis, Pittsburg and Atlanta, respectively, making their total number of branch houses eighteen.

The Union Carriage Company, of St. Louis, which recently announced that it would bring out a motor buggy, has also decided to put upon the market another model with the motor located in front under the hood, which will be provided with either a runabout or light touring body.

The Petrel Motor Car Company has been organized in Kenosha, Wis., to manufacture four and six cylinder cars. They are located in the plant which was formerly occupied by the Earl Motor Car Company. The Petrel cars are friction driven, and take their name from their alleged ability to maintain high speed over rough roads.

The Brown Auto Top Company, 437-439 North Broad street, Philadelphia, have brought out a wind shield of the folding type, which is made without springs and is claimed to be without any parts that are liable to rattle. By means of a thumb screw on each side the shield can be raised or lowered and put in any position while the car is moving.

The Locomobile car which won the recent Vanderbilt Cup race was driven by George Robertson from New York to Bridgeport on Sunday last. On Monday a celebration in honor of the driver and the designer of the car took place in Bridgeport, and on Thursday evening the Vanderbilt Trophy will be formally presented to Robertson at the Automobile Club of America, New York.

At the factory of the former Kansas City Motor Car Company, in Sheffield, Mo., a four cylinder car of conventional construction has recently been completed and given a number of tryout runs. This is the second model car built at the Sheffield works since the failure of the Kansas City Motor Car Company. The first was a motor buggy type of vehicle, but for some reason it was never placed on the market.

An intervening petition asking that they be allowed a commission for assisting in negotiating the sale of the Indianapolis plant of the Pope Motor Car Company has ben filed in the Federal court in that city by Richardson, Kothe & Uhl, real estate dealers. They assert that they were instrumental in the formation of the Waverley Company, which purchased the plant, and that they have received no compensation for their services.

The Nebraska Association of Automobile Drivers was formally organized at a meeting held at the Paxton Garage, Omaha, on October 31, and the following officers were elected: A. Schultz, president; Charles Crawford, vice president; Gus Rudolph, recording secretary; Robert Melvin, financial secretary. A member of the Machinists' Union was present at the organizing meeting and addressed the chauffeurs on the benefits of organization.

Club Notes.

The Kokomo (Ind.) A. C., which was organized only recently, is said to have already over 100 members, and is looking for club rooms.

Herbert M. Sawyer, assistant secretary of the Worcester (Mass.) A. C., has been nominated for secretary of the Massachusetts State A. A.

The Milwaukee A. C. intends to erect a clubhouse, but the plans are as yet indefinite. The club has provided for the institution of a bureau of tours and information in the office of the secretary, James T. Drought, Railway Exchange.

The Rochester A. A., Rochester, N. Y., now has a membership of 531. The club is offering a reward of $100 for information leading to the arrest of the person driving the automobile which ran over Joseph Hartman on East avenue, Rochester, on October 28.

The Fulton County (Ga.) A. C. was formed at a recent meeting at the Piedmont Driving Club, and expects to erect a club house in the form of a log cabin on some water course at a distance from the city. It is said that subscriptions to the amount of $6,000 have been pledged for the purpose.

The American Automobile Association will hold open meetings at its national headquarters, 437 Fifth avenue, New York, during the two automobile show weeks, and reduced round trip railroad rates of a fare and three-fifths has been granted by the Trunk Line Association for members of the association desiring to attend these meetings and the automobile shows.

The Associated Automobile Clubs of New Jersey and the New Jersey Automobile Trade Association were instrumental in the defeat of Senator Colby in Essex County, N. J., last week. Just prior to the election these two bodies sent out a circular in which they denounced the candidate because he stands for the taxation of nonresident motorists in New Jersey.

Commercial Notes.

A motor hack is now being used at the D., L. & W. R. R. Station in Montclair, N. J.

The Towar Creamery, Chelsea, Mich., will shortly introduce a number of motor trucks for carrying milk to the city.

In the annual budget of the city of Milwaukee provision is made in the estimate for police department support for an automobile ambulance. The publication of the budget was the first news of this request.

The Auburn (N. Y.) Automobile Company has placed an order for three taxicabs and will place them in service before the first of the year. The cars are four cylinder, 20 horse power machines, with landaulet bodies.

An automobile service was inaugurated between Stowe and Pottstown, Pa., on November 3, a thirty passenger omnibus being used. The terminal points of the service are the Stowe post office and Washington street, Pottstown.

Samuel C. Cox, of Mt. Airy, Ohio, is organizing a stock company with a capitalization of $7,000 to operate an automobile service between that town and Cincinnati. It is stated that a 60 horse power car is to be purchased at a cost of $6,000.

The Terminal Taxicab Company, Washington, D. C., has taken out a license for the establishment of a garage at 1236 Twelfth street Northwest. The building, which is now used as a livery stable, will be entirely remodeled and fitted up with all modern garage appliances.

The Horlick Milk Company, of Racine, Wis., has purchased a 30 horse power steam motor truck for transportation of goods from warehouses to depots. The capacity is 2 tons. A. J. Horlick, president of the company and mayor of Racine, is well satisfied with the success of the truck and plans to add two or three more soon.

The Dan Canary Taxi Service Company, of Chicago, are moving into larger quarters, at 1322 Michigan avenue. They are at present operating fifteen Thomas cabs, and expect to add to this number in the near future. In addition to this taxicab service a general automobile livery and garage business will be conducted.

An automobile service has been established between Burnside, on the Queen & Crescent Railroad, and Monticello, the county seat of Wayne County, Kentucky, a distance of 25 miles. Burnside is the nearest railroad station to Monticello, and since the oil discoveries at the latter place some years ago, the amount of traffic between the two points has greatly increased. A twenty-four passenger omnibus will be used.

Among recent purchasers of motor delivery wagons in Indianapolis are Bertermann Brothers, florists, being the first firm of the kind in the State to make use of such vehicles. The company expect to do all of their local delivery work from the car, and will use it in taking stock from their greenhouses, 4 miles east of the city, to their downtown store. The wagon is of an attractive design, being painted white with gold lettering and with a wreath of roses painted in colors.

Foreign Notes.

The Government of Chili on May 6, 1908, adopted a law according to which no import duties will be levied on automobile motors, if they are imported separately from the vehicles.

The electric street washing machine which has been in use in Berlin since the beginning of the current year, and of which an illustration was printed in The Horseless Age some months ago, is said to have proven satisfactory, and the municipal council has decided to purchase five more of these machines. The suburban town of Schöneberg will also soon come into possession of a motor street washer.

An alloy of the following composition is said to be extensively used for the levers of typewriters: Copper, 57 per cent.; nickel, 20 per cent.; zinc, 20 per cent.; aluminum, 3 per cent. It will have been observed that these parts, even after the nickel has worn off, never become rusty. The alloy is very hard, and may be bent without breaking, even if the proportion of aluminum is increased up to 3½ per cent.

The administration of the Spanish army has organized automobile drivers' schools in connection with several regiments, with the object of training a staff of skilled drivers. The schools are said to be very well equipped in the way of machine tools and small tools for making all kinds of repairs, and are conducted under the supervision of engineers of the Central Electrical School. A corps of motor volunteers has also recently been organized under the auspices of the Spanish Royal A. C.

A meeting was held at the rooms of the German Imperial A. C., in Berlin, on October 27, to discuss the project of a small car contest for next summer under the joint auspices of the Imperial A. C., the German Motorcyclists' Association and the German Automobile Manufacturers' Association. The plan is to open this contest to vehicles which are excluded from the Prince Henry Endurance Contest, in consequence of their motor dimensions. The contest is to start from Berlin and to end in Strassburg.

GARAGE ITEMS

A Simple Garage Accounting System.

By D. R. H.

Generally garages either use the very simplest forms of bookkeeping systems or very elaborate card indexes and special forms upon which everything is entered, in duplicate, triplicate or even in quadruplicate, as in the case of one Eastern garage. Those that use the simplest forms are liable to make errors, owing to the fact that unforeseen contingencies may arise, or because of the jumble of items in each book. Those using elaborate systems are protected from errors by the number of means of checking up each item, but the amount of work necessary to the correct maintenance of such systems calls for a good sized office force. Simple accounting systems are desirable in all lines of business, even the advocates of the card index systems and triplicate form systems acknowledging its desirability, and claiming it for their own special methods. No business system yet invented, however ingenious it may be, can be applied to all forms of business, and this is particularly true in the case of the garage, where the system adopted when trade was small may have to be discarded and replaced by another when trade increases considerably. The writer has looked into accounting systems in various garages from time to time, and the following system is here given as an example of one of the simplest systems, needing but few special forms and being suitable for establishments doing at least double the amount of trade of the one in which he found it used.

The garage in question has a capacity for accommodating fifty cars on live storage, and comprises besides a repair shop and a space upon the top floor for twenty cars on dead storage. It is nearly full at all times, and in addition to repair work does a small amount of experimental work for inventors, etc.

In addition to the usual journal, ledger and day book the following books and blank forms are used:

- A storage book.
- A bank record.
- A washer's and polisher's record.
- A job book.
- A stock room sheet.
- A gasoline and oil form.
- A duplicate bill form.
- A time ticket.

The storage book is simply a school roll book with the names of the owners on the pages and the record of storage, live or dead, kept on the stubs. A series of symbols is used, a check mark being used to denote live storage, a D to designate dead storage, etc.

BLANK GARAGES, Inc.
STOCK ROOM SHEET.
Acct. ....
Date ....

Quantity	Material.	Price

Received by.... ....
$ ....
No. 362.

Fig. 2.

The tank record is ruled like an ordinary journal, and in it is recorded all gasoline and oil put into the garage tanks.

BLANK GARAGES, Inc.
Gasolene and Oil
No. 332. Date................

Delivered by............................
Received by ....

Fig. 3.

The washer's and polisher's record is kept in a book ruled as in Fig. 1. This record is signed by the night man before he leaves at 7 a. m., it being his business to polish while his assistant washes.

The stock room sheet, Fig. 2, is used for all articles taken from the stock room, whether by chauffeurs or garage employees. These sheets are in the form of pads and are consecutively numbered, and after being filled out and signed are turned into the office daily. As the items on the sheet are entered against the name of those to whom they are to be charged, the sheet number is entered also, and after this has been done the sheets are filed away in regular rotation.

The gasoline and oil form, Fig. 3, is kept in the pump chamber, from which the gasoline and oil are delivered, and is made out by the floorman and signed by the owner or his chauffeur. The sheets are turned in to the office daily, and after being entered are filed away.

The duplicate bill forms, one of which is shown in Fig. 4, are made of twin sheets with a perforation AB between them. The left hand sheet is printed while that on the right is blank, but has six holes punched

NAME	CAR	Jan. 12		Jan. 13		Jan. 14		Jan. 15		Jan. 16		Jan. 17		Jan. 18		WASHER
		Wash	Polish	Wash	Polish	Wash	Polish	Wash	Polish	Wash	Polish	Wash	Polish	Wash	Polish	
A. E. Wettin	Smithson															12 G. Danilo
F. J. Owen	L.-K.															13. G. Danilo
J. Brown	Johnston															14. G. Danilo
A. White	Berlin															15. G. Danilo
																16. M. Koch
																17. M. Koch
																18. G. Danilo

Fig. 1.

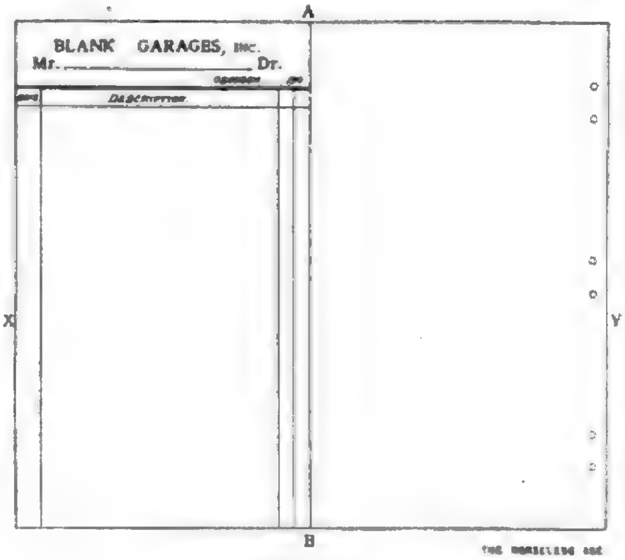


Fig. 4.

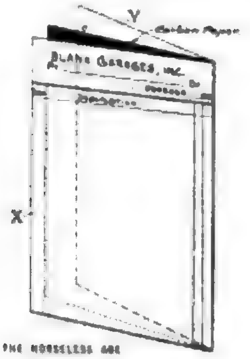


FIG. 4A.

near its right hand side. These holes fit over corresponding metal projections in a binder, after the manner of a loose leaf ledger. When the bill is to be made out it is folded on the line AB so that the margin X will meet the margin Y, and a carbon sheet is put between them (see small sketch). The bill is now put in the typewriter and made out, the printed half being then detached and sent to the customer and the carbon copy (the right half) placed on file in the binder. This binder is arranged by months, and at the end of each month is replaced by a new one, the old binders, with their contents, being put away on file.

The time ticket is shown in Fig. 5. The time at which the work was started is entered in the upper square at the right, the time of finishing being entered in the lower square on the same side. The nature of the work is entered as shown. The name in the upper left hand square denotes that of the customer to whom the repairs are to be charged. In the case of one of the garage's own cars, the repairs are charged to the firm, the same form being used. The name of the machinist and the date are also filled in by the machinist himself, and the job number, which is consecutive, is assigned when the ticket is turned in at the office. The details of the job are entered in the job book, against the number on the ticket, and recorded in the day book and journal in the usual manner.

By comparing the gasoline and oil forms with the tank record for the same period the amount of gasoline or oil remaining in the tanks may be ascertained at any time, allowing, of course, for waste. The various charges to the customers (storage, washing, repairs, etc.) are taken from the corresponding forms, and these can be referred to should any dispute arise. The gasoline and oil forms, being signed by the owner or his chauffeur, are in addition an insurance of the owner against "graft" charges for fuel and oil. The stock room sheets are also positive proofs of the material used, as these likewise are signed by the chauffeur or owner. The system thus acts to protect both the garage and the customer.

Date, Jan. 30, '08 Name, Albert E. Wettin Job No. 472 Machinist, W. Jones	STARTED Jan. 27, '08
Removing carbon from pistons, cleaning cylinders, new bearings, aligning clutch, fixing differential and rear construction.	
Time Ticket for BLANK GARAGES INC. WRIGHT & BENNETT Props.	FINISHED Jan. 30, '08

The system has been in use for nearly three years, and the capacity of the garage has steadily increased during that period. No card indexes are used and every detail is taken care of. As to its adaptability to a garage having an extensive hiring and sales department in addition to the repair and storage branches, the writer is not prepared to make any statements. It is to be presumed that with the addition of extra forms and books to cover the departments in question it will serve the purpose. A card index auxiliary may also have to be added.

Garage Notes.

H. I. Killian will open a garage in Clinton, Ia., next spring.

J. N. Boyce, of New Haven, Conn., is building a $3,000 garage.

The Motor Shop, Broad and Wood streets, Philadelphia, is being reorganized.

Roderick W. Rogers plans to erect a garage at the rear of his residence, 18 Belmont street, Watertown, Mass.

John W. Keating and Louis E. Reynolds have opened a tire repair shop at 35 Church street, Hartford, Conn.

Wm. Butterworth, Moline, Ill., is erecting a large private garage, 44x81 feet, to be completed by the first of the year.

D. B. Rose, Elmore agent in Los Angeles, Cal., has moved into the recently completed new garage building between Seventh and Eighth streets, in that city.

The Lawrence Auto Co., which owns a garage on Mercer street, New Castle, Pa., will make additions and improvements to the building at a cost of $4,000.

Dr. Martin J. Iver has recently completed a concrete garage near his residence at 114 Buel avenue, Joliet, Ill., the building being 20x20 feet, one story high.

P. K. Kelly, New Haven, Conn., plans to build a private garage, 20x36 feet, and one story high, back of his residence at 484 Orange street. The building is to be of concrete.

The permit for the Remington Street Garage in Cambridge, Mass., to which there was considerable objection made by neighboring property owners, has been issued by the board of aldermen.

The Eagle Automobile Co., Cincinnati, Ohio, has leased the vacant property at 3139 Reading road, upon which the company will at once construct a concrete block garage. The price of the site was $2,500.

The Southern branch of the White Co. in Atlanta, Ga., has recently moved into its new building at 120 and 122 Marietta street. Both the ground floor and the second floor are of cement, so that cars can be washed in any part of the building.

Charles C. Mayhew and George F. Gerlach, conducting the Wisconsin agency for the Studebaker and E-M-F lines under the name of the Ogden-Farwell Garage, have opened their new garage at 82-86 Farwell avenue, near Ogden avenue, Milwaukee. It is one of the most modern in the West. The firm has secured the services of an expert battery man to care for the electric division.

A permit has been granted Eugenie Byron to erect a garage at 400 Main street, Manchester, N. H.

The Penn Motor Car Co., Philadelphia agents for Mitchell cars, have removed from 138 North Broad street to commodious quarters at the corner of Broad and Cherry streets.

Ground has been broken for the new building of the Pence Auto Co. on Automobile Row in Minneapolis, Minn. The building is to cost $100,000, and is to be ready for occupancy by May 1 next.

The Bland-Mueller Auto Co., Fourth street, Milwaukee, has increased its capital stock from $5,000 to $15,000. The additional issue is to provide for a general expansion of the repair, tire, livery, garage and jobbing business.

The Kankakee Automobile Co., representing the Stoddard-Dayton line in Kankakee, Ill., have opened a two story, 60x120 foot garage. The firm is composed of W. C. Mellanson, a former liveryman, and A. P. William, an automobile expert.

Dr. John T. Unertl, a veterinary of Milwaukee, and surgeon for the police and fire departments, is building a $5,000 garage near his residence, Twenty-second street and Cold Spring avenue, Milwaukee.

Charles W. Norris is about to erect a $10,000 private garage near his residence, Nineteenth street and Grand avenue, Milwaukee. It will be two stories high, 48x81 feet, of classic design, and perfectly appointed.

L. G. Martin, 3921 and 3923 Forbes street, Pittsburg, Pa., who handles the Rambler in western Pennsylvania, eastern Ohio and West Virginia, is building an addition to his plant to make it 50x127 feet. It will be entirely fireproof and completely equipped.

Work has been begun on the new garage for Frank R. Coffin in Boise, Idaho, on Tenth street between Bennock and Jefferson, which will be ready for occupancy the latter part of January. When completed the building will be occupied by the Inland Auto Co.

The Thomas B. Jeffery Co. have discontinued their Philadelphia branch, and will establish a factory branch in New York instead. In Philadelphia the Rambler will be handled by the Tioga Automobile Co., George G. Brownlee having charge of this department.

George G. Gans and George Whyel have taken over the Fayette Garage of Frank Rosboro and Alfred Johnson in Uniontown, Pa., the consideration being $40,000. The garage is conducted in a two story brick building 100x150 feet, and is located in East Fayette street.

The Maxwell-Briscoe Philadelphia branch has leased the Jeffery Building at 207 and 209 North Broad street, in which to house the branch office and the local sales office. The name of the local agency will be changed from the Kelsey Motor Car Co. to the Longstreth Motor Car Co., Wm. C. Longstreth being general manager of the concern. Possession has already been taken of the new location.

The Excelsior Motor Car Co. has succeeded to the entire business of the Electric Vehicle and Power Supply Co., 621 Grand avenue, Milwaukee, and will occupy the same quarters. The Excelsior Company will handle the Cameron and other lines not yet definitely settled upon, but including both gasoline and electrics. J. G. Bradley is president, and R. Jenson vice president. The company will conduct a garage and repair department, the latter under the personal direction of R. Jenson, a well known repair expert.

A company headed by Mayor E. W. Clarke and George W. Worthing will erect a $15,000 fireproof garage on South Main street, Fond du Lac, Wis. The company will be a consolidation of the Worthing and Crescent garages. The Crescent Auto and Machine Co.'s garage was recently destroyed by fire, and with it $250,000 worth of buildings in the business district were burned. The new garage will be of fire brick construction, 65x100 feet in dimensions, two stories high, and the only wood in the entire structure will be the window and door sills.

The Milford Auto Machine Co., Main street, Milford, Mass., are remodeling their building to adapt it to the display of automobiles and supplies.

A. L. Ryder, agent for Winton and Mitchell cars in Pasadena, Cal., has moved his garage from 134 East Colorado street to 160 East Colorado street.

Geo. B. Peterson, of Plattville, Ill., has leased a portion of the new Monroe Building in Joliet, Ill., in which he expects to conduct a garage and the sales agency for Buick cars.

The New Jersey Automobile and Motor Club will erect a garage in the rear of its clubhouse at Park place and East Park street, Newark, N. J. The building will be 40x20 feet, and will be capable of storing about twenty-five cars.

The Dietrich Motor Car Company, Franklin dealers at Allentown, Pa., are building a garage 52 by 250 feet in size, the building to be of modern design and of fireproof construction. The structure has a street front on three sides.

The Star Automobile Co. has been organized in Wichita, Kan., by H. E. Roberts, E. N. McGregor and A. C. Houston. They plan to erect a two story 40x140 foot garage at a cost of $16,000, but the site has not been selected. J. J. Sprague will be manager of the business.

The Boone Automobile Co., of Boone, Ia., which was recently incorporated, is erecting a garage building on Eighth and Arden streets, in that city. It will be a one story brick structure, 75x50 feet, with basement. The company will handle the Buick, Mitchell, Maxwell and Stoddard-Dayton lines, and also expect to manufacture a car of their own.

The Pioneer Motor Car Co. has been incorporated under Iowa laws at Sioux City, Ia., with $25,000 capital stock, at which not less than $3,000 is to be paid up at the time of commencing business. L. C. Lessenich and Leonard B. Robinson are at the head of the company, which will conduct a garage in a new building specially to be erected for the purpose.

The new Chicago branch of the American Locomotive Company at Twelfth street and Michigan avenue, is being formally opened today, Wednesday. It will be in charge of Benjamin C. Day, who was formerly manager of the Chicago Winton branch. Associated with Mr. Day in the selling department will be B. C. Hamilton, of Chicago, and R. L. Martin from the New York headquarters.

New Incorporations.

Post Motor Co., New York, N. Y.—Capital, $30,000. Directors, George W. Post, Jr.; John N. Blair and Louis F. Staar.

Long Beach Garage Co., New York, N. Y.—Capital, $50,000. Directors, Dix W. Noel, William B. Davis and John Gerdes.

Lozier Manufacturing Co., Plattsburg, N. Y.—Capital, $60,000. Directors, John M. Weaver, George F. Tuttle and Samuel L. Wheeler.

Marion Automobile and Manufacturing Co., Marion, Ind.—Capital, $10,000. Directors, Charles Rennaker, Frank Boyer and Clifford G. Rust.

Shepherd Motor Car Co., New York City.—Capital, $20,000. Incorporators, I. R. Shepherd, Joseph A. Shepherd and Fannie P. Shepherd.

Woods Electric Garage, Chicago, Ill.—Capital, $2,000. Incorporators, A. L. Schwartz, George H. Foster and John F. Rosen. To carry on garage and livery business.

Fulton Motor Car Co., Atlanta, Ga.—Capital, $3,000. Incorporators, Dr. R. F. Ingram, Paul McMichael and J. E. Levi. To establish an agency for the sale of automobiles and supplies.

The Brick Church Automobile Co., East Orange, N. J.—Capital, $100,000. Incorporators, L. Burr Manning, John B. Todd and Melvin O. C. Hull. To manufacture, repair and model automobiles and motorcycles, and conduct a garage.

Vermont Motor Co., Burlington, Vt.—Capital, $5,000. Incorporators, F. A. Rich, Henry H. Hagar, Russell W. Taft, F. W. Chamberlain and Guy E. London. To buy, sell, deal in, rent and repair automobiles, marine engines and accessories.

Trade Personals.

M. B. Strauss, of St. Louis, has assumed the management of the Little Rock (Ark.) Automobile Co., succeeding R. M. Baker.

W. B. Hurlburt, C. R. Teaboldt and S. J. Wise have sold their interests in the Garford Motor Car Co., of New York, to the Studebaker Automobile Co.

H. J. Edwards, chief engineer of the Dayton Motor Car Co., Dayton, Ohio, leaves New York today (Wednesday) for a trip to the old country, where he intends to visit the leading automobile centres.

L. H. Kittridge, president of the Peerless Motor Car Co., has just returned from an extensive trip of the European motor car centres. Charles Schmidt, engineer of the Peerless Co., is still abroad.

Henry Russell, of Detroit, was re-elected president of the Olds Motor Works at the annual meeting held in Lansing, Mich., on October 29. Fred. L. Smith was elected general manager and vice president, and Angus Smith secretary and treasurer.

Robert J. Skilton, formerly with the Quaker City Automobile Co. and the Chadwick Engineering Works, of Philadelphia, has been appointed city sales manager of the new Philadelphia Oldsmobile branch. C. Robert Hayne, formerly with the Motor Shop, will be manager of the wholesale department of the branch.

Otis R. Cook, who for the last two years was connected with the Firestone Tire and Rubber Company, of Akron, Ohio, has been appointed general manager of the tire department of the Federal Rubber Co., Cudahy, Wis. He will have for his assistant Osborne S. Tweedy, formerly with the Diamond Rubber Co.

New Agencies.

Boston, Mass.—South End Motor Car Co., Atlas.

Temple, Tex.—Temple Automobile Co., E-M-F.

Davenport, Ia.—Julius Sander, 218 Ripley street, Kisselkar.

Minneapolis, Minn.—Fawkes Automobile Co., American.

Dayton, Ohio.—Peckham Carriage Co., 14-20 South St. Clair street, Franklin.

Milwaukee, Wis.—American Automobile Co., 187 Wisconsin street, Babcock.

New York, N. Y.—Racine Boat Manufacturing Co., 1626 Broadway, Richmond roadster.

Trade Literature Received.

The Everitt-Metzger-Flanders Co., Detroit, Mich.—"The Hyphen."

Pratt & Whitney Company, Hartford, Conn.—Catalogue of multiple drills.

Packard Motor Car Co., Detroit, Mich.—Folder relating to the company's trucks.

The Dayton Motor Car Co., Dayton, Ohio.—Catalogue of Stoddard-Dayton 1909 models.

The Willard Storage Battery Co., Cleveland, Ohio.—Catalogue of Willard storage batteries.

National Sales Corporation, 296 Broadway, New York.—The Automatic Folding Dust and Wind Shield.

R. M. Owen & Co., Lansing, Mich.—"Two Weeks," an account of the Reo cars' part in the Glidden tour.

National Sales Corporation, 296 Broadway, New York.—"The Tale of a Carburetor," relating to the Buffalo carburetor.

The Peerless Motor Car Co., Cleveland, Ohio.—"Peerless Points and Appointments," relating to the Peerless closed cars.

Stewart & Clark Manufacturing Co., 502 Diversey Boulevard, Chicago, Ill.—Folder of the 1909 line of Stewart speedometers.

The Imperial Brass Manufacturing Co., 241-249 South Jefferson Street, Chicago, Ill.—Circular of the Imperial compression coupling.

Chalmers-Detroit Motor Co., Detroit, Mich.—Bulletin on the Election Day 200 mile runs of over a hundred agents of the company.

Patents Issued October 13, 1908.

900,731. Carburetor.—Frank H. Heitger, Indianapolis, Ind. Filed August 24, 1907.

900,779. Automobile Spring.—William R. Rantz, Greenville, Ohio. Filed November 13, 1907.

900,792. Transmission Gear.—Ernest M. Sternberg, Milwaukee, Wis. Filed November 29, 1907.

900,857. Gearing.—Thomas B. Jeffery, Kenosha, Wis. Filed February 23, 1904.

900,860. Antifriction Bearing.—Ernest C. Ketchum, Boston, Mass. Filed August 28, 1907.

900,975. Steering Means for Automobiles.—Alberto Balloco, Turin, Italy. Filed April 16, 1907.

901,206. Apparatus for Curing or Vulcanizing Rubber Goods.—Ernest Hopkinson, East Orange, N. J., and Thomas Midgley, Hartford, Conn. Filed December 19, 1905.

901,007. Method of Curing or Vulcanizing the Outer Shoes or Casings of Pneumatic Tires.—Ernest Hopkinson, East Orange, N. J., and Thomas Midgley, Hartford, Conn. Filed December 19, 1905.

901,055. Motor Vehicle.—John D. Allen and John A. Conly, Philadelphia, Pa. Filed April 26, 1906.

901,080. Universal Coupling.—Herman Dock, Wyncote, Pa. Filed October 11, 1907.

901,081. Clutch Mechanism.—Herman Dock, Westerly, R. I. Filed January 9, 1908.

901,174. Wrench.—James P. Johnson, Kensal, N. D. Filed October 26, 1905.

901,180. Transmission Mechanism for Motor Vehicles.—Charles M. Leech, Lima, Ohio. Filed February 5, 1907.

Patents Issued October 20, 1908.

901,320. Head Covering for Automobilists and Chauffeurs.—Carlos N. Bruzaud, Peekskill, N. Y. Filed August 14, 1907.

901,345. Carburetor.—Thomson Howell, Newark, N. J. Filed March 5, 1908.

901,365. Valve Controlling Mechanism for Internal Combustion Engines.—Harry M. Neer, Columbus, Ohio. Filed February 13, 1908.

901,369. Jacket for Cylinders.—George B. Pickop and Joseph W. Mills, New Britain, Conn. Filed December 28, 1907.

901,371. Exhaust Muffler.—John M. Porter, John F. Laird and Albert H. Geilfuss, Parkersburg, W. Va. Filed November 4, 1907.

901,456. Variable Speed Gearing.—Achille Loitron, Plaine St. Denis, France. Filed August 7, 1907.

901,403. Automobile.—Frank A. Stephens, Dunkirk, N. Y. Filed December 9, 1904.

901,502. Lubricator.—Josef Vollmer, Berlin, Germany. Filed July 3, 1905.

901,508. Controlling Mechanism for Power Driven Vehicles.—Charles W. Willette, Tacoma, Wash. Filed December 27, 1907.

901,518. Planetary Gearing.—Alanson P. Brush, Detroit, Mich. Filed July 3, 1907.

901,527. Cover for Pneumatic Tires.—Isaac J. D. Fairhurst, Arfordville, Wis. Filed January 28, 1907.

901,528. Anti-Slipping Tire Cover.—Isaac J. D. Fairhouse, Orfordville, Wis. Filed August 19, 1907.

901,578. Steadying Device for Supplementary Vehicle Springs.—William Young, St. Louis, Mo. Filed December 26, 1906.

901,616. Supplemental Hood for Automobiles.—Charles L. Hobbs, Chicago, Ill. Filed February 14, 1908.

901,670. Brake Mechanism.—Alberto Balloco, Turin, Italy. Filed April 16, 1907.

901,735. Vehicle Frame.—Charles J. Pembroke, Rochester, N. Y. Filed September 10, 1907.

901,751. Spring Wheel.—John E. Stannard, Springfield, Mass. Filed August 19, 1907.

901,767. Brace for Supplementary Vehicle Springs.—William Young, St. Louis, Mo. Filed November 24, 1905.

901,842. Detachable Shoe for Self Propelled Vehicle Wheels.—William P. Shattuck, Minneapolis, Minn. Filed April 2, 1907.

901,907. Wheel.—Arthur L. Jiminez, New York, N. Y. Filed July 1, 1907.

The Horseless Age

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A Review of the Present Automobile Commercial Situation in Europe.

By Roy Lindsay.

Just prior to the Olympia, London, show of 1907, the writer ventured on the delicate task of attempting to forecast the likely trend of trade for the 1908 season. That forecast was not mere haphazard guessing and was only arrived at after a series of visits made to the leading British factories and conversations with prominent men connected with the industry. The end of the season proves the prophecy to have been a very correct forecast of the course of events; if anything, it somewhat underestimated the fearful slump that has occurred in sales of large pleasure cars. All the European factories that have hitherto devoted their energies to the high powered chasses are reducing the number of their employees far below what is usual at the beginning of the winter months, while those in charge of the selling side of the companies are at their wits' end scheming how the heavy stocks carried over can be best realized on. Two countries, Germany and Italy, are feeling acutely the effect of too blindly relying upon the fashionable impulse of the moment without pausing to consider the possible demands of the new class of purchasers whose wants must be satisfied. One can sympathize with the aspirations of Italian automobile engineers who, judging other nations in the light of their own mercurial temperament, imagined that all the world would eagerly rush forward to purchase anything bearing an Italian nameplate. Less than two and one half years has elapsed since Italy was proudly, and deservedly, boasting that her designers led the rest of the world, yet to-day what do we find? Only one factory, that of the F. I. A. T., has done business commensurate with its name, and bad as matters are, they would have been considerably worse but for many orders received from the wealthy native princes of India. The Itala ranks next in importance, a long way after, England being the best market for this make of car, of which a few are disposed of in America and the country of origin. The few factories still running in Italy, excluding F. I. A. T. and Itala, have not between them sold as many machines as have been disposed of by one of the better known American factories.

GERMANY.

Germany has been in a far better position than Italy to cope with the falling off of business in large vehicles, because the factories have been much longer established and the inevitable losses attending the first two years' trade in a vehicle unknown to the public were a stage in evolution passed through six or more years ago. The Mercedes has fallen from its once high position in setting the fashion for design, and has been obliged to fall into line with its home and foreign competitors as regards price, design and reliability. When the motor omnibus boom came along in England in 1906, this firm was the first to obtain orders in anything like a quantity, as they were prepared to deliver chasses at reasonable dates, and consequently secured contracts for about 450 machines at $4,500 each. On the erroneous assumption that they could always obtain their own price and that the design for this particular purpose could not be improved upon, the Mercedes (German Daimler) Company built a large new factory solely for the production of commercial vehicles. About 350 of these four cylinder 24 horse power omnibuses were sold for London use, but since October, 1907, orders have ceased because of inherent faults of construction. To those not fully acquainted with this type it may be recalled that a huge internally toothed spur ring is bolted to the felloes of the rear road wheels, spur pinions of very small diameter being carried at the outer ends of the differential shafts which mesh with the internal rings. The big rings run in close proximity to the ground and, being quite unprotected, pick up dust and mud to such an extent that in the London bus service they had to be renewed every six weeks, a costly proceeding and which has been one of the main factors in bringing to the verge of bankruptcy the company (Vanguard Company) that owns the largest number of this type. Honeycomb radiator, splash lubrication for engine, inefficient water circulation pump, exhaust pressure fuel feed that is constantly choking, ignition devices so flimsy as to be a constant source of trouble—these and other faults have sufficed to drive it off the market. The hideous noise created by the internally toothed ring, when worn, has caused the police authorities to take such drastic steps in mitigation of the nuisance that the risk of vehicles being refused licenses to ply for hire has combined, with the point just mentioned, to shut down any trade worth having, not only in London but elsewhere. There is a persistent rumor that the Mercedes Company will market a four cylinder, 24 horse power, live axles pleasure chassis selling for about $2,750 without body; at $2,000 it might have a chance with the dozens of other reputable makers who are competing for orders at the lower figure.

While the Mercedes people have been marking time, younger firms have come forward and taken their trade away in Germany and have also established good agencies in England. Among these are the Adler firm, who turn out work of the highest quality in two cylinder 9 horse power, four cylinder 14 horse power, four cylinder 20 horse power, and four cylinder 30 horse power models, at prices astonishingly low for the excellent design and reliable character of construction. Other firms making four cylinder, 12 horse power cars are the N. A. G. and N. S. U. A car quite unknown outside Germany, the Horch, has achieved considerable success through winning the Herkomer Trophy in 1907, and the Opel, modelled largely on Darracq lines, has also proved a formidable competitor in the moderate priced market. Benz, the pioneer maker of the first car that had any extensive sale in Europe in the early nineties, has within the last three years made enormous strides in design, until today this firm is far in advance in design and finish of anything else turned out in that country, but with a four cylinder, nominal 35 horse power, as the smallest model, the home demand has been moderate and an English agent who opened a smart depot in London early in 1907 closed down in a few months. At the other end of the scale is the little 8 horse power, two cylinder, air cooled Piccolo, an extraordinary hill climber, which, offered complete for $600, has sold in great numbers in Germany while over 300 are running in Ceylon, the big British island south of India. There are probably some twenty other small concerns confining themselves strictly to the runabout type who, together, have disposed of a considerable output at profits sufficiently remunerative to induce factory extensions. In one specialized branch, that of motor fire engines, Germany is much in advance of the rest of the world, quite a number of cities and towns possessing equipment that has astonished those persons who have been favored with inspection at the various fire stations. One large city has altogether discarded horses for fire extinction and it will not be long before Berlin, Hamburg, etc., follow the good example.

FRANCE.

The establishment of a road race for voiturettes by *l'Auto* in 1906, limited to engines with single cylinders of 100 mm. bore or multi-cylinders of equal bore, has done more than anything else to arouse interest in France among this hitherto neglected class, and several firms can count their present prosperity from the time when they participated in the contest. It would be an exaggeration to say that the small car business has been the salvation of the French trade in 1908, yet the speeds accomplished with these very small engines over bad courses comprising many long and steep hills have opened the eyes of the large car makers to the latent possibilities of the type. The industry, as a whole, required a fillip, for the export chasses of big powers to America and England seemed likely, early in the year, to fall away to the vanishing point. Six months of exceptionally fine weather has materially altered the condition of things for the better, but the most optimistic supporters of the industry in France have to admit considerably lesser sales in big cars in 1908 than for several preceding seasons. Panhard-Levassor have experienced as bad a time as anybody, which would have been far worse had they not found a sheet anchor in the four cylinder, 18 horse power, live axle model introduced at the last Paris Salon. Even this has been kept in the background in order to dispose of the accumulated stocks of chain driven machines. The Clement and Gladiator cars—both made in the same factory, with the same details throughout, except that one is chain driven and the other has a live axle—have not maintained their positions, and the Stock Exchange quotation for this company's shares (a $5 share can be purchased for 24 cents) well expresses the public view of the situation. De Dietrich and Delaunay-Belleville are about the only two firms in France who have maintained their positions, due perhaps to catering only for the extremely expensive class of chasses and reaching buyers by means of advertising campaigns on a profuse scale. Brasier has tried for trade in the same direction, but has not succeeded so well and is entering the small car business with a two cylinder, 14 horse power model. It is believed that Renault has sold more machines in 1908 than any other maker in his own country, 750 taxicabs having been disposed of for London alone, in addition to about four times that number for other parts of the world, largely as a result of the good running of these taxicabs. Renault is possibly the only maker who has actually done increased trade in chasses of over 20 horse power. The taxicab has also materially helped to swell the volume of orders taken by Darracq, but the model having a four cylinder monobloc engine and gear box on the back axle has not been a success in London, considerable trouble having been experienced by reason of the extra unsprung weight at the rear causing heavy repair bills, and it is more than doubtful whether cars ordered many months ago on behalf of two or three English companies will be accepted unless alteration is made in the design. In pleasure chasses Darracq has sold very few of over 18 horse power, and no more of the six cylinder, 50 horse power will be constructed. De Dion-Bouton are indebted for a good deal of the business that came to them in the course of the year to the manner in which their machines have been consistently kept in the public eye by the sole concessionares for England and the British colonies. Their business has expanded considerably in 1908, but then the four cylinder, 14 horse power is the model that has been kept to the forefront, rather than the 18 horse power and the 30 horse power; the single cylinder 8 horse power chassis continues to maintain its popularity, and an enormous business has been secured in the supply of engines only to assemblers in France and England. Without particularizing each maker there is sufficient evidence to show that the remainder of the better known houses have, without exception, been compelled to meet the altering conditions of the demand, and in those cases where cheaper models were not listed this year the omission will be rectified the coming season.

In the commercial vehicle branch De Dion has been so far in front that the rest can be neglected in respect to both the home and export trade, 200 omnibus chasses having been sold for London and nearly as many more sent to the French colonies. Quite a number of makers are following the lead set by Levasseur in his Antoinette engine, in trying to evolve big power with small weight principally for marine purposes. The interest recently aroused in aeroplanes has at last opened the way for the turning out of these light engines in commercial quantities, and, just as in the case of the automobile, France is making history while the other nations are looking on.

GREAT BRITAIN.

The purely luxurious car, only purchased by those to whom heavy initial cost and running expenses are minor considerations, has disappeared from the majority of advertisements in the technical journals since the middle of the summer, with a suddenness that tells the story far more eloquently than it is possible to write here. The special six cylinder business created in Napier cars, although assailed from many directions, has not suffered, the only competitor worthy of the name having been the Rolls-Royce, but the output of the latter company, compared with the Napier, is so small that the larger concern can well afford to lose a few orders in that direction. One other company, the Sheffield-Simplex, whose 45 horse power, six cylinder machine is superbly finished, is more likely to clash with the Napier next year, the total output for 1908 only reaching one machine per week. In the big four cylinder class the English Daimler Company have always held the lead, and they have not a single 1908 pattern chassis left in the factory. By the introduction of the Knight engine the Daimler Company has secured an amount of publicity in the general press throughout Great Britain that is bound to react favorably upon the new chassis when the public see it at Olympia. The "know-alls" who predicted the early demise of the Daimler Company because the directors have placed all their eggs in one basket overlook the fact that the Knight engine is not an experiment, and that the people who are now handling it possess a technical staff without rival in Europe, backed up by a sales management who years ago learned everything that is worth knowing in the automobile business. To predict disaster to the Daimler Company under these circumstances is ridiculous, yet the general impression prevails in trade circles that the safer policy would have been to work this engine as a new model in conjunction with older and surer order getters, and then, if truly successful, to have discarded the mushroom valve type. People are not placing orders for this engine, and are not likely so to do, until it has been proved very much better than all others by the stress of public competitions, reliability trials, etc. The Daimler Company may be very strong, but they cannot force the buyers to depart from the customary means of judging merit.

The recent failure of the Argyll Company has nothing to do with general conditions of trade, being caused entirely by extravagant and unbusinesslike management. Formed originally with a very small capital, upon which no dividends were paid for the first three or four years, the securing of one large wholesale order enabled a very big dividend to be paid one year; on the basis of this a new company was floated with an inflated capital that was fully subscribed by the public. A huge factory was erected sixteen miles from Glasgow, and at this out of the way spot palatial offices were the main feature. An entrance hall rivalling the administration building of a State Capitol, lined with costly marbles, imposing marble staircases, a gilded dome, stained glass with carved teak and walnut doors everywhere were things which pressmen marvelled at on the official opening day—and which caused them to await the inevitable bankruptcy. Financial juggling of the worst character kept this ill-starred concern on its feet twelve months longer than ought naturally to have been the case, and the downfall has unfortunately been accompanied by the withdrawal of credit from many honest concerns slowly building up reputations on sound commercial lines. Through no fault of their own, and with plenty of orders in hand, about half a dozen companies are, from the cause just mentioned, having a very bad time indeed. A further disturbing cause, reacting upon the whole industry, is the "Four Inch" race, recently decided in the Isle of Man, for the remarkable results obtained in hill climbing and speed with the four cylinder engines of that bore have taught prospective purchasers that an engine with four cylinders of 4 inch bore is ample for all ordinary touring requirements. No other race in the history of automobilism has so profoundly upset designers and factory management generally; makers who have been working on the old lines for 1909 models have had to rush through new patterns in time for the annual Olympia show. The coming season's trade is certain to be done with the four cylinder machine of about 20 horse power, selling for not more than $2,000. The Wolseley Company was the first of the big British makers to market a car at this price, early this year, and their example is now being followed by the firms of Napier, Austin, Thornycroft, Enfield, Talbot, etc. As remarkable as anything else is the sudden determination of many French makers, who rely upon the English market to take the greater portion of their output, to offer quite small cars, that is, small in comparison with what they have been making. Renault announces a two cylinder, 8 horse power; Mors a two cylinder, 10 horse power; Brazier a two cylinder, 10 horse power; Peugeot a two cylinder, 10 horse power, and even the conservative Panhard firm will sell a four cylinder, 12 horse power, etc. It is to be feared these French machines will not have the success anticipated, as there are several British firms who have been specializing in this particluar type for some years and with quality of work and design quite equal to the French, and perhaps better in respect to reliability, are quite prepared to fight strenuously by cutting prices to such an extent that the French makers cannot compete. In the small single cylinder class of 6 to 8 horse power, the English have the field to themselves, excepting only the French De Dion, because, despite the attention now given to this type in France by quite a host of firms, they persist in building on very light racing lines that do not appeal to the average British buyer, who values beyond all else reliability and minimum of personal attention to keep in good running order.

The trend of trade in England and British colonies, outside India, which for the moment is buying luxurious cars, will be for vehicles not over 24 horse power. The spending power of the community is as great as it was last year, or at any period since 1870, but so much has been written in the general press concerning the high cost of maintenance for cars over that power, as to educate the public relative to these facts, concerning which there has been hitherto much intentional obscurity. Nor is it likely that this will be the minimum, the unnecessary and present wasteful expenditure upon pneumatic tires making certain that there must be, in the very near future, an emphatic demand for a very light yet quite reliable chassis of not over 15 brake horse power, capable of doing all that the standard 1908 24 horse power can attain, with less annual cost for gasoline, repairs and tires.

Some Tendencies in Body Work Details.

By Morris A. Hall.

It is interesting to look back on the automobile industry and notice how it has progressed. At first the idea was to get something that would run, regardless of looks, and the result of the maker's or inventor's attempt at this was placed in a buggy or some slightly modified form of the horse-drawn vehicle, but minus the horse. Later, as the mechanism became more reliable, it expanded and required more and more room, so that we had a gradual evolution in which the motive power unit slowly but surely moved forward in the car, until it assumed the now almost universal position in front under a bonnet or hood. Coincident with this development there came changes in the body structure, so that we gradually moved away from the buggy form and developed the present type of automobile body. For this type of bodies there have been developed special forms of wood and metal work, special forms of upholstering and trimming, special methods of doing this trimming work, distinctive hardware, special fabrics, etc., all of these belonging to the automobile and not to the carriage or buggy industry. Formerly we had carriage builders doing all of the wood and body work, and carriage trimmers did all of the upholstering, and so long as this was the case the ideas advanced and the work produced were both modifications or copies of the carriage builders' or trimmers' work.

Now, however, we have separate trades for automobile coach work. There are the automobile body builder and the automobile trimmer, men who, if they have ever worked at the carriage building and trimming trades, have been forced to forego or forget what they knew regarding these lines. In many cases these men have learned their trades within the automobile business, and thus know little or nothing of the carriage men's work. Take, for instance, sheet metal bodies—what do carriage men know about this work? And yet these are all well nigh universal in automobile practice.

This development, the writer believes, has been a real step forward and has been brought about by the demands of people owning or expecting to own machines. It is interesting to note the progressive methods or, as they might be called, the signs of the times.

A little over a year ago high power and large space were the talking points. The manufacturers vied with one another in producing immense power plants up to 70, 80 and even 90 horse power, which were necessary to propel the extra large, very roomy, seven and eight passenger bodies with their heavy weight and attendant heavy loads. Thus, a full load of passengers might easily weigh from 1,000 to 1,200 pounds.

During the past year the automobile public has learned to its sorrow the expensive upkeep of these gasoline and tire eaters, so that we have seen and will continue to see a sort of hedging on the manufacturers' part. This consists of equipping the same high powered chassis with a close coupled body, baby or toy tonneau, as it is variously termed. The seating capacity is thus reduced to four or five, with a consequent large reduction in body weight, and the passenger weight is nearly cut in half.

That the public appreciated the fact that this is not the best solution of the problem is shown by the cry from all over the country for the small or town cars. These may be said to have developed from the taxicab. The latter as first produced were entirely of the enclosed type of body, either limousine or landaulet being the standard equipment, but now we find the former produced with every form of body, two passenger city racer, three or four passenger fast runabout, five passenger close coupled touring body, six passenger ditto with a rumble seat added behind, etc.

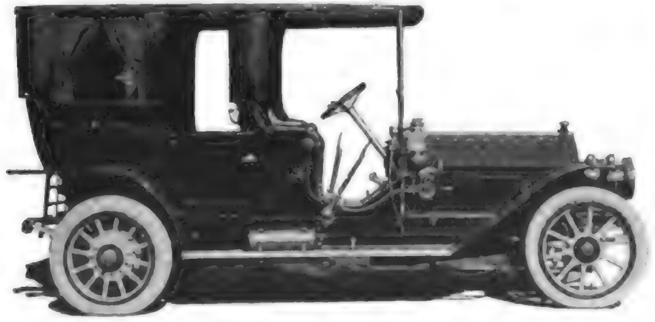
The tendency now is to give the public what it wants, and in the higher priced cars this has developed into a search for distinctiveness. It must be said that the results attained in this search are sometimes of the freak order.

This does not apply, however, to such ideas as dull finish lamps and metal work, or aluminum metal parts, the latter, with a medium shade of green body, forming one of the more beautiful specimens of body work. Aluminum for this purpose has the advantage that it shows silvery and shiny, whether frequently polished or not, if it has once been brought to a bright surface. It is susceptible of a very high polish and holds this polish under severe, frequent or dirty use about four times as long as brass. It does not show finger marks, as does the polished brass, and so is more useful. In dividing the work of polishing by four, a great deal has been accomplished, and, further, this work of polishing may be entirely given up without the metal parts assuming the dirty, repulsive appearance that brass assumes under those conditions.

The same thing applies with respect to the materials of the body and those used for trimming or upholstering. One prominent manufacturer is making a very extended trial of pigskin as a substitute for the various leathers heretofore used. This is upholstered plain without any tufts or a pattern. Also, quite a heavy roll is formed at the top of the back and the front of the cushion. Pigskin is exceedingly hard to work, stretches little or none dry, and only a very little more when wet, in contradistinction to the ordinary leathers. It is soaked in water for 24 hours previous to being applied. It is limited in size and in quantity, in color and in texture and the price is high. Extensive use will probably alter all this, except the matter of size.

When finally worked up it will excel all others in length of wear, in quality of service and particularly in its ability to hold its shape and resist weather conditions. In the very dryest kind of weather it will not crack and under no conditions of wet or dampness will it stretch or shrink. These qualities make its advantages practically balance its disadvantages of extra first cost, extra cost of working up, etc. It will be remembered that pigskin is the only leather which is used for footballs, as it is the only one that will stand this unusually severe service.

The writer has seen one or two extra fine car bodies gotten up exclusively for show purposes, regardless of expense, in which roeskin was used for the upholstering material. This would not wear well and the price would make its use prohibitive were it possible under our game laws even to obtain enough to make its use commercially practicable. It is thought, however, that even aside from considerations of wearing quality, price and quantity, popular sentiment against the wanton destruction of young deer for this purpose would render it impossible to use this leather successfully. This, then, must be regarded as a freakish tendency towards exclusiveness which could never be said of the use of pigskin.



Demountable Closed Body.

In regard to the line of woven fabrics for curtains, tops, linings of limousine tops, etc., the same remarks would hold good. Manufacturers who are seeking new things, novelties or better and more useful materials, are now beginning to be able to obtain them.

Returning to the subject of bodies, we find many new and distinct ideas making for economy. The ordinary closed or semi-closed body of the limousine or landaulet type makes for great expense, first, because it costs from $1,000 to $2,000 more than a touring car body, and, second, because, not being interchangeable with the regular touring body, for summer weather, an additional car with a touring body is necessary.

In this connection it may be observed that a few of the larger manufacturers have attempted convertible limousine-touring bodies. These have a detachable top which may be put on at will, the car then having the appearance of a limousine or closed car. Upon the return of warm weather, by loosening a few bolts the top may be removed and the car used as a touring car either with or without a light folding or Cape top.

One of the best of the convertible types, as well as one of the most recent, which has been called to the attention of the writer is shown in the cut, Fig. 1. As shown here this is a regular stock touring car with the limousine top in place. There are two glass fronts, one in front of the driver and directly above the dashboard; the other between the driver and the passengers, forming a front window (removable) for the latter. The other windows, one on each side, and a large one in the rear, have been removed in this instance and the inside silk curtains are shown. For winter use, these are all put in place and rigidly fastened, while storm curtains complete the side of both the rear part and the driver's compartment.

While not giving all of the advantages of the limousine in extremely cold weather, this demi-limousine or convertible body ought to become very popular. The makers call it a demountable body. As shown, the top is placed on a seven passenger, six cylinder, 70 horse power machine, but it is also made to fit smaller cars. Offering practically all the advantages of both the open touring and the enclosed body at the price of one (the limousine) it would be strange if this idea did not "catch on." The writer looks for a great deal of activity this fall and next year in all types of convertible bodies.

Spanish Duties.

The Spanish duties on automobiles are 80 pesetas gold ($15.45) per 100 kilos (220 pounds) on chasses weighing less than 1,000 kilos, and 100 pesetas gold ($19.30) on chasses weighing more than 1,000 kilos. If the car be provided with a body, a further duty of 200 pesetas ($38.60) will be assessed in case of an open body, and 320 pesetas ($61.76) in case of a closed body.

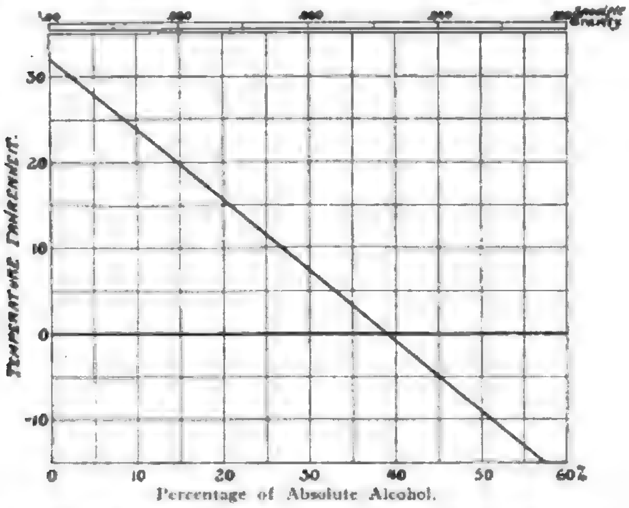
Non-Freezing Cooling Fluids.

The subject of non-freezing fluids for use in the cooling system in water cooled gasoline cars during the cold weather season has been discussed in these columns at great length, and most of the older motorists have by actual experience found some fluid or solution that fills all their requirements. But as there is a new crop of novice motorists each year, the subject requires more or less extended treatment each fall. There is no anti-freezing liquid which can be proved to be the best for all conditions, because, first, widely different minimum temperatures must be counted with in different parts of the country; second, all cooling systems are designed to use pure water, and some are not capable of doing their work when a cooling medium of much greater viscosity is used; and, third, the availing cooling media differ greatly in price and in volatility, and economic reasons, therefore, also intervene. Following is a list of the non-freezing cooling liquids which have been used to date for this purpose:

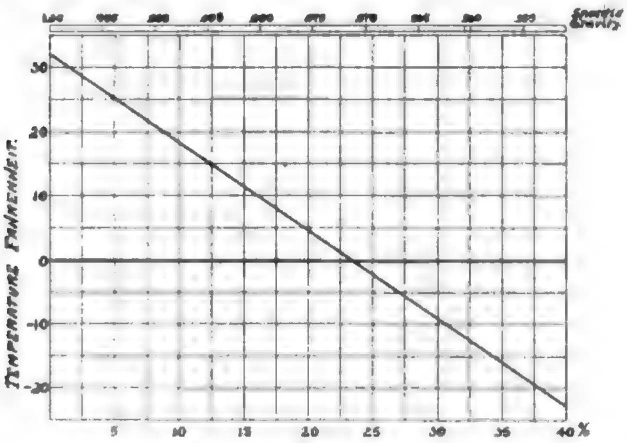
1. A solution of glycerine.
2. A solution of calcium chloride.
3. A solution of wood alcohol or denatured alcohol.
4. A solution of alcohol and glycerine.
5. A solution of glycerine and potassium carbonate.
6. A solution of common salt.
7. A light mineral oil.

Of the above, the first is now very little used and may be disposed of in a few words. Glycerine is expensive and becomes foul in the course of time, and must then be removed. It is held that it attacks rubber hose, though, with the short lengths of this article found on the average car, it could not possibly do very much damage. It was the one non-freezing liquid recommended by foreign writers up to a short time ago, but abroad automobiles are not used during the winter season to the same extent as in the United States, and in most sections of Europe the winter is not nearly so severe as here.

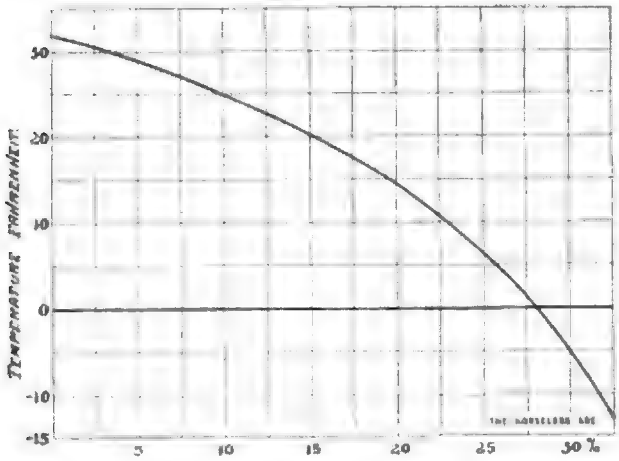
Calcium chloride has been and is yet widely and successfully used. It is comparatively cheap, and if the solution is made of sufficient strength, it does not freeze at any temperature which we are likely to have in this latitude. Like every salt solution it has a higher boiling point than water, and evaporation is therefore minimized. Whatever evaporates is nothing but water, and any loss from evaporation can be restored by adding water. The solution really requires that it be tested for strength with a hydrometer once in a while, because if it is allowed to become too strong from excessive evaporation, some of the calcium chloride will precipitate and may prevent circulation, while, if it is allowed to become too weak, as, for instance, through loss by leakage and replenishment with water, there is danger that the solution will freeze in extremely cold weather. Among the objections that have been raised to the use of calcium chloride solutions is that it attacks the metals of the cooling system. Very contradictory statements have been made in this respect, but there can be no doubt that when the solution is properly prepared and any acidity is taken out the dissolving action on the metals is negligible. The freezing temperatures of calcium chloride are given in the accompanying curve. In the latitude of New York a solution of 1.22 specific gravity, which has a freezing point of about minus 15° Fahr., meets all requirements. This solution is best prepared by first making a saturated solution of calcium chloride. To make 1 gallon of this saturated solution requires about a half gallon of water and 8 pounds of commercial calcium chloride. The solution is shown to be saturated when a few crystals of the calcium chloride remain at the bottom of the vessel, undissolved. This saturated solution is then diluted with an equal amount of water, and a handful of lime is added to render it slightly alkaline. If you want to be sure of having added enough lime you can get some red litmus papers from



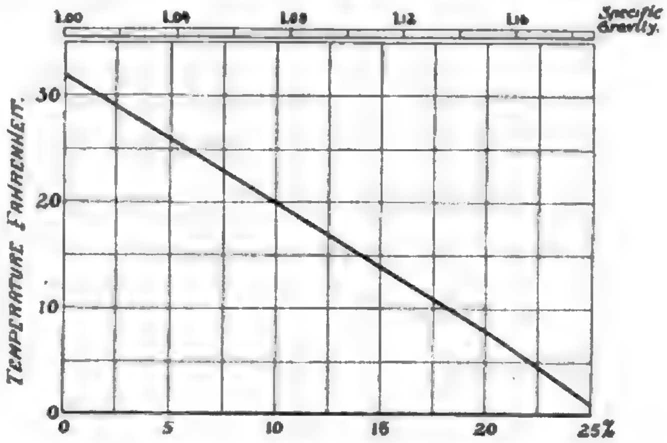
Freezing Temperatures of Denatured Alcohol Solutions.



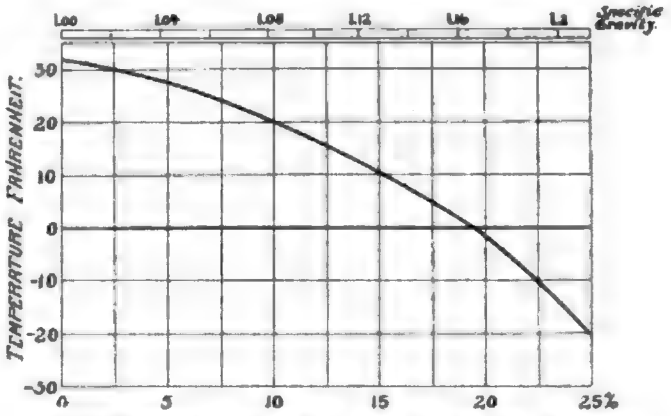
Freezing Temperatures of Wood Alcohol Solutions.



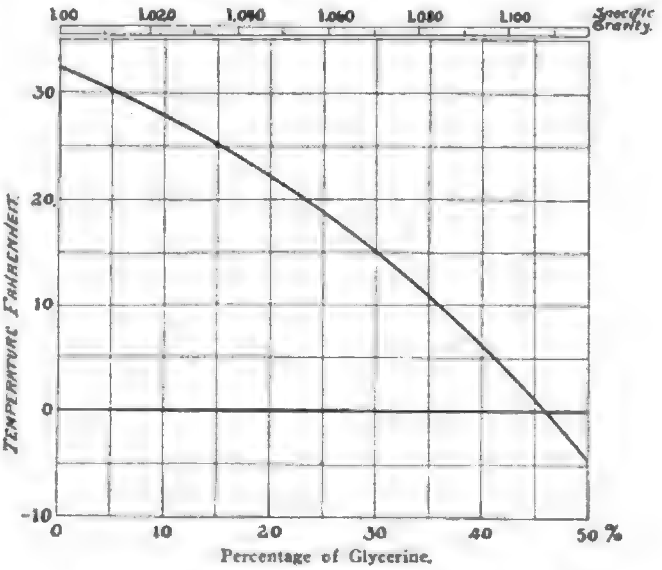
Half and Half. Wood Alcohol-Glycerine Mixture Solution in Water.



Freezing Points of Salt Solution.



Freezing Temperatures of Calcium Chloride Solution.



Freezing Points of Glycerine and Water.

a drug store and insert one of them in the solution, and if it turns blue it is proof that the solution is alkaline. Such a solution boils only at 220° to 225° Fahr., and it is, therefore, not likely to evaporate rapidly. In the case of cars which are much used it is advisable to test the strength of the solution once in a while with a hydrometer, and to add water if the density is found too high, or saturated solution if it is found too low.

A solution of wood alcohol has been much used in recent years. Such a solution when made of the proper strength will withstand any temperature to which a car is likely to be exposed, and the only disadvantage of the alcohol solution is that it boils at a low temperature, and, therefore, evaporates rather rapidly. Furthermore, the alcohol boils away somewhat faster than the water, instead of only the cheaply replaceable water being lost, as in the case of the calcium chloride solution. Denatured alcohol having essentially the same properties as wood alcohol, and being cheaper than the latter, is now generally used in preference. One advantage of the denatured over the wood alcohol is that it does not boil at so low a temperature and its loss by evaporation is therefore smaller. For instance, a 30 per cent. solution of wood alcohol boils at 168° Fahr., while a 30 per cent. solution of denatured alcohol boils only at 184° Fahr. For 40 per cent. solutions the corresponding boiling temperatures are 150° and 182°. There is, therefore, quite an advantage in favor of denatured alcohol from this viewpoint.

There has recently been a considerable decline in the price of wood alcohol, and we note that at present it is practically the same as that of denatured alcohol, the latest New York quotation for 95 per cent. wood alcohol being 47 to 49 cents per gallon in barrel lots, and 46 to 47 cents per gallon of 188 proof denatured alcohol in barrel lots. With these prices it is very doubtful whether there is any advantage in the use of denatured alcohol over wood alcohol for a non-freezing fluid. It will be seen from the curves herewith that for the same freezing point the denatured alcohol solution must be of considerably greater strength than the wood alcohol. Of course the boiling point of the denatured alcohol solution of given strength is considerably less than that of a wood alcohol solution of the same strength, which compensates for the difference in freezing points. In making use of the accompanying curve showing the freezing temperature of denatured alcohol solutions of different strengths, the percentages refer to the proportion of absolute alcohol in water, and if the ordinary 90 per cent. alcohol is used for making the solution, about 12 per cent. more alcohol by volume must be used, to allow for the 10 per cent. water in the alcohol.

The alcohol solution is not very suitable for cars which are subject to hard usage and which have a rather inadequate cooling system, in which the water is kept constantly at or near the boiling point. It will be seen from the curve that a 30 per cent. solution of wood alcohol has a freezing temperature of minus 9° and would serve practically all requirements, except during a spell of extreme cold. To overcome this defect of rapid loss of the alcohol by evaporation the glycerine-alcohol solution has been devised. Alcohol and glycerine are generally mixed in equal quantities, and a solution of this mixture of given strength has about the same freezing point as an alcohol solution of the same percentage. Now, the glycerine does not depress the boiling point of water, and as there is only half the amount of alcohol present the boiling point is much higher than for an alcohol solution of the same freezing point. A number of manufacturers recommend a solution of 30 per cent. half alcohol and half glycerine, which has a freezing point of minus 5° Fahr. It has been found that there is no loss of glycerine from such a solution by evaporation, and only alcohol needs to be added from time to time. The addition of more alcohol is also recommended in case lower temperatures must be guarded against than the solution as originally prepared will stand.

The solution of glycerine and potassium carbonate was recommended by a writer in THE HORSELESS AGE some years ago as a substitute for the calcium chloride solution, on account of its lesser corrosive effect, and has been used with satisfaction by a number of our readers. The potassium carbonate is used on account of its anti-rust properties, but a simple solution of this salt, even near the point of saturation, has not a low enough freezing point to meet the requirements of automobile work. It is with the object of further reducing the freezing point that the glycerine is added. A solution of 75 parts, by weight, of carbonate of potassium, in 100 parts, by weight, of water, to which 50 parts, by weight, of glycerine had been added, was found to remain perfectly liquid at minus 22° Fahr.

Common salt solutions have also been used with satisfactory results by a number of motorists, and are recommended by some manufacturers. It is well known that brine has a corrosive effect on iron and steel, but this can be almost entirely neutralized by adding a little sal soda or sodium carbonate to the solution to render it alkaline. The defect of the salt solution is that it does not withstand low enough temperatures to be serviceable for all winter use in every part of the country. It will be seen from the accompanying curve that a solution of 20 per cent. by weight will stand temperatures down to about 8° Fahr. Where no lower temperature than this needs to be provided against, this is undoubtedly the cheapest of all non-freezing solutions. Where a lower freezing point is required it seems that the addition of glycerine to such a solution might serve the desired end.

Light mineral oil has been used as a cooling fluid for winter use by a number of motorists, but the opinions regarding its suitability for the purpose have been widely divergent. It can only be recommended for cars having a pump which circulates the cooling fluid energetically. For thermo-siphon cooling systems its use would be out of the question, as the engine would overheat when working for any length of time under full load, and would probably pound. Oil has a much lower specific heat than water; that is, much less heat is required to raise a certain volume of oil through a certain temperature range than the same volume of water. The fire danger involved has also been referred to, but is negligible if proper caution is exercised. Oil might be recommended where extremely low temperatures have to be guarded against and where energetic circulation is assured by the construction of the car.

No scientific accuracy is claimed for the curves shown herewith, but they are sufficiently accurate to serve all practical purposes. The specific gravities indicated in the diagrams are for 60° Fahr.

Standard Storage Battery Rating in Great Britain.

In order to correct abuses said to be prevailing in Great Britain in connection with the capacity rating of ignition storage batteries, the tire and accessories committee of the Society of Motor Manufacturers and Traders has recommended the following rules:

(1) Accumulators shall have printed on their labels their actual capacity when discharged at a definite rate continuously, this rate being one-twentieth of the capacity claimed. An interval of rest to be allowed, such interval not to take place until half the period of discharge has expired.

(2) The accumulators can have printed on their labels the approximate capacity with intermittent current, which shall be arrived at by doubling the actual capacity, obtained by following Rule 1.

(3) In cases of dispute on the subject of the actual capacity of an accumulator, such dispute may be referred to the S. M. M. T., which may order tests carried out on the basis of Rule 1 by some competent authority, such as the Electrical Standardizing and Training Institution, Faraday House, London.

The S. M. M. T. will permit all manufacturers who agree to these conditions to mark on their labels, above the capacity values, the words "S. M. M. T. Rating," and all accumulators bearing labels with such marks are understood to be subject to the above test in case of dispute.

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A New Principle of Carburetor Automaticity.

Since the advent of the Krebs carburetor in 1903 there has been relatively little advance in carburetor construction. A number of attempts have been made to improve upon the Krebs principle by variously shaping the supplementary air openings or the spring on the supplementary air valves, so as to insure complete compensation for the increase in richness of the mixture formed in the spray chamber with increasing suction, by the addition of the correct amount of supplementary air at all suctions. The fact that the mixture formed in an ordinary spray carburetor becomes richer as the suction increases was observed by the Daimler engineer shortly after Maybach first introduced the constant level carburetor. At first the only means provided to correct this defect was a hand regulated air valve, but since the announcement of the Krebs carburetor practically all new carburetors brought out had some arrangement for automatically keeping the mixture constant, regardless of variations in suction. In general the means provided were very close copies of the Krebs supplementary air valve, though in some instances this valve, instead of being actuated by the suction, was operated either hydraulically by means of a diaphragm in a chamber communicating with the water cooling system, or mechanically by direct connection with the throttle valve.

There are available the following different methods for correcting the propensity of the ordinary spray nozzle to give too rich a mixture at high suctions, if proportioned to give a correct mixture at light or medium suctions. First, a supplementary air valve may be provided, admitting additional air to the mixture at some point beyond the spray nozzle. Second, the throat of the air passage around the mouth of the nozzle may be increased and decreased with the suction, so as to keep the suction at the nozzle substantially constant. Third, the opening of the spray nozzle may be decreased and increased as the suction increases and decreases, respectively, thus increasing the resistance to the flow of gasoline as the power of suction increases. Fourth, a supplementary gasoline jet may be provided, whose discharge is independent of the suction, and which delivers more gasoline per explosion at low speeds than at high. Two or more of these principles may also be combined in a single instrument.

The principle referred to as the "fourth" is embodied in a new French carburetor and formed the subject of a recent communication to the French Academy of Sciences, which is reproduced *in extenso* elsewhere in this issue. The principle is certainly an attractive one, especially since the carburetor based on it is devoid of all moving parts which are liable to get out of order. The principle is, briefly, that a supplementary jet is provided to which gasoline is fed by the pressure due to a certain head of gasoline without suction effect, and whose delivery per unit of time is therefore constant. The charge formed by the main jet is enriched by the fuel delivered by the supplementary jet, and as there is a greater time interval between successive charge inductions at low motor speeds than at high motor speeds, the original charge is enriched more at low speeds than at high, which is what is generally found to be required.

However, the relative excess or undersupply of gasoline in the mixture produced by the ordinary spray nozzle does not depend directly upon the engine speed, but upon the suction created by the piston movement, and this suction may vary widely for a given engine speed according to the degree of opening of the throttle. Suppose that the carburetor gave the correct mixture at all speeds with full throttle opening, which it is evidently capable of doing if correctly proportioned. Now consider the load on the motor to be reduced so it can run at the same speeds with half throttle openings. Evidently there is then less suction around the spray nozzle for a given motor speed than with full throttle opening, and the mixture produced by the regular nozzle will be relatively poorer in gasoline than the mixture produced at the same speed at full throttle. The mixture must therefore be enriched more, proportionately, and as at the same engine speed the amount of supplementary gasoline delivered per suction is the same, but the volume of charge to be enriched is less for half throttle than for full throttle, the charge *will be* enriched more in the former case than in the latter, and thus the theoretical conditions are satisfied, at least in a general way. Stated in other words, this principle of carburetor automatism takes care not only of variations of engine speed, but also of variations in throttle position. The supplementary air valve, of course, does all this, but if the thing can be accomplished without springs and moving parts a real advance in carburetor construction would seem to have been made.

The Rising Price of Crude Rubber.

Hardly had the American tire manufacturers announced the recent reductions in their list prices, which came more or less as a direct result of the gradual decline in the price of crude rubber that began a little over a year ago, when a stiff rise in the price of this commodity was noted in the New York market. On December 1, 1907, Islands, fine, sold in this market at 72@73 cents per pound. Last week it was quoted at $1.22@$1.25. Upriver, fine, sold at 83@84 cents on December 1, 1907, while last week it was quoted at $1.28@$1.30 a pound. There has, therefore, been an increase of about 70 per cent. in the price of the first named grade, and of about 50 per cent. in that of the second.

To just what causes the erstwhile decline and subsequent rise in the price of rubber were due is rather hard to determine with any degree of assurance. European writers generally ascribed the drop in prices to the financial depression in the United States. Now, the financial depression cannot have had a very marked effect on the consumption in this country of the higher grades of rubber used for tires. There has been no decrease in the number of cars turned out by the manfuacturers, and undoubtedly the majority of cars which were already in the hands of the public have been kept in service wearing out rubber tires in spite of bad times. Several of the leading rubber goods manufacturers have only recently begun erecting new buildings for their tire departments, which tends to disprove the assumption that they have not been fully occupied in this branch the past year. In fact there is nothing to show why the financial crisis should have given such a shock to the rubber market, especially since this country is only one of several large rubber consumers. It is, of course, conceivable that a disproportion had gradually become established between the supply and demand of rubber, and that the Wall Street panic brought matters to a head and caused the tumbling of more or less inflated prices to which rubber had attained during the several years' phenomenal growth of a number of rubber consuming industries previous to the depression.

In judging the present advance it must not be lost sight of that it is by no means certain whether the ruling higher prices will continue for any length of time. They may be the result of a sudden increase in demand consequent upon increased business activity immediately after election, although it was stated in the latest market reports that holders of Para rubber were disinclined to shade prices despite the absence of buyers; or they may be due to some sort of manipulation of the market. However, if these prices should be maintained it does not seem likely that the recently issued reduced price lists on pneumatic tires will remain in effect very long; probably even sooner than pneumatic tires, solid tires will show an upward trend in price, consequent upon the increase of the price of rubber, they having also been first to react upon the decline of crude rubber, for the simple reason that the cost of rubber bears a greater proportion to the selling price of the tire in the case of solid tires than in that of pneumatics.

Necessity for "Foolproofing" Passing.

Until recently it was considered by most manufacturers that, as their cars were, in the main, to be operated by persons practically devoid of any previous knowledge of motor vehicles, they must be so designed as to be as nearly "foolproof" as possible. There was, and perhaps still is, a very reasonable ground for such a view, but conditions have changed very much in this respect within the last few years. At the present time a considerable proportion of the machines sold go into the hands of persons who have previously driven at least one, and sometimes several cars, and who are well versed in the practical operative lore of the motor car. The technical press, automobile schools and the advertising literature sent out by manufacturers have assisted in the work of education, and few indeed are the prospective purchasers of automobiles who have not had extensive opportunities of personally observing and studying the methods of operation of a variety of makes of cars. The result is that the public is no longer a "fool" as regards automobiles, and "foolproofing" need be resorted to much less than formerly.

A decided effect has been produced upon the design of cars offered by the manufacturers by this general enlightenment which has been going on, as a few examples will serve to illustrate. It was formerly considered that the planetary possessed a very important advantage over the sliding gear transmission in that it was measurably free from the liability of being disastrously mishandled. Much of this assumed superiority has vanished, now that the sliding gear transmission has become so familiar to all interested in motor vehicles. At present the manufacturer no longer hesitates to embody a sliding gear set in his low priced cars, which he knows will go into the hands of all sorts and conditions of owners who drive their own cars.

In the early years of the industry it was the general practice to interconnect the clutch and service brake, in the fear that the "fool" owner would attempt to start his car with the brake on and do some damage to the mechanism. Now the owner is evidently regarded as sufficiently enlightened, so that he may be trusted to use his brake and clutch pedals in a proper manner, for the interconnection has generally been discarded, enabling the motor to be employed as a brake and thus conducing to safety of operation.

It was the view of many manufacturers a few years ago that the operator could not be trusted to adjust his carburetor to meet changes in fuel quality and atmospheric conditions. No dashboard adjustments were provided, and indeed, in some instances, carburetors were made unadjustable and permanently set at the factory. It is evident that the operator is now being trusted by the manufacturer to regulate his carburetor, free from any likelihood that he will put it hopelessly out of condition, since dashboard adjustments are being provided upon quite a number of the new models which are of the class that are driven by private owners.

On the whole, the manufacturer is safer than hitherto in assuming a reasonable intelligence upon the part of the user and in adopting the constructions best fitted mechanically to do the work, with very slight regard for their "foolproof" qualities. "Foolproofing" a car is a very different matter from safeguarding its operation. The former aims to protect against the ill effects due to ignorance, the latter aims to protect against the inadvertent or accidental lapses which may happen to the skilled operator, as well as to the ignorant one. The reverse gear latch and the spark retarding starting attachment are typical of the latter class of devices, and should be provided upon all cars to guard against the purely accidental mishandlings which may happen to any operator, however intelligent.

The Advantages of the Electric Runabout for City Work.

An attempt has recently been made by a manufacturer of both gasoline and electric cars to furnish a demonstration of the alleged superiority of the electric runabout over the gasoline car for city work. Two cars were sent out from the branch of the firm in Boston over the same predetermined route of about 10 miles through the congested downtown district, in opposite directions, each making twenty stops. The electric runabout won, in 1 hour 10 minutes, as compared with the 1 hour 13 minutes required by the gasoline car.

In considering the probable reasons why the electric car achieved a victory over its competitor in this contest (which, it should perhaps be pointed out, was entirely a private affair and not conducted under the auspices of any recognized public body) it must be remembered that the electric car has a shorter wheel base and can therefore cut in and out among traffic with greater facility. The entrance to the seat of the electric is entirely unobstructed, and the driver does not need to walk around the car in leaving and entering his seat. In restarting the electric car the controller lever can at once be pushed to the high speed position, and the car will pick up as fast as the power of the motor will accelerate the weight that must be moved. In the case of the gasoline car the motor must first be speeded up, which requires a certain amount of manipulation of the throttle and spark levers, after which the clutch must be withdrawn, the gear engaged and then the clutch let in again. We understand that one of the conditions of the contest was that the gasoline motor had to be stopped and restarted every time the vehicle made a stop, which condition was, however, hardly just to the gasoline car, as for such short stops there is no necessity for stopping the motor.

But accepting the results of the test as they are, the only tangible conclusion that can be drawn therefrom is that slightly better time can be made by means of an electric runabout than by a high powered gasoline car in making trips through very congested districts, with numerous stops. This advantage may possibly be a consideration with a few buyers, but we believe that the majority of purchasers who prefer the electric do so on account of two other well established advantages of this type of car, viz., its greater cleanliness and the non-necessity of mechanical adjustments in the course of a run. They prefer to do without the noise, smell and dirt of the gasoline power plant, and its ever present liability of developing some fault that requires instant adjustment. These are the non-mechanical. In the future, however, the contest between the electric and gasoline runabouts will be fought out more along lines of economy. The 30 horse or 40 horse gentleman's roadster is decidedly not the machine to oust the electric from city service, though it would make the best showing in a comparison with it on the basis of the above test. But when we have 10 or 12 horse power runabouts specially built for city use, as thoroughly developed and of as high grade as the high powered tourabouts, etc., the question of supremacy in this field may have to be solved anew. One useful lesson from this test for the designers of such cars, and, in fact, all cars for work in which frequent stops are required, as in mail delivery, is that the usual arrangement of the gear and clutch levers, blocking the entrance to the driver's seat, is unsuitable for such a car.

The Swiss Commercial Vehicle Works "Safir" in Zurich is to be reorganized and placed on a healthier financial basis by reducing the stock capital and issuing new stock to provide additional working capital. The capital now is 2,000,000 francs.

Maintenance and Repairs

The Oiling of Magnetos.

Almost all magnetos have some sort of oil reservoir. Where ball bearings are fitted there is generally an oil-tight chamber surrounding the bearing, and where the wick-feed system of lubrication is used there is a chamber of considerable capacity. Except in the wick feed system, no purging outlet is usually provided. To remove the stale oil from the reservoir one obvious method is to "cut the oil" with kerosene and then remove the kerosene from the reservoir. The manufacturers' directions regarding this point usually are to the effect that the bearings need not be oiled often, only once in, say 5,000 miles, and then if the oil has to be drained off, "why anyone can easily dismount this casing and that cover and wipe off the oil." The chauffeur, whose duty it is to look to this matter, often lets the oil stay in and fills up the reservoir when more oil is added.

Obviously, the manufacturer realizes that the average motor car driver, be he owner or chauffeur, is lazy, and he considers it necessary, in order to effect the sale of the magneto, to create the impression that the apparatus needs very little care and will practically take care of the oiling itself, provided it is filled up at the end of so many miles. The result of such policy is seen in the gummy condition of magneto bearings and the wear consequent thereto so commonly seen on private motor cars. A case recently seen was that of a well-known make of American magneto with plain bearings, whose armature shaft upon being cleared of gummed oil at the bearing surfaces showed a side play of one millimeter on the drive end and nearly as much on the distribution end. The manufacturer claimed that oil was necessary only every 3,000 miles. The driver, noting that the timing had become irregular, "took up" on the driving pinion, in order to have the magneto generate at the proper time. This necessitated adjustments every week and in the end new bearings had to be made to order to fit the shaft. Regular oiling and purging of the oil reservoir would have prevented the above.

As for the ease in dismounting casings, etc., the manufacturer hardly serves his own ends by such a statement, for these casings when removed expose portions of the delicate magneto mechanism, and the aim of the manufacturer to render the instrument fool-proof is thus at least partly defeated, as the person dismounting the casings will in nearly every instance disarrange a part, or fail to replace it properly, and the magneto will not work, for which it and its maker will be blamed. Magneto knowledge is not so widespread as it should be, despite the numbers in service at the present time.

Regarding the policy of letting the stale oil remain in the reservoir and replacing such as is lost by fresh oil, the bearings will not suffer to the extent as by simple neglect, and a considerably longer time will elapse before wear shows itself. Dynamo and motor builders, who have had years of experience in similar work, insist upon the removal of stale oil from reservoirs and its regular replacement by fresh oil, providing drain cocks or plugs for the purpose. This, unfortunately, all magneto builders fail to do.

Allowing, then, that the stale oil must be removed, this is accomplished by "swilling out" the reservoir with kerosene regularly every 500 to 600 miles, and removing the kerosene by suction, absorption or pressure, as the case may call for. When the reservoir is provided with no overflow channel, most of the kerosene may be removed by sucking it out by means of a fine bore tube inserted in the oil hole. A portion of the kerosene will remain, which can only be removed by inserting spills made of blotting paper or woolen pipe cleaners, the writer having used the latter to good effect, especially where the oil holes were small. Care should be taken that the wire core does not scratch the shaft or bearing when using pipe cleaners.

Where overflow channels are fitted the kerosene may be ejected by blowing through the filler hole, using either a pump, syringe or the mouth. The kerosene clinging to the sides of reservoir and bearings must then be absorbed as above. With magnetos having wick or candle oil feeds, the kerosene should be allowed to drain off, and any traces remaining can be removed with blotting paper, etc. The wicks should be washed with kerosene, and allowed to dry. After all possible traces of kerosene have been removed, the reservoir can be filled with fresh lubricant and closed.

Under no circumstances should gasoline be used for "cutting" oil, as gasoline on drying out leaves a white precipitate which is injurious to bearings, preventing the oil from forming a film and tending to score the shafts. Kerosene should always be used, it being free from this objectionable feature.

Coming Events.

November 13 to 21—Olympia, London, Show.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

November 28 to December 13—Paris Pleasure Vehicle Show.

December 22 to 29—Paris Commercial Vehicle Show.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 15 to 20—St. Louis Show.

February 27 to March 3—Hartford, Conn., Annual Show, Automobile Dealers' Association.

A New Principle of Automatic Carburetor Regulation.

(Paper Presented to the French Academy of Sciences by M. A. Lauret.)

THE SPRAYING CARBURETOR.

Since the spraying carburetor was first introduced, it has been known that there is an inherent fault in its principle. A nozzle discharging gasoline into a passage through which there is a flow of air does not deliver a quantity of gasoline proportional to the delivery of air, at different rates of air flow. The proportion of gasoline increases with the suction. This difficulty was at first met by providing a supplementary air inlet to the carburetor, which could be regulated by the driver at will.

A scientific explanation of the operation of a spray nozzle was first given by Krebs in 1903, who, in order to insure that the mixture remained constant, suggested the provision of an automatic supplementary valve actuated by the suction of the motor. This principle of automatism, the only one which has been made use of up to the present, and which is employed in the majority of modern carburetors, may thus be formulated: A correct mixture having been obtained for the minimum suction on which the motor is capable of running, the excess of the gasoline which is delivered at higher suctions is compensated for by the introduction of additional air at a rate varying automatically according to the suction.

This principle of automatism announced by Krebs is evidently independent of any theory. However, the hypotheses adopted by Krebs in order to explain the increase in the proportion of gasoline at strong suctions do not seem to entirely conform to the facts.

1. The capillary attraction which holds the gasoline at the orifice of the jet is very slight. We have never been able to observe a flow of gasoline starting under a pressure of more than 5 mm., and that for a nozzle of [illegible] mm., which corresponds very nearly to the very smallest diameters used in practice. The pressure which determines the flow of gasoline is variable according to the position of the nozzle (upright, inverted, horizontal), and according to the vibrations to which it is subjected. But it is certainly too feeble to explain the variations in the quality of the mixture obtained from a carburetor.

2. While admitting that the suction at the opening of the nozzle is subject to periodic changes, it does not follow that the gasoline must flow at high motor speeds with a speed close to that corresponding to maximum suction. If the inertia of the gasoline has the effect of keeping it in motion after the suction has become nil, it has the opposite effect of retarding the moment of emission when the suction begins, which would compensate at least in part for the continuation of flow after the cessation of suction.

In any case, this influence of the periodic variations in the suction is sufficiently small, especially in the case of a six cylinder motor, to make it admissible to base the theoretical investigation of a carburetor on the assumption of a mean suction. Experience must then show what corrections are necessary for each type of motor in order to obtain the most perfect mixture, these corrections depending upon various factors, including the influence of the periodical variations in the suction, as we shall see further on.

From the experiments of M. Rummel it results that the rate of gasoline discharge, Q/*t*, of a spray nozzle or of a very narrow passage through a relatively thin shell is represented with very close approximation by an expression of the form

$$c_1 (Q/t)^2 + c_2 (Q/t) = h,$$

as a function of the suction h. This is to say that the law assumed by Krebs,

$$c_1 (Q/t)^2 = h - h_0$$

is not applicable.

The law of Poiseuille for capillary passages, which may be represented by an expression of the form

$$c_2 Q/t = h$$

is not applicable either; it is necessary to add to it a correction term $c_1 (Q/t)^2$, which may be considered as required by the small length of the capillary passages used, which produce eddies proportional to the square of the speed.

The very numerous and very accurately conducted experiments of M. Rummel were made with water. We have taken them up again with gasoline (Benzo-Moteur), and used the spray nozzles of actual carburetors. The results obtained are entirely in accord with those of M. Rummel and lead to a representation of the discharge of gasoline by the parabolic expression

$$c_1 (Q/t)^2 + c_2 (Q/t) = h.$$

The accompanying diagram shows the results obtained with a spray nozzle of $^{83}/_{100}$ mm. bore, from a Zenith carburetor.

Values of Q/t.	Values of *h*. Measured.	Values of *h*. Calculated.
14	3	3.05
20.5	5	4.9
35.3	10	10.4
45	15	15.3
53.8	20	20.1
62	25	25.4
68.3	30	29.8
75.2	35	34.6
82	40	40

The values of the head of gasoline h are measured from the smallest head which causes a flow of gasoline.

Now, let us trace the curve I of gasoline flow as a function of the suction and that of air flow (II.), Fig. 2. For the curve of the proportion of air to gasoline we obtain a section of a hyperbolic curve which has for its asymptotes a straight line parallel to the axis of X, representing the equation, air/gasoline = constant, and the vertical line $h = h_1$, h_1 being the suction under which the gasoline begins to flow.

In order to re-establish the constant proportion of gasoline to air, the most natural *a priori* method, and the one which was introduced by Krebs, is to provide suitable sections of air and gasoline outlets to insure a proper mixture at the minimum suction h_0 at which the motor is to be operated, and to introduce gradually increasing quantities of supplementary air, as indicated by curve IV, the ordinates of which are the differences between those of the parabola of gasoline discharges and those of the air flow reduced to the same scale for $h = h_0$. This curve is the same as that obtained by Krebs, independently of any hypothesis, and to which one is also led by his method of calculation.

A second method of obtaining a constant mixture, suggested by M. Baverey, and applied in the Zenith carburetor, of which he is the inventor, consists in providing, in addition to the first spray nozzle, which

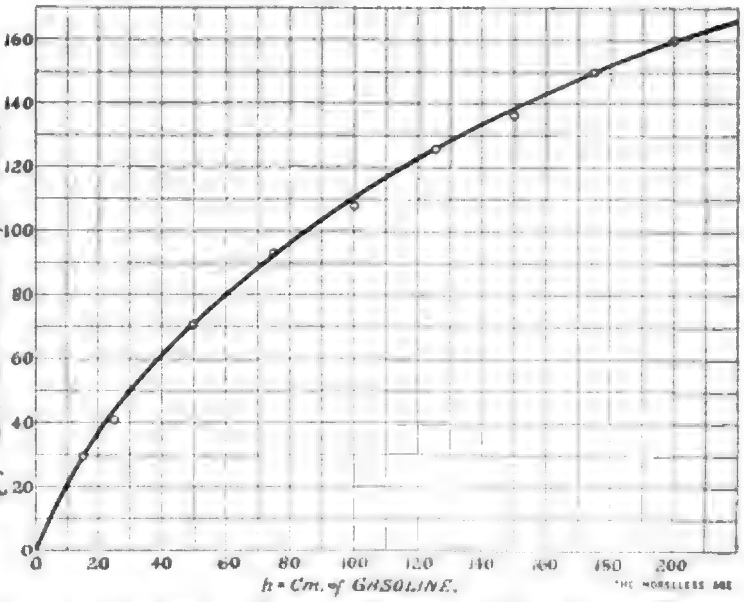


FIG. 1.—CURVE OF DISCHARGE OF A NOZZLE 83/100 MM. (33/1000 INCH) DIAMETER.

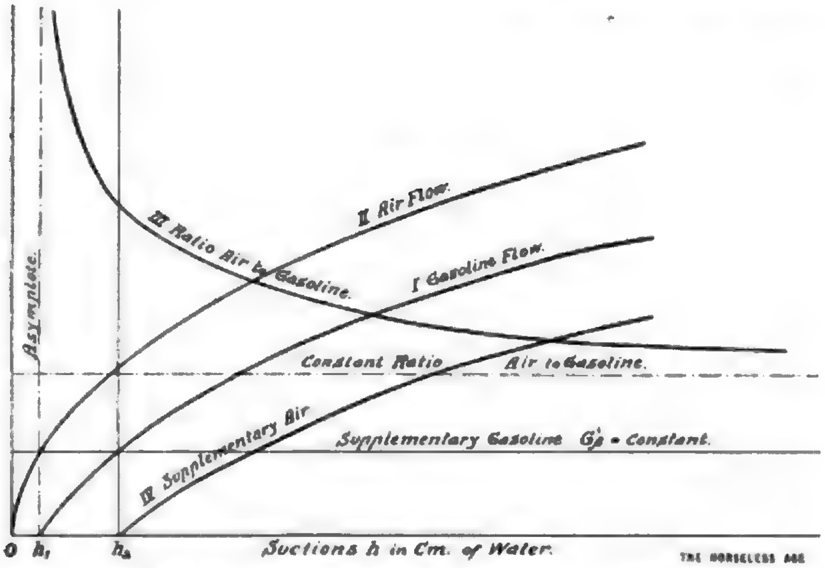


FIG. 2.—DIAGRAM OF RATIO OF FLOW IN A CARBURETOR.

furnishes too little gasoline at low speeds and too much at high speeds, a second spray nozzle, which discharges little gasoline at high motor speeds and proportionately much at low speeds. When it is considered that a gasoline nozzle discharging into the the atmosphere through an orifice under a constant head, and consequently at a constant rate, gives per revolution of the motor quantities of gasoline inversely proportional to the number of revolutions, and consequently smaller at high speeds than at low speeds, it will be seen that the addition of such a nozzle corrects, at least to a certain extent, the variations in the proportion of the charge.

COMPENSATING ACTION MAY BE PERFECT.

We have seen that the discharge of gasoline may be represented very closely by an equation of the form,

$$c_1 G^2_B + c_2 G_B = h - h', \qquad (1)$$

in which c_1 and c_2 are constants, G_n is the discharge of gasoline in cubic centimeters per minute, h the suction head in centimeters of gasoline and h' the suction at which the gasoline just begins to flow.

The delivery of air may be represented by the generally accepted form of equation:

$$c_3 G^2_A = h \qquad (2)$$

Let K be the ratio between gasoline and air, which should be constant no matter what the suction h_2. Also let G_B in cubic centimeters per minute represent the discharge of the compensating nozzle, and T in cubic centimeters per minute the total discharge of gasoline. Then we have

$$T_B = G_n + G'_n, \qquad (3)$$

and should have

$$T_B = KG_A \qquad (4)$$

From (1) and (3) we derive

$$C_1 (T_B - G'_B) + c_2 (T_B - G'_B) h' - h = c_3 G^2_A$$

and taking account of (4)

$$C_1 (T_B^2 + (C_2 - 2c_1 G'_B) T_B + c_1 G'^2_B - c_2 G'_B + h' = c_3 K^2 T_B^2$$

from which it results that

$$T_B^2 c_1 - \frac{c_3}{K_2} + T_B (c_2 - 2c_1 G'_B) + c_1 G'^2_B - c_2 G'_B + h' = 0 \qquad (5)$$

In order that this equation may be satisfied, whatever the value of T_B, it is necessary that

$$c_3/c_1 = K^2 \qquad (a)$$

$$c_2/c_1 = 2G'_B \qquad (b)$$

$$c_1 G^2_B - c_2 G'_B + h' = 0 \qquad (c)$$

From (*a*) and (*c*) we deduce that

$$C^2 G'_B = 2h' \qquad (e)$$

These equations are not incompatible, it is practically possible to satisfy them, and they are easy to interpret.

The curve II., representing the delivery of air, is, according to equation (2) a parabola whose summit is at the point of origin and whose axis is that of the suctions. If, therefore, the curve of gasoline delivery were also a parabola, superimposed on its axis and its tangent at the summit, the ratio of gasoline to air would remain constant and equal to the square root of the ratio of parameters. Now, the curve of gasoline delivery represented by equation (1) is also a parabola, but its summit has for its co-ordinates

$$y = \frac{-c_2}{2c_1}\ x = h' - \frac{c_2^2}{4c_1}$$

If, then, we add to the ordinates of the parabola those of the straight line,

$$y = \frac{c_2}{2c_1} = G'_B$$

and place

$$h_1 - \frac{c_2^2}{4c_1} = \frac{c_2 G'_B}{2} - h_1 = 0.$$

the resulting curve is a parabola superimposed on its axis and its tangent at the summit.

It is thus possible to obtain a constant mixture of gasoline and air by adding an ordinary supplementary nozzle of suitable size and giving a constant discharge.

CONSTRUCTION.

To an ordinary nozzle, G (Fig. 3), taking its supply directly from the float chamber F, is added the compensating nozzle H, which takes its gasoline from a standpipe, J, open to the atmosphere. A calibrated jet I delivers into this pipe, and as the head is constant, and there is no suction at the orifice of this jet, the delivery of gasoline into this pipe is constant. It follows that the rate at which gasoline can be drawn from the nozzle H is also constant. It is thus evidently possible in practice to satisfy equations (*a*), (*b*) and (*c*).

The variable parameters are c_1, c_2, G'_B and h_1; c_3, which measures the volume of air drawn in, is determined by the condition that at speed the suction can never exceed a certain value, as otherwise the cylinder could not be properly filled. In practice it is not convenient to derive c_1, c_2 and G_B from equations (*a*), (*b*) and (*c*) and to deduce from them the dimensions of the jet, as c_1 and c_2 are very complex functions of the diameter and length of the jet. On the other hand, in calculating h from the equation

$$h_1 = c_2^2/4c_1$$

it is found that h_1 remains within the limits of 5 and 15 mm. for all practical cases. As the suction at which the gasoline begins to flow is not exactly equal to the pressure due to a head of gasoline equal to the distance of the level in the nozzle from the top of the nozzle, but differs therefrom in the case of a vertical nozzle by 2 to 5 mm., according to circumstances, the limiting values of h' may be taken at 3 and 10 mm. In practice the distance of the level in the nozzle below the top of the nozzle has been fixed at 3 mm., thus insuring a very slight excess of gasoline at low speeds, approximately one-thirtieth of the total discharge.

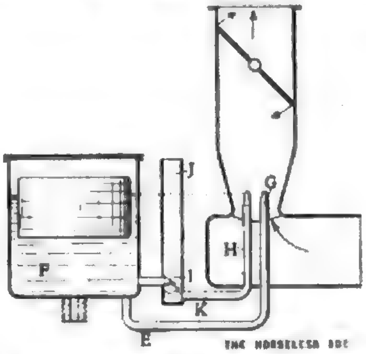


FIG. 3.—DIAGRAM OF ZENITH CARBURETOR.

VALUE OF THE FUEL-AIR RATIO.

We have thus far assumed that the ratio of gasoline to air should remain constant; this, however, is only a crude approximation. In endeavoring to find, for different motor speeds, the minimum value of the ratio of gasoline to air corresponding to the maximum power produced, one arrives at materially different results, according to the speed, and very variable values according to the cooling of the motor and the method of ignition employed. There is no doubt that we can burn extremely poor mixtures of gasoline at high motor speeds, mixtures which are not inflammable in the eudiometer and absolutely useless at low motor speeds, at least with the methods of ignition now in common use. It is thus necessary, in order that a carburetor may be very economical, that it give a poor mixture at high speeds and a rich mixture at low speeds. This result is obtained in automatic carburetors by giving the supplementary air inlets which are opened at high speeds a greater area than they should have according to theory.

In the Zenith carburetor the same result is arrived at by giving the compensating jet a greater discharge than it should have according to theory. Thus for a carburetor tried on a 100x140 mm. four cylinder motor, experience has shown the most advantageous value of the discharge of the compensating jet to be 34 cubic centimeters per minute, while theory gave for this discharge the value

$$2\,G'_n - c_3/c_1 = 40,$$

which corresponds to an excess of gasoline of $(34\text{-}20)/G_n - 34$; by taking for G_n the value 36, which corresponds to about 300 r. p. m. of the motor, we have an excess of gasoline of one-fifth. In other words, the fuel mixture is one-fifth richer at 300 r. p. m. than at high motor speeds. This value is small in relation to that of the majority of other carburetors. This possibility of using relatively lean mixtures of gasoline at small speeds may be attributed largely to the fact that all of the air passes over the gasoline, and homogeneity of the charge is thus insured.

We have seen that there is no need in the adjustment of the carburetor to take account of the very slight variations of h', which are indicated by theory. For the adjustment on a given motor the following three variables are available.

(1) The diameter of the throat in the air passage. Its determination, which is nothing else than that of the co-efficient c_3, is effected while the motor is running at full load at very low but uniform speed; in other words, the minimum practical suction is determined.

(2) The diameter of the regular nozzle. This nozzle has a preponderant influence at high speeds. Its value is determined by subjecting the motor to a brake load at 1,500 r. p. m., for instance, and varying the diameter of the nozzle until the maximum power is obtained. This determination corresponds substantially to that of c_1, the term $c_1\,(G_n)^2$ being the preponderant term for high speeds in equation (1).

(3) The diameter of the compensating nozzle. This is determined by braking the motor at 250 r. p. m., for instance; at this speed G'_n is greater than G_n, which is already determined; its variations therefore play a preponderant part.

We now return to the adjustment at high speed in order to determine whether the change in the supplementary jet has altered the adjustment of the regular jet, and if this is found to be the case, the latter is again adjusted.

The carburetor being thus adjusted for two different speeds, it is necessarily properly adjusted for all intermediate speeds, by reason of the principle of automatism of the apparatus.

The carburetor being thus adjusted, the motor may be accelerated with the greatest ease; a carburetor in which there is no condensation of gasoline during slowdowns will permit quick speeding up, provided it insures proper carburetion at all speeds at which the motor can possibly be run. In order to insure this result, it is not necessary to have recourse to special expedients; and it may even be asserted that in a carburetor the provisions of a device having for its sole object to permit of quick acceleration is an indication that the apparatus is imperfectly automatic.

Fig. 4, herewith, represents a sectional view of the Zenith carburetor. The two nozzles G and H are arranged concentrically one with respect to the other, both of them opening at S, the regular nozzle being in the centre and the supplementary nozzle being of annular form. The annular nozzle H communicates through F with the pipe J open to the atmosphere, into which at the centre discharges the calibrated jet I.

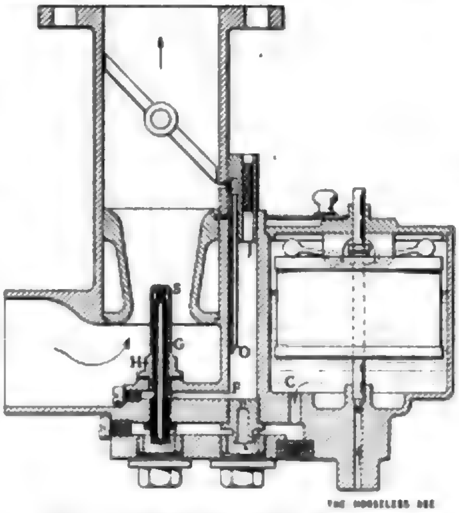


FIG. 4—SECTIONAL VIEW OF ZENITH CARBURETOR.

OPERATION AT LOW SPEED.

The operation at low speed and no load corresponds to an admission of very little charge. The suction around the nozzles is thus insufficient for drawing in the gasoline which flows into the pipe J. Advantage has been taken of the vacuum which exists behind the butterfly valve for drawing in violently through a small auxiliary tube O the gasoline which is accumulating in the pipe. It will be noted that the discharge of gasoline of the jet I at low speed is not equal to its normal discharge, decreasing as the level of gasoline in the tube J rises, thus decreasing the head of gasoline causing the discharge through the jet I. It is, therefore, an easy matter to regulate the discharge of the compensating nozzle by varying the length of the tube O, and consequently the quantity of gasoline necessary for steady running at slow speed under light load.

This expedient has still another advantage. When the motor is stopped the pipe J fills with gasoline up to the height of the level in the float chamber. From the first revolutions of the motor this small store of gasoline is violently drawn in through the tube O and sprayed on the butterfly valve, thus facilitating the starting of the motor and doing away with the necessity for submerging the float, or "tickling" the carburetor.

Owing to the principle of its construction the Zenith carburetor offers the following advantages: (1) It is absolutely automatic; that is to say, whatever may be the speed of the motor, it produces a mixture causing the motor to deliver its maximum power at that speed. (2) All of the air drawn in serves to spray the gasoline, and the mixture is therefore very homogeneous. (3) The device does not comprise a single moving part; the vibrations due to road shocks or to the intermittent suction of the motor can, therefore, have no effect on it, and do not interfere with the carburetion, as is the case with many so-called automatic carburetors with spring returned supplementary air valves; it is, therefore, impossible to get out of adjustment. (4) Operation at low speed is quite practicable, and the restarting of the motor is greatly facilitated by the presence of the compensating nozzle and the auxiliary suction tube which in a sense is automatically submerged after the motor has been stopped.

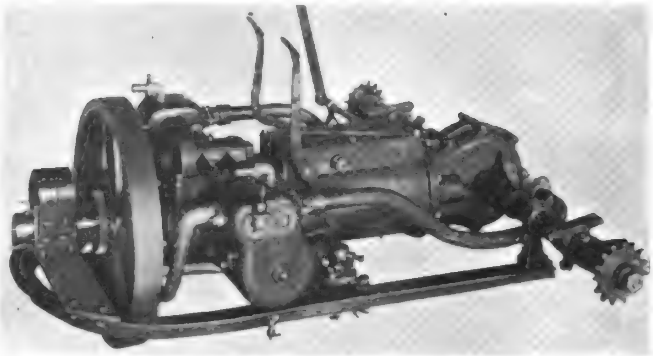
Rubber Road Coverings.

Alfred W. Leslie, in a paper read before the Rubber Congress in Great Britain, spoke of the future possibilities of rubber as a road making material. "As regards road paving," he says, "I have little doubt that in the course of a very few years the principal streets of the most important cities of the world will be paved with rubber. This material as a road covering has very many advantages over the present wood or asphalt covering. It is much more durable and more sanitary, noise is reduced to a minimum and mud to the vanishing point. * * * It is but a question of price which hinders the general adoption of rubber paving in our great cities. If a good rubber paving could be produced today at, say, $9.87 per square yard, as against $3.15, the present price of the best other materials in Great Britain—and I see no reason why this cannot be done—then in view of the much longer life of rubber as against wood or asphalt, which is about six to one, I am of opinion that this branch of industry should be at once opened out."

Messrs. Sizaire and Naudin, the French runabout manufacturers, on the Brooklands, England, track, recently attained the remarkable speed of 65.35 m. p. h. with a single cylinder car having a 4 inch bore and 10 inch stroke, in a 50 mile run.

NEW VEHICLES AND PARTS

The Hart-Kraft Model A3 Delivery Wagon.



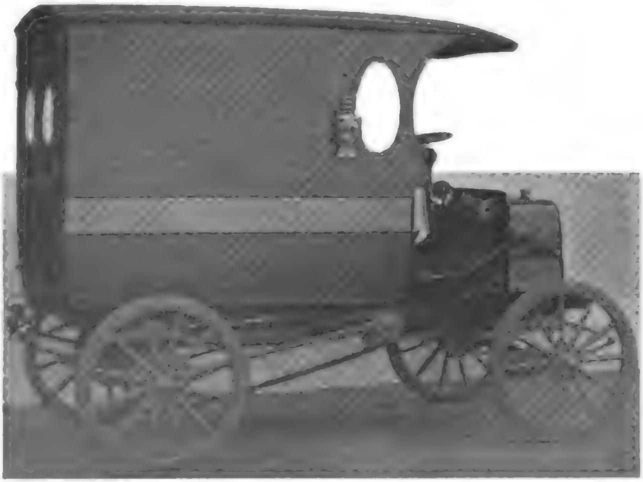
Unit Power Plant of Hart-Kraft Delivery Wagon.

The Hart-Kraft Motor Company, of York, Pa., have recently placed upon the market a delivery wagon, known as their Model A3. The motor is of the water-cooled, two-cylinder opposed type. The bore is 4½ inches and the stroke 4 inches. The inlet and exhaust valves are mechanically operated from a single cam shaft, both valves being located in chambers on top of the cylinder head and integral therewith. The crank case is in one piece, with openings for the cylinders, cover, flywheel and change gear bearings. The cam shaft and half-time gear and valve push rods run in bearings in the cover, so that the cover may be removed and replaced without disturbing the timing of the valves. The fan-bladed flywheel is located at the front of the motor on an extension of the crank shaft. Another extension at the rear carries the internal members of the planetary change gear. Ignition is by Splitdorf high tension magneto, which is driven from the crank shaft at the front end. Circulation is by thermo-siphon, a honeycomb radiator being fitted at the front of the wagon. Lubrication is by automatic oiler, glass sight feeds being placed on the dash. A Schebler carburetor is fitted. The change gear is of the planetary type, giving two speeds forward and one reverse. The high speed clutch is of the multiple disc type, and runs in oil. The change gear is enclosed in a circular gray iron casing bolted to the crank case at one end and to the differential casing at the other. A large square hand hole admits of adjustment of clutch bands, etc. The pedals and hand lever controlling the various speeds are mounted on the crank case. The differential is of the Brown-Lipe bevel and pinion type, and is encased in a crucible steel casing, which also encloses the bevel drive gears. Thrust on the bevel gear is taken up by a conical roller bearing against a conical face on the back of the gear. All gears within the differential casing run in an oil bath. The jack shaft is contained within seamless steel tubes, which are forced into extensions on the differential casing by hydraulic pressure. The half shafts run on Hyatt roller bearings. The sprockets are put on by pressure and keyed in addition, to prevent slipping. Brackets are fitted on the jack shaft tubing for bolting to the side members of the frame.

The above parts (motor, change gear and combined jack shaft and differential) are mounted on a U shaped T section steel cradle, and form a self contained power unit. Realizing the length of time usually consumed in making repairs to and replacements of portions of the power plant, the builders have constructed as above, so that the entire plant can be removed in two hours and replaced by another in about the same time. The suspension of the cradle is from three points, two of which are the brackets on the jack shaft casing, the third being at the front end where the cradle is bolted to a stirrup attached to the forward frame cross member. The method of attaching the various parts to the cradle is readily understood by referring to the cut of the power plant.

The final drive is by side chain to sprockets on the hubs of the rear wheels. Adjustable distance rods are fitted, running from tubular sockets on the jack shaft casing to the tubular rear axle over which the yoked ends of the rods fit and are retained in place by bolts and yoke keepers. The rear axle is of seamless steel tubing, the wheels running on Standard roller bearings. The front axle is a drop forging, the steering knuckles also running on Standard roller bearings. Full elliptic springs are fitted at both front and rear, and are underhung. The frame is of armored wood, the body being built integral therewith. Gasoline is carried in a 10 gallon tank located under the driver's seat. Steering is by hand wheel, with spur pinion and sector reduction gearing. Three pedals are provided on the footboard, the left hand one giving the reverse, the centre one giving low speed forward and the right hand one operating the contracting hub brakes. A latch device retains the brake pedal in any desired position. A lever at the side operates the high speed clutch. Spark and throttle levers work over toothed sectors on the steering column. The wheel base is 92 inches and the tread standard. Thirty-four by two inch solid tires are fitted all around.

The body shown is for delivery service and allows of a load of 1,000 pounds. A delivery speed of 20 miles per hour with full load is guaranteed by the manufacturers.

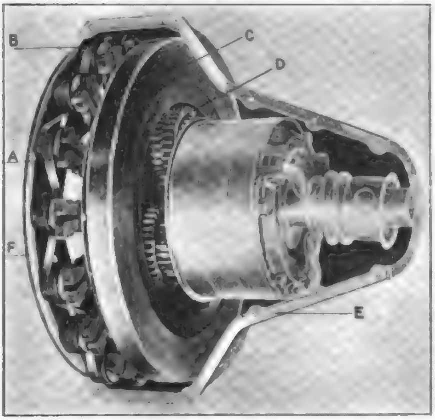


The Hart-Kraft Delivery Wagon.

Google

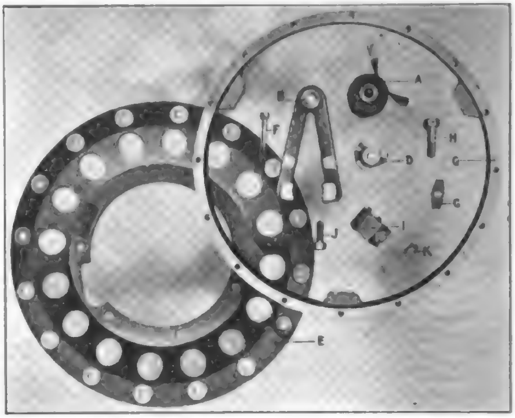
The Ford Magneto.

We show herewith a number of detail views of the magneto of the new Ford Model T. This magneto is of decidedly noved construction, avoiding all separate bearings and sliding contacts for collecting the current. It is of what is usually referred to as the inductor type of magneto generator, the armature coils being stationary and the field magnets being moved past them. Sixteen separate field magnets are used, made of vanadium-tungsten steel. They are of substantially horseshoe shape and secured to the side of the flywheel, as shown in Figs. 1 and 4 herewith. They are held in place by screws at their middle and by clamps near their poles, all the screws used for fastening them being securely locked in place by passing wires through their heads. Evidently the magnets are so arranged that like poles are adjacent to each other, so that the aggregation of magnets forms a sixteen pole field magnet crown. The magnets, instead of being placed close against the flywheel, are clamped against a ring of non-magnetic material (brass), so as to reduce the leakage of magnetism through the flywheel rim. At their middle the magnets are fastened directly to the flywheel, as at this point they are neutral and there can be no leakage to the flywheel. On a coil supporting ring F slightly in front of the flywheel is carried a series of sixteen armature coils. These are wound with heavily insulated magnet wire, and after winding are subjected to the so called vacuum treatment for impregnating them with an insulating compound. This vacuum treatment insures that the compound penetrates entirely through the coil and prevents air-bubbles, which are often the cause of breakdowns of high tension coils. In this treatment the coils are placed in an air tight receptacle from which all air is pumped, and the insulating compound is then introduced. It will be observed that the coils are so grouped around the supporting ring



A, one of the magnets; B, one of the armature coils; C, flywheel supporting magnets; D, transmission gears which form a part of the flywheel weight; E, portion of housing which encloses the magneto flywheel and change gear; F, coil support which is bolted to engine.

FIG. 1.—MAGNETO COMPLETE.



A, insulated armature coil; B, permanent magnet; C, brass ring separating magnets from flywheel; D, pole piece for coils; E, support for coils; F, bolt for magnet; G, clamp for magnet; H, second pole for magnet; I, terminal; J, bolt holding coil support to engine; K, nut for pole piece.

FIG. 2.—PARTS OF MAGNETO.

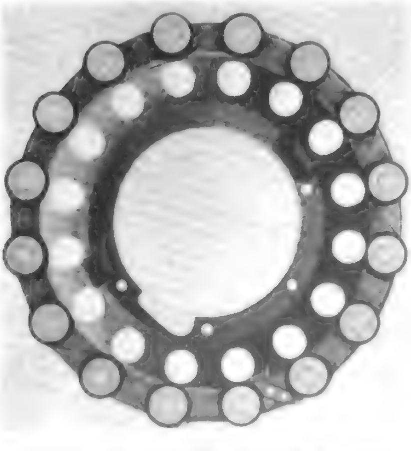


FIG. 3.—ARMATURE COILS ASSEMBLED ON CARRIER.

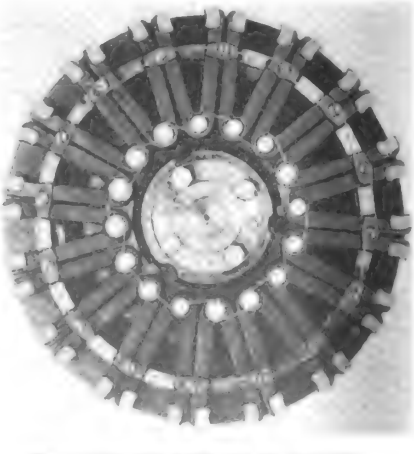


FIG. 4.—MAGNETS ASSEMBLED ON FLYWHEEL.

that the winding of adjacent ones is in different directions, the winding of one being clockwise, that of the next one counter clockwise, the next one clockwise, and so on. All of the coils are connected in series, and the terminals are brought out near the top of the casing. As the poles of the magnets are located opposite and very close to the coils, the magnetic circuits are completed by the cores of these coils and the coil support F. There are evidently sixteen electrical impulses produced during the revolution of the crank shaft and flywheel, although only two impulses are required for the ignition of the motor, one per stroke. However, as the armature circuit is closed only when a spark is wanted, a current only flows at that period, and there is no loss from the other impulses. The magneto generates a low tension current, and this must be transformed to a high tension current and distributed to the individual cylinders by means of a coil and high tension distributor in the usual manner. The magnets being secured to the revolving flywheel, they add to the flywheel capacity and the flywheel can be made proportionately lighter. It may be judged from the illustrations herewith that the magneto is of relatively large size, as compared with the usual ignition magneto, and it gives a sufficiently large spark for igniting the charge when the engine is turned over by hand, consequently no battery is needed for starting.

Motor and Manufacturing Works Cut-Out Valves.

The Motor and Manufacturing Works Company, of Geneva, N. Y., are putting out this year a full line of valves along with other attachments for handling exhaust gases, three designs of which valves are herewith illustrated. Fig. 1 represents a cut-out valve in which the valve opens outwardly and is held on its seat by a spring. The spring is placed at a sufficient distance from the hot valve stem to prevent the temper being drawn. The valve is made to open outwardly, so that in the event of a muffler explosion the valve will open and allow the gases to escape, thus preventing injury to the muffler. The operating mechanism is universal and can be connected to the pedal on the footboard without the use of pulleys or other mechanism. The yoke which carries the lever is free to turn round the valve stem and is held in any desired position by means of a screw, which clamps the yoke to a projection on the valve body. This form is intended particularly for manufacturers, and is made threaded for screwing on to the pipe or bored smooth for brazing to tubing.

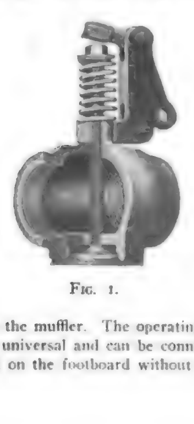


Fig. 1.

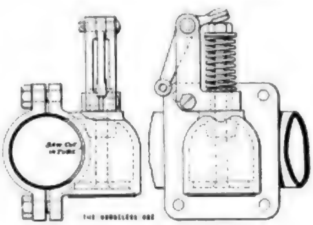


Fig. 2.—Clamp Cut-out Valve.

Fig. 2 shows a valve of practically the same design, but intended for clamping to the pipe or tubing by means of a flange. This type can be fastened to any tubing or pipe, without disconnecting from the engine, by cutting an opening in the tube or pipe with a hack saw and clamping the valve over the opening. The valve will work in any position desired, and is designed to meet the requirements of the repair man, or wherever it is intended to attach a cut-out valve to an engine that is already piped. The controlling mechanism in this valve is also universal and can easily be attached by a novice, it is claimed.

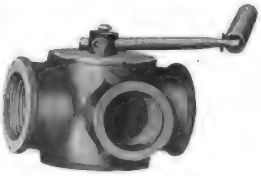


Fig. 3.

Fig. 3 shows a horn blowing valve, which is intended to be placed in the exhaust line between the engine and muffler. When the horn is not in use a free passage is left for the gases, and the connection to the horn is completely closed, thus preventing carbon or oil from passing down into the horn and clogging up the small passages. The controlling lever may be placed on either side and in any one of four positions.

The Elmore Screwdriver.

The Elmore Tool Manufacturing Company, of Hartford, Conn., have designed and perfected a screwdriver, known as the "Elmore drop forged," for general automobile work, which is claimed to avoid all objectionable features found in other screwdrivers. Among the special features of this tool is the ribbed protection on all sides of the wood part of the handle, which prevents cracks caused by shrinkage of wood. The entire driver, handle and ferrule, is drop forged from "best quality" steel. The end of the driver is made very heavy and flat on the extreme end, for hammering and other unusual work, which for automobile work is very often necessary. The style of both the butt and ferrule end is claimed to be such as to prevent cracking the wood scales by any such severe work. The driver is made not only with different styles and lengths of blades, but is made in several sizes of handles from very small to very large, and with both round and square shanks necessary for all kinds of work. The shape of the handle is oval. Hardwood oval scales, finely polished, are used.

Exhaust Joints.

Of the motoring mischances which annoy without necessarily delaying, none is worse than a leaky joint on the exhaust, which causes a car to spit like a vicious cat, instead of purring like a contented pussy. Many repairers and amateurs fall into the error of imagining that asbestos string makes a sound packing for exhaust joints, instead of using asbestos card, as they should. The temptation to use it is great, since if string be used there is no need to undo the securing bolts at more than one joint, as string can be inserted when a single joint has been prised apart a little. We saw a big car being repaired after this fashion on the Holyhead road, and when it caught us up 30 miles further north, it was spitting as badly as ever, and the passengers were looking very weary and shamefaced. The radial pressure of the exhaust at these joints is far greater than anyone would imagine, and it will soon blow out any string packing, unless the studs and nuts are big enough for an enormous wrench to be used in tightening. It is simply indispensable to use in all such repairs asbestos card, cut into proper washers, with a central hole fitting the pipe bore, and side holes for the boltheads to slip through. These packings will last a couple of years at the very least, and never blow out unless the nuts are allowed to work loose. The reason string is often substituted for card is that an extra joint has to be taken down to string the flange off the studs, so that the washer may be slipped in; but the additional trouble is labor very well spent.—*Autocar.*

Exact Information.

In a description of a new car of local manufacture an Illinois country paper says: "Aside from the motor the machine resembles the many other varieties of autos. A glimpse at the engine shows the difference from the others. Instead of chains and cog wheels the power is derived through shafts operated by friction. To the common individual that word 'friction' means little, but to the average fortunate one in possession of an auto, who understands all sorts of machine talk, it covers a wide area."

COMMUNICATIONS

Aluminum Solder.

Editor Horseless Age:

Will you kindly tell me the composition of the alloy or solder used to solder aluminum to brass or other metals? W. B. S.

[Aluminum does not solder very well, but the following composition is said to serve the purpose of a solder for this metal if the surfaces to be united are first thoroughly cleaned mechanically and a flux of a strong solution of hyposulphate of soda is used, into a bath of which the aluminum is placed for two hours prior to the soldering being attempted: Ten parts of tin, 10 of cadmium, 10 of zinc and 1 of lead. It is claimed that no aluminum solder known gives a permanent joint, and we cannot vouch for the efficiency of the above named solder. The best plan, if a strong and durable job is wanted, is undoubtedly to have the brass and aluminum welded together autogenously.—Ed.]

How to Suppress Offensive Fumes from Wood Alcohol Cooling Solutions.

Editor Horseless Age:

My experience with wood alcohol in the circulating system of water cooled automobiles is that the smell of the fumes given off is very strong. I put about a tablespoonful of cylinder oil into my water tank, which floats on top of water and alcohol, and keeps it from evaporating, and so practically does away with that bad smell.

C. E. McFadden.

Metaline Bearings.

Editor Horseless Age:

Referring to the inquiry of J. G. Zimmerman in your November 11 copy, I believe that the North American Metaline Company, 43 Third street, Long Island City, N. Y., can be of service, as in their advertisement in this week's *Iron Age* they offer both bushings and bearings requiring no oil.

Can you advise me what firms make four speed and reverse transmissions for cars of 1,500 to 3,000 pounds weight?

Wooglin Kennel.

[We do not know of any manufacturers of four speed and reverse change gears for the market, but shall be glad to forward any letters from manufacturers who may refer to this inquiry.—Ed.]

Avoid Sharp Corners to Facilitate Cleaning.

Editor Horseless Age:

I would like to call attention to one detail that seems to have been overlooked by automobile manufacturers. Parts, especially those about the wheels and running gear, should be so shaped that they can be easily cleaned. Take the rim of the wheel for instance. Most of them are made as shown in Fig. 1A. At X the dirt has to be dug out. They might as well be made as shown in Fig. 1B, in which case the dirt could be readily wiped or dusted off.

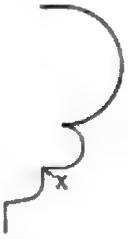


Fig. 1A.

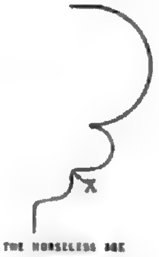


Fig. 1B.

There are many places about the axles, motor, etc., where the same principle applies. Such an improvement would be especially appreciated among owners, very many in number, who run and care for their cars themselves. A maker who would advertise that the lines of his cars were so laid out that the cars were readily kept free from dust and dirt, without injury to its beauty and utility, could certainly attract the attention of owners who had had experience in caring for cars. X. Y. Z.

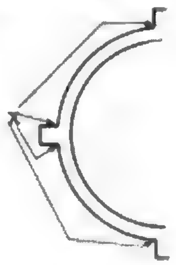


Fig. 2A.

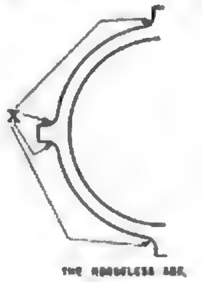


Fig. 2B.

Offset Crank Shaft.

Editor Horseless Age:

Every salesman knows the value of a "talking point." It is a well known method of advertisement, especially where competition is keen, to pick out some distinctive feature and place it in the lime-light, or to explain some known feature in a new way.

The advantages of this method were realized by the salesman who was demonstrating a novel type of gasoline engine at a county fair. This engine was a double opposed with two crank shafts and only one cylinder, the explosion occurring between the two pistons. The object of this arrangement was to secure a good mechanical balance and a quick expansion, but the salesman was not an engineer and he hit upon the following "talking point":

"Gentlemen—This engine is a wonder! It gives just twice the power of the single piston engine of the same dimensions. In the single piston engine all the pressure which acts upon the cylinder head is wasted, whereas in this engine it is utilized by the addition of another piston in the same cylinder."

It sometimes happens that the advertising department of some company is unfortunate enough to hit upon a talking point which is founded on a false theory. In an advertisement in a recent issue of The Horseless Age a well known company, in attempting to explain the advantages of an offset crank shaft, makes the statement that this feature "eliminates the dead centre." This it attempts to illustrate at length by the use of several cuts.

The advantages of offset cranks are well explained in the 1906 Engineering Number of The Horseless Age, page 566, but the advantage in question is not mentioned. It is true that offsetting the cranks, by the ordinary amount, displaces the angle between the out and in dead centres about 3 degrees, so that they are no longer exactly 180 degrees apart, but this is not enough to seriously alter the turning moment. Elimination of the dead centre means a constantly positive turning moment. Referring to Fig. 4, page 512, of The Horseless Age, May 6, 1908, it will be noted that overlapping the out and in dead centres by 3 degress would not produce this result. It is produced by a six cylinder engine, however, as shown in Fig. 5 of the same article.

L. E. French.

Ball Bearing Crank Shafts.

Editor Horseless Age:

I have persistently watched your columns for articles relative to ball bearing crank shafts, but have not seen anything at all on that subject. I firmly believe that the subject would interest a great many manufacturers, and that the adoption of this construction would benefit a large percentage of users who are more or less in favor of the reliable type of ball bearing so much in vogue for every other purpose except on crank shafts. No doubt there are a great many men who can prove conclusively that such an adaptation, provided the bearings are correctly mounted and the proper size is selected, will eliminate the bothersome necessity of taking up on shaft, as well as connecting rod bearings. I should be very much pleased to have you secure at least one article on this subject and have it fill a prominent position in your forthcoming Engineering Number. "Pawl."

Two Cylinders Weak.

Editor Horseless Age:

While reading your paper at my office this evening the thought came to me to ask you for a little personal advice. I have had more or less trouble this season with the engine of my four cylinder car missing. A local repair man told me that whenever a time came when I did not need my car for a considerable period, I should bring it to his place and he would remedy the trouble. I brought the car to his shop on October 12, and, the owner of the place being away, his men proceeded to overhaul my engine, putting in new valves, a new timer, new cam gears, etc., but after the engine was all assembled again we could get no power out of the cylinders No. 1 and No. 2, the two forward ones. They then tried a 1907 carburetor, when all the cylinders seemed to knock, so we ordered a new 1908 model ——— carburetor and put it on. I tried the car on October 22, but turned it back to them, and the foreman acknowledged that he would have to locate the trouble, and would time it again, etc. He is simply stuck. Cylinders 3 and 4 have plenty of power, but the other two are extremely weak. The compression is about the same in all, there are no leaks about the carburetor, the battery has just been charged, and new plugs are in the engine.

I have owned a car five seasons, but I am the sickest I have been in all my experience. It was hinted to me to write to the factory for information, but the garage owner came home to-day and perhaps he can locate our trouble. If you can suggest anything, however, it will be much appreciated. J. C. A.

[We cannot, from the mere statement that the two forward cylinders are weak, say what is the cause of this weakness, but we can point out a few possible causes of the trouble. The carburetor cannot be the cause, as if it furnishes a proper charge for one cylinder it will furnish a proper charge for all. This is not saying, however, that if one cylinder gets a proper charge, all will. Suppose, for instance, the exhaust valve springs on the two forward cylinders had become too weak through having lost their temper or for some other reason. Then these valves would not close promptly and the cylinder would draw back some of the spent gases from the muffler, which would mingle with the charge of explosive mixture and impoverish it. The trouble must evidently be with some of the parts whose action affects only the two front cylinders. An air leak at the joint of the inlet pipe to this cylinder pair might cause the trouble. The valves may not be lifted the proper distance, owing to wear of the cams or of the ends of the valve stems and push rods, or the timing of the valves may have been disturbed. The trouble may also be with the timer or the coils, though trouble with the electric system would most likely show itself by complete cessation of explosions in the corresponding cylinders, instead of merely a reduction in power.—ED.]

Metaline Bearings.

Editor HORSELESS AGE:

Mr. Zimmerman asks about "Metaline bearings." These are simply plain bronze bearings, having about half of their surface bored and plugged with special plugs of graphite held together by some substance that produces a very firm plug. I have used these bearings in most of my autos since '95 or earlier, particularly in the planetary transmissions. The idle pinions, for example, ran on studs three-quarter diameter by 1 inch long, and would not need new bushings on an average of once a year. Of course with a powerful engine there would not be a great amount of low gear work. The other bearings in the gear were longer and practically never needed renewing. The bearing on the shaft end which took the chain pull was about 1 inch diameter by 1½ inches long. These dimensions are from memory, and may not be exact, but are nearly so at any rate. Here the service was not so good. The constant pull to one side on such a small surface would tear it away, so that frequent renewals, two or three times per year, were needed. But this is to my mind indicates good service. Oil was never applied, and if it did get on the plugs it tended to soften them and roll the graphite out till below the surface, when the metal would cut quickly. This was the principal trouble with this form of bearing. Somebody insisted on oiling them. It was considered good practice to inject dry graphite when convenient, but there was no worry about it. The bearings were on duty anyhow. Even the high speed clutch was of cast iron female cones, bearing on a double male ring of bronze. This ring had a liberal sprinkling of plugs in its faces, probably 15 per cent. of its surface, and this decreased its wear to a very low point. By an occasional application of graphite I have been unable to notice any wear in this clutch for 1,000 miles at a time. These bearings are particularly adapted to loose pulleys, where the wear comes on all sides and where the attention required by an oil bearing is likely to be neglected. I do not think they run quite so freely as an oil bearing, but this was of little consequence in most places where I used them. L. A. Rhodes, successor to the N. A. Metaline Company, of Long Island City, can supply them.

CHAS. E. DURYEA.

Looks Forward to the Engineering Number.

Editor HORSELES AGE:

I look forward to the coming Engineering Number to be of great help to those contemplating the purchase of a new automobile. I will be in the field for a new five passenger car next season, and would like to know the following points, e. g.: What bearings are the best throughout the car? Some makers use annular ball bearings and others use roller bearings on rear wheels; also are ball bearings preferable to babbitt lined bronze at the ends of the crank shaft or Parsons white bronze or babbitt lined bronze for intermediate crank bearings? and, lastly, which is best, three or five crank shaft bearings?

L. P. WALBRIDGE.

Rainier Motor Car Company's Affairs.

The Merchants' and Manufacturers' Association, of Saginaw, Mich., through whose efforts the plant of the Rainier Motor Car Company was secured for that city, claims to hold a deed to the property of the company, and states that the local investors will not lose anything through the failure of the company. The association had a contract with the Rainier Company according to which it provided a factory site of 25 acres, free of cost, under condition that the company employ a certain number of men for a certain length of time. This condition of the contract was not fulfilled by the company, and the property therefore reverts to the association. A consultation between Receiver Jesse Watson, of the Rainier Company, and a number of Saginaw stockholders was held on November 10. It is hoped that the factory will be started up again at an early date, but no definite agreement seems to have been reached at the conference.

Automobiles in the Argentine Republic.

According to a recent report of a French commercial agent resident in Buenos Ayres the Argentine Republic imported during the year 1906 712 automobiles valued at 486,546 piastres gold, and in 1907 610 cars valued at 782,520 piastres gold. It will be observed that although the number of cars imported decreased from 1906 to 1907 the average value of the cars practically doubled. This is said to be due to the fact that the Argentine buying public in 1907 largely patronized the leading French and Italian makers, but the commercial agent remarks that the purchasing power of the public seems to have reached its limit, and that lower priced vehicles will be in demand from now on. The American motor buggy has made its appearance in Argentina, and a German firm is sounding the market with a combined passenger and goods vehicle.

The weekly publication, *Motoring Illustrated*, has been absorbed by the *Autocar* of London and Coventry.

E. De Rodakowski, who has managed the Brooklands, England, special automobile track ever since it was opened, has resigned.

The following statistics from the *Daily Mail* show the growth of the motor cab and decrease in the horse-drawn cab in London for the last six years:

	Hansoms.	Taxicabs.
1903	7,499	1
1904	7,137	2
1905	6,996	19
1906	6,648	96
1907	5,952	723
1908	5,095	2,273

A firm in Christiania, Norway, has petitioned the Norwegian Government to either remove the tariff on commercial automobiles entirely or reduce it to 5 or 3 per cent. ad valorem. The present tariff rate is 12 per cent., and it is contended that this cannot be regarded as a protective tariff, for the reason that there are absolutely no prospects that Norwegian factories will take up competition with the numerous foreign automobile factories in the immediate future.

GARAGE ITEMS

The Garage as a Conflagration Risk.

By J. E. Jennings.

In an article in The Horseless Age for August 26 on the danger arising from the misuse of gasoline, or rather carelessness by those handling this useful substance, it was delicately hinted from a knowledge of the trend of insurance men's opinion that in a short time the rates for the insuring of garages would be raised materially, both in the East and the West. That time has arrived, the managers of the insurance companies having determined that they could no longer stand the greatly increased demands on their reserves without attempting to recoup themselves in the only way open to them. Besides the increased rates there is also talk of demanding better protection from the garage man in the way of fire walls in lieu of the large open spaces customary in garages. It is thought that an inclosure for each car run into a garage will lessen the risk of complete destruction of the building. The expense would be considerable, but the scheme would pay in the end.

As remarked previously fire underwriting of garages has practically been without a scientific foundation, that is to say, insurance men have not reduced the subject to a science. Indeed, the whole business, being based chiefly upon experience and judgment, rather than knowledge, can never become nor be reduced to a science. It is from the well of experience that fire underwriters draw judgment. Their present judgment, resulting in agreement to raise rates, can hardly be grumbled at when it is remembered that the fires resulting in the destruction of garages and surrounding property have cost a million dollars, if not more, so far in this year of 1908. The destruction represented by a million dollars seems highly reprehensible when it is pointed out that the sum total of loss by fire in Paris, France, in 1907 was but $1,450,215. They apparently do things differently in France—and better.

So far as insurance is concerned the rates of premiums are approximated from experience. The underwriter learns from the records whether a class, garages, for instance, as a whole has been profitable or not. Exactness in the rate of premium is impossible, for the nearest approach to specific knowledge which is within the underwriter's reach is that which experience gives of the cost in the past of an average risk amid the thousands of its class. This is why the business is carried on upon lines of approximation, and why rates go up when the companies are hard hit on certain lines.

The garage as a conflagration risk at present occupies an unenviable position in the insurance field. Carelessness appears to be the cause of this, for the warnings of the dangers of explosions, etc., are practically without number. We as a people plume ourselves on the fact that our facilities for extinguishing fires are not approached by other nationalities. Such is undoubtedly the case, but what we want is what the other peoples possess in great measure—the art of preventing the outbreak of fires. In Europe the property owner is made severely responsible for any fires which may break out on his premises. When that is the case in the United States a great step will have been taken toward the elimination of carelessness. That great fault has undoubtedly been the cause of the majority of fires in garages, and the paramount question now is how to insure carefulness. The National Fire Protection Association, the National Board of Fire Underwriters, and similar organizations may be depended on to help along this good work. They certainly think that the garage risk, with its immense yearly losses, requires a vigilant eye and severer rules and regulations than now obtain. There can be few laymen who would entertain the opposite opinion. Our people must learn the lesson that they must be more careful, or be confronted with the possibility that the strong arm of the law may be employed successfully to this end. Leaving out the fire records in other directions—such as warehouses, dwellings, factories, etc.—it is humiliating to think that the garage, public and private, is responsible for the black eye it administers to the automobile industry as a whole, when its fire record is considered.

There is evidently much to learn on the part of the garage man, and those whose labors or interests take them to garages, about the art of keeping down the fire hazard in these necessary structures. There are many insurance organizations doing good work in the direction of learning the secret of keeping down the fire hazard; but what should be done is to pay attention to the personal hazard.

The leaders in the fire insurance business think that it would be worth while to try to control by law this serious phase of the business. The enactment of a law permitting an insurer to collect, in case of fire originating on his own premises, not more than 50 per cent. of his loss, and if such fire extended to the property of others then only such proportion of his own loss as the amount of loss and damage to his own property bore to the loss upon all property involved has been proposed, and there is no doubt that the insurance interests will work to that end.

There are no closer watchers and fomenters of legislation affecting their interest than the fire insurance companies. They contend that a premium is placed on carelessness and indifference, and, worse than either, incendiarism by the ease with which fire insurance is collected after fires and by the lack of thorough investigation. Under stricter legal restrictions, such as the passage of better building laws, the insurer would make sure that his building would be made safe, watchfulness against carelessness—apparently the cardinal sin in garages—would be vastly increased, and there would be present every known appliance for putting out a fire.

For the safeguarding of property, as above outlined, the companies would be willing to reduce rates from 30 to 40 per cent. In the meantime the garage as a fire risk will receive the strictest attention from them and their agents, and every means will be taken to see that they will not suffer pecuniarily so much as they have done recently. At present the cry is that there is no money in the business, and rates will undoubtedly be raised again if the recent increase prove insufficient.

There is undoubtedly much truth in the underwriter's assertion that there is very little margin left after paying the losses, although the number of garages is constantly on the increase, even in profitable years. At present it is the duty of everyone in the industry to assist and encourage the underwriters in their efforts to minimize the conflagration hazard in so far as garages and automobiles are concerned. The public, here and there, is also in arms against what is considered a prospective danger, and while its alarm may be pooh-poohed it will undoubtedly have the effect of bringing about more stringent building codes and in surrounding garages with other protective measures and appliances.

Philadelphia Automobile Show Plans.

The eighth annual automobile show under the auspices of the Automobile Trade Association of Philadelphia, Pa., will be held in the Second Regiment Armory, Broad street and Susquehanna avenue, from January 27 to February 3 next. The reason for the change from the First Regiment Armory on Broad and Callowhill streets to the newly selected building is that larger floor space is needed than the former building can provide. The Second Regiment Armory has several thousand more feet of space than that of the First. Exhibitors for the last two years have been complaining of the restricted spaces allotted to them, the spaces being only sufficient to show one car in most cases, while those showing several lines were cramped to such an extent that there was no room for spectators to get about. A number of prospective exhibitors were barred out, there being no room for them. These difficulties will be overcome in the new quarters, and it is hoped that space can be provided for all. The management will be the same as in former years.

The commercial automobile owners of Berlin, including numerous taxicab owners, as well as business houses using motor delivery wagons, have been considering to form an organization to protect their interests.

OUR FOREIGN EXCHANGES

New Magneto for V Motors.

The type of double cylinder engine in which the two cylinders make an acute angle with each other and in which the two pistons work on a common crank pin has recently come into extensive use on motorcycles, and the provision of a magneto for the ignition of such motors has been quite a fine problem for magneto manufacturers. In the ordinary magneto with two pole field and revolving H type armature two electric impulses are produced per revolution, these being evenly spaced and opposite to each other in direction. In a two cylinder, four cycle motor only one spark is required per revolution of the motor, and the magneto can, therefore, be driven at half motor speed or cam shaft speed. If the angle between the two cylinders of a V motor is designated by α, the explosion in the two cylinders follow each other at irregular intervals, corresponding to angular motions of $360^\circ + \alpha$ and $360^\circ - \alpha$. The magneto running at half this speed, half these angular motions of its armature correspond to the same time intervals, and the magneto should, therefore, produce sparks at time intervals corresponding to $180^\circ + \frac{\alpha}{2}$ and $180^\circ - \frac{\alpha}{2}$. In order that the output of the magneto may be utilized to the greatest advantage, the maximum voltage induced in its armature coil must coincide in time with the periods of ignition of the two cylinders respectively, and if we are able to produce a magneto in which the two impulses induced during a revolution, instead of being spaced evenly, 180° apart, are spaced unevenly, so that one follows the other at $180^\circ + \frac{\alpha}{2}$ and the next one follows at $180^\circ - \frac{\alpha}{2}$, the problem is solved.

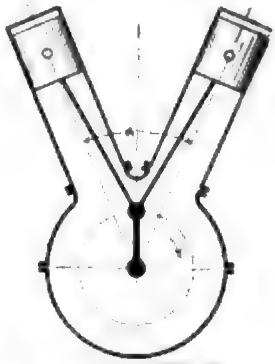


Fig. 1.—V Type of Engine.

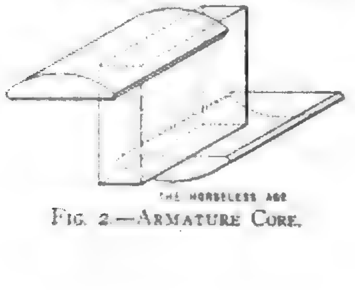


Fig. 2.—Armature Core.

The following described very interesting solution of this problem is due to the firm of Robert Bosch, of Stuttgart, Germany. As shown in the isometric prospective view of the armature core herewith, the two pole shoes of the shuttle armature are displaced longitudinally with respect to each other, one shoe extending beyond the central part of the shuttle at one end and the other shoe at the other end, the inner end surfaces of the two shoes lying in the same medium plane of the magneto. The pole pieces of the magneto also change in section at the middle of their length. Referring to the front elevation of the magneto herewith, the front half of the left hand pole piece subtends a comparatively small arc of the circumference, while the rear half subtends a considerably greater arc. Correspondingly, the front half of the right hand pole piece subtends a comparatively large arc of the circumference, and the rear half a small one. In the drawing the halves of the pole pieces and the armature core which are near the reader are cross sectioned. The voltage induced in the winding of the armature attains its maximum when the pole shoes of the armature are midway between the pole pieces of the field, as then the direction of the magnetic flux through the armature core is reversed. It will be seen that the armature is shown in one of these positions of maximum voltage. The next position of maximum voltage is reached after an angular motion of $180^\circ + \frac{\alpha}{2}$, as indicated in dotted lines. Then both armature pole pieces are again midway between the field poles at their respective ends of the magneto. From the period of this maximum voltage to that of the next an angle of $18^\circ - \frac{\alpha}{2}$ must be passed through by the armature.

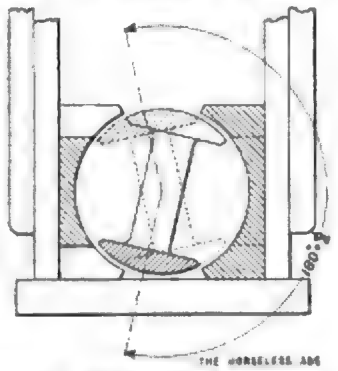


Fig. 3.—Magneto for V Motors.

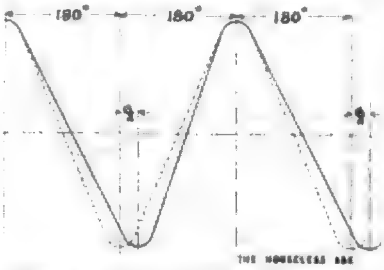


Fig. 4.—Voltage Wave Diagram.

The accompanying diagram shows the voltage curve obtained with such a magneto, in full lines, and the curve obtained with the ordinary magneto, whose maximum voltages are spaced evenly, 180° apart, in dotted lines. The same object may be obtained by giving both the field pole faces and the armature pole faces a different width at opposite ends, but the construction here described is the simplest, and is preferred by the manufacturers.

Paris Salon May Become a Biennial Event.

There is a movement afoot among the large manufacturers in France at the present time to do away with the annual automobile show in 1909, and to have a show only once every two years from now on. The larger manufacturers feel that they do not derive any great benefit from these shows, while it causes them a great deal of expense, consequently they have circulated a petition among all manufacturers who turn out more than 100 cars per year, requesting them to furnish a bond for 50,000 francs to guarantee that they will not take part in any show in France next year. If a considerable proportion of these manufacturers agree to the proposition the circular will also be sent to the smaller manufacturers. It will be remembered that the German Automobile Manufacturers' Association last year decided not to participate in any automobile show in that country this year, and in consequence of this decision there will be no automobile show in Germany the coming winter. Whether the plans of the large French manufacturers will go through is as yet rather questionable. M. Baudry de Saunier, commenting on the subject in his *Omnia*, thinks that the present movement will come to naught, for the reason, he says, that the holding of a show is not dependent upon any one man or one building, and even if a considerable number of manufacturers should decide not to exhibit, there would be others who would consider it to their advantage to show their vehicles, and they would readily find the necessary building and show manager. It would be a misfortune to the national industry, he says, if an exhibit in some music hall by a score or so of second rate manufacturers should be presented as the Paris automobile salon.

The Society of Motor Manufacturers and Traders, whose show at Olympia, London, is now running, decided that there should be no demonstrating outside the building, and prohibited the stationing of cars either in the grounds surrounding the building or in the private roads leading to Hammersmith road entrance of Olympia.

The Tendencies of French Design.

To all appearances 1909 will be a small car year in France. The majority of cars turned out will be under 20 horse power, the average being about 8-10. Single cylinder motors and four cylinder models are about equal in numbers, the former being built as high as 12 horse power. Up to date there have been no motors of that power with more than four cylinders, but it is expected that at least one firm will market a six cylinder motor of 10-12 horse power.

The tendency is toward simplification, not only in the parts, but in the control. It is no longer essential to be an expert to drive a car. Prices have been considerably reduced, partly because the cost of manufacture has been reduced, and partly on account of strong competition. As to the motor, it is being gradually freed from manifolds and piping, the most popular form of four cylinder being the block type with inlet and exhaust passages cast in the motor. The single cylinder motor has numerous advocates.

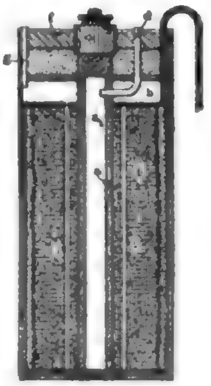
The governor, which is looked upon by many as an unnecessary adjunct, has practically disappeared. As regards lubrication, the force feed system seems to be in the lead, the splash system being almost extinct. Oiling by pressure, as used in the Delaunay-Belleville, has won many partisans and has the advantages of positiveness and a total suppression of smoke. The tendency is toward high tension magneto ignition with separate distributor and coil, the latter being mounted on the dash for accessibility. The Mercedes type of bonnet is disappearing, and the old Darracq and Renault type are increasing rapidly. Renault's radiating system, brake, regulators, etc., are being adopted, or modified by the majority of designers, the greater accessibility resulting from the use of these devices being the chief cause.

The cone clutch holds its own well, even claiming as a "convert" one of the multiple disc users, the De Dion firm, which, however, uses it only in its 8 horse power single cylinder car, probably from motives of economy. The multiple disc clutch has had a slight falling off, while the contracting band and expanding shoe clutches have not increased in number to any extent. There are few structural changes in frames, the pressed steel type being almost universally used. Frames are not made so large, but just sufficient to accomodate comfortable bodies. There is a tendency also to reduce the wheel base.

Accessibility of all parts is now a feature of nearly all cars. The time needed to dismount and replace the clutch has been greatly reduced and there is a marked tendency now to facilitate the rapid removal of the change speed gears and rear axles. The majority of cars are fitted with three forward speeds only, while a few still have four speeds. The reduction in price is doubtless responsible for the return to the three speed gear, it being estimated that the difference in cost between a four speed gear and one of three speeds is from 30 per cent. to 50 per cent. More attention, too, is paid to the advice and ideas of agents and users than was previously the case.

A Ventilated Dry Cell.

The Dewa dry cell, in which the carbon rod is made hollow from the bottom to near its top, and the opening in it communicates with the atmosphere, is described in a recent issue of the *Electrician* of London. It is claimed that as a result of the opening in the carbon, which communicates with the atmosphere through a special tube *d*, passing through the seal *f*, depolarization is largely prevented. The depolarizer *b*, which surrounds the carbon rod, is, in addition, ventilated through the hollow in the latter and is also ventilated through a tube *g*, which projects into a hollow space above the depolarizer. In one type vertical channels *i* have been provided in the depolarizer to allow of increased air supply and to promote the expulsion of the gas. In some cases a special ventilating space is also placed at the bottom of the cell, while instead of the tube *d* ventilation of the carbon can be effected through the tube *g*. This system of ventilation, it is claimed, "allows any free hydrogen to be quickly removed from the carbon, while at the same time the depolarizer is provided with fresh supplies of oxygen, thus increasing both the efficiency and life of the cell." Cells of the size 3x3x6.8 inches and weighing 4.4 pounds each were tested by the Reichsanstalt. One cell was kept on open circuit to observe the changes of voltage, while each of the other two was connected through a resistance of 10 ohms until their terminal voltage had decreased 0.4 volt. In a period of 128 days the e. m. f. of the open circuited cell decreased from 1.59 to 1.51 volts, while the e. m. f. of the other two cells in eighty-six days reached the limiting value of 0.4 volt. These cells, in coming down to 0.8 volt, gave out about 100 ampere hours, while when still kept in circuit till their voltage had reached 0.4 volt, they gave out about 60 ampere hours additional.



Dry Cell.

Parisian Anti-Smoke Apparatus.

The Automobile Club of France has installed an anti-smoke apparatus in its garage on the Place de la Concorde in Paris. As is well known, the Paris police handle severely any infractions of the ordinance against the emission of smoke from a motor car, even a slight amount of vapor emerging from the exhaust sometimes causing a summons to be issued. Running down a side street and drawing off the extra oil is of no avail, summonses having frequently been issued against motorists who were trying to stop the emission of smoke. The apparatus at the Automobile Club consists of a flexible pipe fitting over the end of the exhaust pipe and leading to the garage chimney by suitable connections. An electrically driven fan insures a proper draught. It is proposed to fit a number of such apparatus to garages in various parts of the city, so that motorists can run into one of these garages and draw off excess smoke instead of staying on the streets and being summoned by the police.

The Berna Motor Car Works in Berne, Switzerland, have taken over the Berna Motor Works in Otten, and have been reorganized as Berna Commercial Motors, Limited, being evidently financed with English capital.

The London Improved Cab Company, whose recently published semi-annual balanced sheet showed a loss for the first time in twenty years, has decided that as horses and cabs are being retired, they will not be replaced, but the motor cab department of the company will be increased instead. The company has decided to place 750 motor cabs on the streets of the metropolis.

At a meeting of motor-phobia interests held at the Mansion House, London, a few days ago the Duke of Northumberland proposed that in cases of violation of the speed laws the cars of the offenders be impounded for certain lengths of time. The following resolution was carried by the conference: "That this conference of delegates from local authorities throughout the country earnestly calls upon the Government to introduce without delay fresh legislation for the better protection of the public from the abuses of motor traffic."

The rapid development of automobile traffic in Zurich, Switzerland, is shown by the following statistics of the traffic police: In 1904 the city had 133 automobiles and 157 motorcycles; in 1905 201 automobiles and 182 motorcycles; in 1906 257 automobiles and 212 motorcycles; in 1907 348 automobiles and 257 motorcycles. In September, 1908, the automobiles had exceeded the 400 mark and the motorcycles the 300 mark. Consequently the number of automobiles has trebled in the course of four years, while the number of motorcycles has not quite doubled.

Commercial Applications.

Commercial Motor Vehicle Development in New York City.

(Continued.)

By H. H. W.

In making an investigation of the various installations of commercial vehicles in New York city, the assumption is confirmed that where the proper conditions exist and the vehicles are given the proper attention, the motor vehicle can be operated on a more economical basis than an equal horse service, and offers the further advantages of greater convenience and cleanliness. It seems to be the universal opinion that the motor vehicle, either of the electric or gasoline type, is bound to eventually take the place of the horse. The majority of users of both types of vehicles are of the opinion that the gasoline motor truck will be the universally used type, and unless great improvements are made in storage batteries, tending to make them more durable and less costly, this condition of affairs must of necessity come about. There are, of course, some users of electrics who are thoroughly satisfied with their service, just as there are users of gasoline trucks who are dissatisfied, and this condition of affairs will always prevail to a greater or less extent. There are undoubtedly several makes of gasoline trucks on the market to-day which will give satisfactory service if properly taken care of, but taking the general run of gasoline commercial vehicles it is doubtful if they can show marked advantages over the electric. The writer does not believe that this state of affairs will last, for, without doubt, in a few years, when manufacturers have become better acquainted with the conditions and requirements of motor vehicle service, the gasoline truck will prove itself superior in many ways to the electric. The electric, of course, has a field of its own and for purely local service will undoubtedly be used by many in conjunction with the other type.

Reverting to the question of batteries for electrics, if they could be so made as to be capable of supplying sufficient current for 100 miles on one charge, without being of prohibitive size, weight and cost, and yet have about the same lease of life, the electric truck could undoubtedly hold its own with the gasoline truck. The best men in the electrical profession have been working on this problem for years, yet comparatively little advance has been made. Much was expected from the Edison nickel-steel battery, and, while it undoubtedly has its advantages, its present high first cost has proven a serious drawback. Several users of electric trucks in New York city have in use, for purposes of comparison, representative forms of the Planté and Faure types of lead batteries, and the Edison alkaline type, but have not used them for a sufficiently long period to enable final conclusions to be drawn as to the superiority of the latter, although one firm has had one of the latter batteries in use for about four years, during which time no renewal has been required. Inasmuch as the ordinary lead battery requires renewal on an average of once a year, at a cost of between $300 and $400, the total cost of upkeep in four years would amount to about $1,500, as against the first cost of about $1,000 for the Edison nickel battery, thus showing, in this case at least, a saving of about $500; besides, this battery is claimed to have the advantage of requiring less attention. Whether or not this remarkable showing can be duplicated by the average user remains to be proved.

An attempt has been made to classify the users of commercial vehicles under several general heads. Thus, for instance, under "Dry Goods" are included department stores and all dealers in cloth goods, clothing, etc., while under the head of "Hardware" are included dealers in steam fitters' supplies and manufacturers of such goods as would come under this head. In some cases it may be necessary to add a supplementary list at the end of the article for those firms about which no data can be obtained at present.

ALCOHOL.

James A. Webb & Sons, 52 Stone street, dealers in denatured alcohol, have had in use for over a year one five-ton gasoline truck, and during this time it has given very satisfactory service. Alcohol is used for fuel, with (to them) very satisfactory results. The engine compression is carried as high as 115 pounds per square inch, to permit the use of this fuel on as economical a basis as possible. It is doubtful, however, whether the company would use this fuel if they were not dealers in it, as it is undoubtedly more expensive than gasoline, even with the use of the higher compression in the motor. The company gives as one reason for its use of this fuel that it is allowed on the docks, along with the electric trucks, which at present is an advantage, but it is doubtful whether the discrimination against gasoline trucks will continue for long, as the manufacturers of these trucks are fighting the measure that bars their trucks and they already have gained access to a few docks. This truck is used for general hauling purposes to and from the docks and for general delivery purposes throughout the city. It has also made long runs as far as Stamford, Conn., without any trouble of any kind. No figures are available as to operating expenses, but the company states that they are perfectly satisfied with its use. There have been times when there was no work for the truck, and rather than have it stand idle they rented it with its driver, at different periods, to a neighboring concern, to the satisfaction of all concerned. To those so inclined this feature can undoubtedly be made very profitable.

COAL, ETC.

Burns Brothers, 50 Church street, have experimented with a number of motor trucks, but are not satisfied that in the present state of the industry they are more economical than horse service.

H. L. Herbert & Co., 143 Liberty street, have had in operation for over eight weeks a seven-ton electric truck which, for the time it has been in service, has done satisfactory work. The truck has been used regularly hauling full loads, making deliveries uptown as far as Ninety-seventh street. Records have been kept of the work performed over a period of thirty days, extending from August 25 to September 24, 1908, during which time ninety-nine trips were made covering a distance of about 365 miles. On these trips a total of 1,337,000 pounds of coal were hauled at a cost of about $150. The time consumed both going and coming was 113 hours. The truck is charged at the yards from the Edison circuits, and the battery is capable of supplying current for eighteen miles. This truck is really being tried as an experiment, and if it proves practical the service will be increased.

The National Coke and Coal Company, a subsidiary concern of the Consolidated Gas Company, has had in use for some time a five-ton gasoline truck for hauling coke, but no data is available as to its use.

CONSTRUCTION.

The Terry Construction Company, 90 West street, have had a five-ton gasoline truck in use for over four months, using it for the transfer of their various construction machinery and materials to their different scenes of operation. This work takes the truck all over the City of Greater New York, up into the northern surburban districts and over to New Jersey, many of these runs being made with considerable overloads. It is fitted with an auxiliary winch, driven by the motor, which in their work adds greatly to its usefulness. It has not been in use long enough to tell conclusively as to its economy over horses, but the company is fully satisfied with the service that it is giving, stating that the truck is being used on work that it would be impractical to use horses for.

DRY GOODS.

Aitken, Son & Co., 873 Broadway, have in use several light electric delivery wagons, but do not care to express themselves concerning the work of these vehicles at present, further than saying that they feel that their delivery service has been improved. They have not used them for a long enough time to draw conclusive results as to their economy, and therefore do not care to give out any data as to their operating expense.

B. Altman & Co., Fifth avenue and Thirty-fourth street, are using several light electric delivery wagons in their delivery service, but no data is available as to their use or operating expense.

Arnold, Constable & Co., 881 Broadway, are using eleven electric wagons and four two cylinder gasoline cars in their delivery service. The gasoline cars are used for surburban work and the electrics in the Borough of Manhattan. Their heavy and long hauls are done by horses, as they have not as yet developed the heavy motor vehicle for this class of service. The cars are housed in their private garage, where all necessary work is done on them. No data is available as to operating costs, but they say that the service has proved very satisfactory.

Best & Co., 60 West Twenty-third street, are using several motor vehicles in their delivery service, but do not care to give any data as to what success they are obtaining from them.

Bonwit, Teller & Co., cloaks, 62 West Twenty-third street, are using two light gasoline cars, which they contract for from a company making a specialty of this kind of business. They did not care to say, however, what satisfaction this arrangement was giving.

H. B. Claflin Company, 224 Church street, have been users of electric trucks for over five years, having a total of twelve trucks in use at present, of one and three tons capacity and of two different makes. All of these trucks have given fairly satisfactory service, but to be perfectly satisfactory they consider that the trucks should be capable of at least forty miles on one charge, at a speed of not less than seven miles an hour. Heretofore no electric trucks have been capable of doing this, but they are now trying some new electrics with a single motor drive from which they hope to obtain such results. However, these have not been in use long enough to draw definite conclusions. They have a garage of their own where entire care is taken of the trucks. No data is available as to operating expense.

Deering, Milliken & Co., 81 Leonard street, have had one electric truck in use for about two years, and say that while it is more expensive to operate than an equal horse service, the greater convenience in certain lines of their work causes them to consider it worth the added expense. They placed the truck at first in the hands of their teamster, who only had to pay for the operating expense. After a short period of use this man refused to continue with it, because of the expense, and the company took it back and have been operating it themselves since. No figures are available as to operating expenses.

Einstein, Wolff & Co., 443 Broadway, used a 1,500 pound electric truck about a year ago, which while in use gave satisfactory service. It was destroyed by fire, however, and they have never replaced it. No figures are available as to operating expenses.

Fleitman & Co., 484 Broome street, used two electric trucks about three years ago but no data is available as to their use. They were destroyed by fire and never replaced.

Jas. A. Hearn & Sons, 20 West 14th street, have one of the largest motor vehicle delivery services in the city. Little data is obtainable as to this installation, however, beyond the fact that at present they have thirty-eight machines in use, twenty-eight of which are electric, of two different makes, and the rest are gasoline, some of them of what they claim as their own make. These cars are used to supplement their horse service, the gasoline cars being used principally on long hauls. No data is available either as to their use or operating expense, but the vehicles are evidently giving satisfaction as the firm will shortly put in service two more cars, making a total of forty machines. The electrics are housed in their private garage on West 13th street, where complete facilities are provided for charging and repairing. The gasoline machines are housed in another garage further uptown.

A. J. Hyde & Sons, cotton goods, 361 Broadway, have had in use for over a year two electric delivery wagons of one ton capacity each, and say that during this time the vehicles have given very satisfactory service. While no figures are available as to operating expenses, they are satisfied that the cars are cheaper than an equal horse service. The cars are stored in a public garage where care is taken of them according to a contract which covers storing, washing and charging. All minor repairs are made by the drivers. The cars are capable of a speed of twelve miles an hour and the battery supplies current sufficient for 30 miles on one charge. They also had a three ton electric truck in operation some time ago, but it proved unsatisfactory, and they gave it up.

R. H. Macy & Co., 34th street and Broadway, have one of the largest and most efficient motor vehicle delivery services in the city. Their equipment at present consists of thirty electric delivery wagons of one ton capacity each, and one gasoline truck of three tons capacity. The latter is used for the delivery of merchandise to their distributing depot at Woodlawn and the electrics are used to supplement their horse service in the Borough of Manhattan. Before the installation of the present service, which is about four years old, they had tried other types with varying degrees of success, but their service now is so satisfactory that Mr. Price, their superintendent, expresses it as his opinion that within five years all of their delivery service will be by motor vehicles, either electric or gasoline. When one realizes what the installation of a service of this kind means with a firm like R. H. Macy & Co., it certainly would show that when properly handled the motor vehicle can be made more efficient and economical than a horse service. The exclusive use of motor vehicles would in their case mean doing away with something like 500 horses, used for their present delivery service, which covers New York city, with depots in Hoboken, Newark and Hackensack, N. J.; Brooklyn and Flushing, L. I., and Staten Island. The whole of their present equipment of motor vehicles is housed at their garage, which is in the rear of their store, on the street level, and takes up all of the accommodations they have here for this type of cars, and any further addition would mean storing outside, which they do not care to do. When the time comes they will build a special garage to accommodate their increased equipment. At their present garage in their store they have complete facilities for caring for the batteries and making all minor repairs to the cars. All heavy repairs must be done outside, but there has been little need of such repairs. They generate their own current and have a complete switchboard for controlling the main line current, the current from the motor driven booster—used when the line voltage is too low—and for controlling the amount of current used in charging the batteries in the cars. This part of the switchboard is divided into panels, one panel for each charging plug placed on the wall in the garage, from which the leads run to the vehicle. Each panel has a volt-ammeter, switch and rheostat for controlling the current used in charging the battery, and this switchboard is in the hands of a competent electrician, whose duty it is to see that each battery is being properly charged. Each battery is dropped from its car at regular intervals and tested, a spare battery being put on its place, and the car thus kept in operation. If the battery is found not to be up to the required mark, it is at once overhauled, and to this carefulness is undoubtedly due their success with their batteries, as some of them have lasted as long as seventeen months. They are using electrically formed, pasted and alkaline batteries, the latter being used for long runs, being capable of supplying current for fifty miles. A car fitted with such a battery was used for special delivery work for about a month last year, making runs to Far Rockaway and return on one charge. At longer intervals the batteries are thoroughly washed and overhauled and any bad plates replaced. No figures of operating costs are available, but the company are satisfied that they are more economical than horse service.

(To be continued.)

California Stage Line Grows.

The automobile stage service between Glamis, on the Southern Pacific Railroad, in California, and Palo Verde, on the Colorado river, has been increased by the addition of two 50 horse power touring cars. The Palo Verde valley has been subdivided and a number of new settlers have bought small tracts, making increased transportation facilities a necessity. The present stage line has the contract for carrying the mails to Palo Verde. The postmaster general has been petitioned for two other post offices in the valley, and, if the request is granted, the auto stage line will probably obtain the additional contracts.

Commercial Notes.

The City Council of Oshkosh, Wis., has decided to purchase an automobile for the fire department.

The Board of Health of Newark, N. J., has appropriated $2,500 for the purchase of a motor ambulance for the City Hospital.

A taxicab company has been organized at South Bend, Ind., and promises to have cabs on the streets of the city inside of two weeks.

A motor truck is now being tested in express service between Denver and Greely, Col. If the trial proves satisfactory a regular service will be established.

The Maxwell-Briscoe Motor Company put on 100 additional men at its Newcastle, Ind., plant about a week ago. Most of the men came from Cleveland.

The Hart-Kraft Motor Company, of York, Pa., is reported to have received an order for 1,100 light gasoline delivery wagons from the Post Motor Company, of 1623 Broadway, New York.

The Manhattan Auto Company, of New York, has sent one of its sightseeing cars to Jackson, Fla., for the winter, where it is to make four daily round trips for the accommodation of sightseers.

The agricultural tractor used by two farmers in the northwestern portion of Kansas, to which we referred to in a recent issue, is manufactured by the Transit Thresher Company, of Minneapolis, Minn.

The Crystal Park Company was recently incorporated in Colorado with a capital stock of $780,000 to connect Crystal Park with Manitou, Col., by a private automobile road, and to operate a regular service of cars.

Mayor A. J. Horlick, of Racine, Wis., recently recommended that a car be purchased for the Racine fire chief, and promised that if the city did this, he would donate a like machine for use of the police chief. His offer will be accepted.

The Autocar Company, of Ardmore, Pa., who only recently entered the commercial field, have added to their line a 20 horse power motor station bus, seating nine passengers. The interior of the car is finely upholstered, ventilated and heated.

The Continental Motor Manufacturing Company, of Muskegon, Mich., have recently placed in service a 3 ton gasoline truck, made by the Commercial Motor Truck Company, of Columbus, Ohio, whom the Continental Company supply with engines.

All of the large plumbing, pipe and tool supply dealers in Indianapolis are now using automobile trucks, the Indiana Supply Company having just purchased a 30 horse power truck to look after its Indianapolis work. The Central Supply Company has a truck and also uses runabouts for its city and traveling salesmen. Knight & Jillson use two trucks with excellent success.

The Excelsior Laundry Company, Indianapolis, has purchased a 30 horse power automobile delivery wagon, with which it expects to experiment with the question of making city collections and deliveries of laundry with motor cars. This is the first Indiana concern to employ motor vehicles in this manner, and it is the intention to displace its whole horse drawn equipment if the present experiment is satisfactory.

Merger Rumors Persist.

The rumors of a big merger in the automobile industry, to which we referred in our issue of October 21, have continued to re-echo in the press, though most of the information regarding the negotiations that were apparently carried on has been of a negative character—denials by officers of firms said to be involved in the deal that they knew anything about the matter. A positive statement has been made by President Kobusch, of the St. Louis Car Company, to the effect that he had been approached by the Morgan interests, which were reported to be engineering the merger, but that his company would not enter into the combine. The three firms whose names are being most persistently linked with the movement are the Olds, Buick and Maxwell concerns. The Olds Motor Works have just announced a $1,500 four cylinder car, which is regarded in some quarters as a sign of a selling alliance between the Olds and Buick concerns.

Suggested "Non-Repair" Competition.

Col. George Studebaker, of the Studebaker Automobile Company, suggests that a "non-repair" competition be held in connection with next year's Glidden Tour, wherein all participating cars shall have their bonnets and tool boxes sealed, no repairs are to be allowed and the reports of the observers are not to be shown to the contestants until the contest is finished. It is proposed to incorporate this competition into next year's Glidden Tour, and Col. Studebaker offers to present a $5,000 trophy if the touring committee of the A. A. A. will agree to the contest. There will be no restrictions as to price or power, and any car may enter the contest. In order to win the trophy, a car will have to go through the entire tour without requiring a repair or having one made The rules and conditions other than the above will be left to the touring committee of the association.

Free Lectures on Automobiles.

The following series of free lectures on automobile subjects will be given at the Brooklyn Public Library, South Branch, Fourth avenue and Fifty-first street, by W. W. Ker: Tuesday, November 24, "The Gasoline Automobile—Part I." (The gasoline engine. Action of the carburetor. Dependence of explosive force upon proportion of gasoline and air. Illustrated by experiments and stereopticon views.) Tuesday, December 1, "The Gasoline Automobile—Part II." (The ignition system. Magnets, batteries, coil and spark plug. Illustrated by experiments and stereopticon views.) Tuesday, December 8, "The Gasoline Automobile—Part III." (Pneumatic tires. Substitutes for pneumatic tires. Acetylene generators and lamps. Illustrated by experiments and stereopticon views.) Tuesday, December 15, "The Electric Automobile." (Storage batteries and their care; charging from alternating currents; speed control. Illustrated by experiments and stereopticon views.)

Detroit Show Dates Fixed.

The Detroit Automobile Dealers' Association, which last year held a show at the Riverview Park, has decided to hold another show this year at the Wayne Pavilion, and the date has been set for February 15-20, the week immediately following the Chicago Show. Until last year the Detroit Show was run by private parties, among whom were William E. Metzger and Seneca Lewis. There was at that time no building in the city large enough to accommodate all those who wanted to exhibit, with the result that last year two separate shows were held, the first one in the Light Guard Armory and the second one in the Riverview Park, 3 miles from the city. Since that time the big Wayne Pavilion has been completed, and the Dealers' Association having secured it for the purpose of an exhibition, the former show promoters voluntarily withdrew. E. LeRoy Pelletier, advertising manager of the E-M-F Company, has been appointed manager of the show.

Society of Automobile Engineers to Meet in New York in January.

The Society of Automobile Engineers will hold its fourth annual meeting in New York city during the course of the shows, and in order that all members who may come to New York for the purpose of attending either one of these functions, may have an opportunity of being present, a dual date has been decided upon. The first sessions will be held Tuesday, January 5, adjourning to Tuesday, January 19, the first date falling in the week of the show to be held in the Palace under the auspices of the A. M. C. M. A., and the second during the week of the "Licensed" Show at the Garden. In addition to an interesting list of technical papers, the annual election of officers will be held. Further details of the places of meeting and the remainder of the program will be made public as soon as decided upon definitely by the local committee which has these matters in charge.

The Berlin Fire Department has just come into possession of its first motor propelled fire fighting train of four vehicles. It comprises a motor fire engine, a hook and ladder wagon, with telescopic ladder, a chemical engine and a fire ambulance.

Some Experience with a Two Cycle Runabout.

By J. C. Cunningham.

I believe the two cycle motor is the coming motor for automobiles. Though it must be admitted that it is not as flexible as the four cycle, it is nearly so, and the simplicity of it makes up for its shortcomings. My principal reasons for favoring the two cycle cars are these:

In the first place there is a fascination about running a four cylinder car compared with a motor of fewer cylinders, and the two cylinder, two cycle, has the same number of impulses as the four cylinder, four cycle. In other words, the frequency of the impulses is double that of the four cycle, cylinder for cylinder, making the torque more constant than on the four cycle. For this reason the motor will hold its rotative effect at low speed with less flywheel, and will answer the throttle more promptly under hood. The absence of valves, gears and cams makes the two cycle less likely to get out of order than the four cycle—more foolproof. The few parts make it lighter.

Of course I have never seen, I will admit, a two cycle motor that was not pulling or had work to do that did not miss. This is one of their faults, if you wish to call it that. Even on a full throttle, when the motor is not laboring, they miss. Strike a hill or go through sand or give them work, and they will not miss, but the explosions will come as regular and even as a clock ticking. I consider the missing when power is not needed no objection. The motor might just as well miss as to explode a weak mixture and not need it. Though all two cycle motors that I have had experience with miss more or less under the conditions I have mentioned, not one in a dozen ever notices it unless his attention is called to it. I have also noticed this missing in a very popular four cylinder, four cycle, air cooled motor when the motor was not laboring.

The light weight and simplicity of the two cycle motor are the principal advantages it has over its four cycle rival. They are not as economical in fuel as an air cooled motor of the same power, but I know my two cycle, 10 horse power motor uses less fuel than the two cylinder, 10 horse power, four cycle motor.

Until the last few months I have always used more oil on my two cycle motor than I ever did on other four cycle motors. No doubt I wasted oil, but I always believed in using plenty rather than not enough. Lately I have been mixing the oil with the distillate before putting it into the tank. I put about one-fourth of a pint of good oil to every gallon of distillate or gasoline. I use for fuel either the No. 1 Union distillate or stove gasoline. Though I find distillate a little harder to start on, it gives a little more power and is a cheaper fuel. Since putting a late model carburetor on my car I can start it the coldest morning by pouring a few spoonsful of gasoline into the carburetor and turning the crank immediately before it runs out of the overflow.

As regards mixing the oil with the fuel, it looks to me to be the ideal way, for the more fuel used the more oil is used. Possibly the engine may give a little less power this way, but I have not yet been able to speak with authority on the matter, as I have never noticed any difference. In two cycle motors the fuel mixes with the oil anyway, and, according to my way of thinking, it might just as well be mixed in the fuel tank as in the crank case. The only bad feature I can see about it is that it might have a tendency to clog or dirty the carburetor, but so far I have had no trouble that way. My cylinders are small, 3½x4 inches, water cooled, and for this size engine at least this way of lubricating excels all other ways I have ever tried.

To those reading this who might try mixing the oil with the gasoline to use on their two cycle motors I would advise trying a spoonful of their oil in a tumbler of gasoline. Stir it with the gasoline and let it stand a few days and see if it will stay mixed with the gasoline. Some oil will not work well this way. Another thing, do not pour your oil in the gasoline tank to mix it, but mix by stirring it with the gasoline in a bucket before putting into the tank. If you pour a spoonful of oil in a tumbler of gasoline and do not stir it you will see the oil will not disseminate well. In fact you can shake the glass some time and it will not mix as it should unless you stir it with something.

As regards the use of distillate for fuel, some will tell you it carbonizes and dirties up the engine more than gasoline. The manager of the company building my car recommended me to use distillate, saying it was cheaper and more powerful. I have been doing so now for over five months, and have examined the parts of my engine twice, and have noticed no difference so far, as compared with gasoline. I do believe, however, that the use of distillate has a tendency to heat up the motor more than gasoline.

My opinion about buying a car, if economy in every thing is considered, is to get as light a car as possible for the work required. My car weighs only 930 pounds, with all tanks filled, storage battery and five extra dry cells that I always carry for an emergency. The frame is all wood, and the whole body complete with upholstered seat will hardly weigh 100 pounds. I had the turtle back removed and a trunk put on the rear, with iron rail for seat. I often carry three people with a little baggage, making my load half the weight of the car. I would like to see some of the large touring cars carrying half their weight over bad roads. The rear axle of my car is a weak part of it. I have strengthened it, however, until it will no doubt last as long as the rest of it. The new models have heavier axles.

By buying a light car you save fuel, oil and tires. Of course judgment must be used in not getting them too light. Never accept catalogue weights as the correct weight of a car; they are all underrated. This summer I saw eighteen different cars weighed, and all of them, from the runabouts to the big cars, weighed from 275 pounds to 800 pounds more than specified in the catalogue.

I will say that I use my car for about everything I would use a team for; that is, when the country roads are good. There are very few country roads in California where the automobile can be used for business every day. In the first place, in wet weather, it is hard to keep a car on wet, curved or sloping roads. It is almost impossible to steer them, and if the road has much mud, or hills, it is better to keep off them. You will have more tire troubles, and it will be more profitable to you to use a good team. Of course the inexperienced will say: "See what they did in the endurance runs; see what they did in crossing the American continent the last winter, and what they did in Asia and Europe." A buyer must consider that in these runs the drivers and their mechanics are experts, and they have a rich factory back of them. Experience will teach you that one week's constant run in mud and slush is harder on a car than one month's use in dry weather going four times the distance.

For a four cycle runabout I would not advise over two cylinders. I know there is a fascination about running a four cylinder car, but if you are figuring on practicability and economy you can get two cylinder cars that will do all the work any runabout is required to do. In the two cylinder you will have only half the bearings and coils to adjust, half the valves to grind, half the plugs to buy; in fact, you have almost half the trouble.

There are more runabouts used for business than any other kind of car, still there is not what I would call a good business runabout made. I can call to mind two or three runabouts which, if they had three speeds forward and a reverse, and good carrying space behind, would be ideal cars. I believe that it is better to use more speeds rather than such large and powerful engines. The little rumble seats and turtle backs on some of the runabouts are a nuisance. Why not have a decent box or trunk on the rear that will hold something and so an extra passenger can be taken along?

In conclusion let me say we use three automobiles in our business. Two of the cars are two cycle runabouts, the same as I have described here, only a later model that has just been made to order and has three speeds instead of two as on my old car. The transmission is also on the rear axle. We depend altogether on a magneto for ignition on this car. The other car is air cooled and has given very good satisfaction, but the owner, another partner, says his next car will be a two cycle. In our business we have learned that where the owner takes care of his own car and where it is a light runabout of standard make, it will give satisfaction and be about as economical as a good horse and buggy.

My ideal of a runabout is a light two cylinder, two cycle, 12 horse power car, weighing not over 1,000 pounds, shaft drive, three speeds forward and one reverse, the differential and transmission to be a unit. The cooling system to be thermo-siphon, plenty of carrying space in the rear, with a seat for a passenger. The finish of the car to have no brass or nickel about it, not even the lamps; everything to be painted or enameled. The ignition to be magneto. I am having such a car made to order, only the engine is a 20 horse power, two cylinder, two cycle. These little cars cost less than $1,000, and can easily travel at a speed of 30 miles an hour on the high gear. The low speed on these cars is hardly ever used, as in nearly all cases they start on second speed. Second gear is a nice speed to use in crowded streets, as the engine responds to it quickly, and one can run from 3 miles up to almost 20 on it.

Shawmut Motor Car Company Plant Burnt Down.

The factory plant of the Shawmut Motor Car Company in Stoneham, Mass., was destroyed by fire early on November 13. Not only was the two story brick building occupied by the company, valued at $15,000, entirely ruined by the conflagration, but machinery, valued at $100,000, and cars in process of construction, valued at $50,000, were also much damaged. The watchman of the factory, who discovered the fire about 1:30 o'clock a. m., was badly burned in trying to subdue the flames, and had to be taken to his home. The fire proved a hot one, and while the firemen were at work on it their engine house, across the street from the motor factory, caught fire. In an hour the fire was under control. The company's loss is estimated at $65,000, while it carried only $42,000 insurance.

Race Driver Killed.

Emil Stricker, who participated in the recent Vanderbilt Cup race on Long Island, was killed in an attempt to lower the twenty-four hour record on the Fair Grounds track at Birmingham, Ala., on Tuesday. The attempt was made by Stricker and Lewis Strang, who took turns at the wheel at intervals, under the management of W. H. Pickens. The track was poorly lighted, and in making a turn two of the tires exploded, the car overturned, and Stricker was killed instantly, while his mechanic, Leon Barrows, was severely injured.

A new emblem has been adopted by the Association of Licensed Automobile Manufacturers, to be used in various ways on insignia and stationery, and it will be particularly conspicuous in connection with the ninth national automobile show of the licensed makers in Madison Square Garden, January 16 to 23. The design is that of an eagle with outspread wings perched atop an automobile wheel, between the spokes of which appear the initial letters of the association name, "A. L. A. M.," and the figures "'09."

Worcester Club Plans Endurance Run.

The Worcester (Mass.) A. C. plans to hold a ten hour, 200 mile endurance run on Tuesday, December 8. The route selected will be over the rough, hilly back roads of Worcester County and surrounding territory, and the event is designed to be a more practical test for automobiles than any similar contest that has been run off. The start will be made from the Worcester A. C. at daylight, and will be so arranged that cars will be checked in at the clubrooms every two hours. Already a sufficient number of cars are said to have been assured to guarantee the success of the run. The route will not be made known to the contestants until the time of the start. It will be a sealed bonnet contest, and the consumption of gasoline will be an important factor.

Quaker City Endurance Run Plans.

The Quaker City Motor Club of Philadelphia will hold its third annual midwinter endurance run from Philadelphia to Wilkes-Barre and back, a distance of nearly 300 miles, on January 1 and 2, 1909. The contest committee of the club went over the course last week, and decided upon the checking stations or controls. The start from Philadelphia will take place at 7 a. m. on New Year's Day in front of the Hotel Walton. The outward run will lead through Quakertown, Allentown, Bethlehem, Easton, Stroudsburg, Mt. Pocono and Bear Creek. The return trip will lead through Hazleton, Reading, Pottstown and Norristown. The cars which complete the two days' run will be subjected to a rigid mechanical examination by the technical committee.

Wilkes-Barre Auto Club In Doubt.

The president and chairman of the racing committee of the Wilkes-Barre (Pa.) A. C. have not yet decided whether the club shall apply to the A. C. A. or to the A. A. A. for the sanction for the club's fourth annual hill climb up Giant's Despair, which is to be held on May 30 next. Officials of each organization are understood to be willing to grant the sanction but the club desires that the two organizations act in harmony in the effort to make the contest one of the largest events of the year. The club desires the entrance of European as well as American cars, and negotiations are now under way. The A. C. A. will be requested to obtain as many foreign entries as possible, and the A. A. A. as many American entries as possible.

Club Notes.

The Automobile Club of America announces that the Boston Post road through Rye is again open for travel, having been put in excellent shape. A new process of pavement has been laid, which is exceptionally smooth.

The Lehigh Valley Motor Club was organized at a meeting held in the Masonic rooms, Allentown, Pa., on November 10. The following officers were elected: Robert L. Stuart, president; H. A. Seaman, vice president; William D. Schantz, secretary, and Fred H. Sterner, treasurer.

Owing to the increase in membership of the Milwaukee Automobile Club the board of directors has been increased from nine to fifteen members. The six new directors are George C. Forgeot, Alfred Kieckhaefer, one year; George A. West and Oscar F. Fischedick, two years; M. C. Moore and O. Z. Bartlett, three years.

The Board of Governors of the A. C. of Philadelphia recently made an appropriation for the purpose of revising the touring maps tentatively issued last year. These maps cover the district as far east as the Delaware River, north to Easton, west to Lancaster and south to within six miles of Wilmington. Four maps will be out by March 1, 1909.

The legislative committee of the Minneapolis A. C. are drafting an automobile bill to be presented at the next session of the Minnesota Legislature. It provides for State registration of all automobiles and taxation for road maintenance purposes, and contains a clause to the effect that automobiles must "at all times be driven at reasonable speeds."

The Fulton County A. C. was formally organized at a meeting held in Atlanta, Ga., last week, and the following officers were elected: Edward Inman, president; Charles I. Ryan, vice president; W. G. Humphrey, secretary and treasurer. It is stated that already about 100 local owners of automobiles have joined the club, and that $6,400 has been subscribed toward the building of a country club house, for which purpose it is intended to expend $25,000.

Dr. Charles L. Bonifield, president of the Cincinnati A. C., was painfully injured on November 11 in endeavoring to start his machine. In stopping the car in front of Christ Hospital he had moved the gear level beyond the neutral point into the reverse position, and when he cranked up the motor, on coming out of the hospital, the car at once began to run backward. Dr. Bonifield rushed to the side of the car to disengage the gear, but fell under the wheels and was severely bruised.

French Exports.

The exports of automobiles from France, which showed a rather remarkable decline during the first four months of the current year, have recuperated perceptibly during recent months. Thus, while the value of automobile exports was only 42,000,000 francs during the first four months of 1908, as compared with 52,000,000 francs during the first four months of 1907, a comparison of the following five months of the two years shows that there has even been an increase of 2,000,000 francs in the value of exports during this period of 1908 as compared with the same period in 1907. The value of the exports during the first nine months of the year was 101,178,000 francs in 1908, against 108,946,000 in 1907.

LEGISLATIVE and LEGAL

A. C. A. After a Justice of the Peace.

A civil suit against Manfred Naar, a New Jersey justice of the peace, at Trenton, for the recovery of a fine which it is charged he imposed by mail upon an absent automobilist, for an alleged violation of the speed laws, has been instituted by the Automobile Club of America. The suit, if successful, will be the first of a series which the club purposes to bring against this justice on behalf of hundreds of automobilists who have complained of Mr. Naar's methods of treating alleged violations of the New Jersey speed laws. According to the complaints of these motorists, Mr. Naar has made a practice to have a constable hide along the Hightstown road and take the numbers of passing autos from his place of concealment. A day or so later, it is alleged, the owners of many of the cars which have passed along this road have received a letter from Naar notifying them that they were accused of having exceeded the speed limit and proposing to fix a day for a trial at Trenton. The notices, it is said, have been sent largely to non-residents of the State, to whom a trip to Trenton on a week day to attend a trial would be a serious inconvenience. The recipient of the letter usually replies to that effect and thereupon receives another letter stating that the matter can be arranged by the payment of a fine and costs, the fines ranging from $1 to $25 and the costs being about $3.50. As the expense of attending at Trenton, to say nothing of the loss of time, usually exceeds that amount, the alleged violator of the speed laws almost invariably has paid the amount demanded. Mr. Naar, it is claimed, has in this way collected several hundred fines within the last few months.

Richard Boardman, of Jersey City, has been retained and has commenced a civil suit against Naar for the recovery of a fine imposed and collected by him. Other suits will be brought as parties come forward who desire to prosecute them, and if the courts hold that the fines were unlawfully imposed, action will be taken to make Mr. Naar refund them. The matter has also been called to the attention of the criminal authorities at Trenton, and an attempt will be made to have Mr. Naar indicted for his actions, if the club attorney's contention that they are illegal is upheld.

New License Plates for Jersey Motorists.

Commissioner of Motor Vehicles J. B. R. Smith, of New Jersey, in a circular letter calls the attention of automobile owners and drivers registered in that State to the fact that the amendments to the Motor Vehicle act adopted by the last Legislature provide that all registration certificates for cars and all drivers' licenses expire on December 31. Any automobile duly registered may operate under such registration certificate for a period not exceeding thirty-one days after its expiration. The department deemed it wise this year to begin a new series of registration numbers, inasmuch as the identification markers are furnished by the State. The contract for markers numbering from 1 to 20,000 has already been placed. Provision has accordingly been made for retaining for those who desire it registration numbers below but not above 20,000. To retain the present registration number it will be necessary to make the application on or before December 1. All who personally drive cars are required to obtain drivers' licenses.

Legal Notes.

Owners of garages at Fond du Lac, Wis., have been given time until July 1, 1909, to convert their buildings into fireproof structures. All gasoline must be stored underground. The penalty for disobeying the order is to have their places of business closed.

A final warning was issued last week by City Collector Magerstadt, of Chicago, that all automobile owners who had not paid their wheel tax by Monday of this week would be arrested. At the time this warning was issued there were estimated to be 1,500 delinquent owners.

Sheriff William R. Knell, of Milwaukee County, and Chief of Police John T. Janssen, of the city of Milwaukee, have started agitation looking toward legislation requiring all motor cars in Wisconsin to carry a device to show the rate of speed similar to the method advocated by Seth K. Humphrey in the *Atlantic Monthly*. Milwaukee motorists look upon this agitation as a passing fancy.

City Controller George T. Breunig has announced that he will make no special effort to require Indianapolis owners who have not paid the 1908 license fee, to take out licenses before the end of the year. There are about 500 owners in the city, according to the books of the Secretary of State, who have not paid this year's fee. However, the number who have paid is greatly in excess of the number who have paid in previous years.

Dr. E. R. Walters, president of the Select Council of Pittsburg, Pa., is preparing an ordinance requiring that oil pans be attached to all automobiles to prevent oil dripping from the machinery from falling onto the pavement. Dr. Walters claims that the oil thus spilled onto the street pavements makes them slippery and dangerous for horses. He claims that it causes special difficulty for the horses of the fire department, and also mentions the detrimental effect of the oil on the asphalt pavements.

Charles W. Bacon, a real estate dealer of Philadelphia, was recently charged with exceeding the speed limit at Eagleville, near Norristown, Pa. His counsel, Edwin S. Nyce, until recently secretary of the Norristown A. C., made the defense that the mere fact that the number issued to a certain party was displayed at the rear of the car is no proof that this party was in the car. He was sustained by Judge Weand, and the case was dismissed.

Hearing on Suggested Sale of Pope Property.

The receivers of the Pope Manufacturing Company appeared before Vice Chancellor Howell, of New Jersey, at Newark on November 16, for instruction with regard to the proposed sale of the entire property of the company, a bid of $1,500,000 having been made for the same. W. C. Fiske, representing Thos. H. O'Connor, of Jersey City, holder of 250 shares of Pope stock, opposed the sale on the ground that while sufficient money would be realized to pay all debts and to terminate the receivership, there would be little or no capital remaining in such case to continue the business. The vice chancellor reserved decision until the end of the week.

Business Troubles.

Frederick F. Goodman, Inc., conducting an auto garage at 51-55 West Ninety-third street, New York city, made an assignment last week to Frank G. Conway. The business was started in February, 1906, and was incorporated May 2, 1907, with a capital stock of $15,000. Frederick F. Goodman was president, Frank B. Goodman, vice president, and W. B. Craighead, treasurer. Among the creditors are Charles H. Lewis for $525, Lindsay Russell, as receiver for Charles A. Duerr & Co., for $17, and Samuel H. Shaw for $200. The assets of the firm are estimated at $5,000. Hamilton Holt has been appointed receiver.

Licensed Association Meeting.

At the annual meeting of the board of managers of the Association of Licensed Automobile Manufacturers, which was held in New York on November 10, and was the best attended meeting in the history of the association, the following officers were re-elected for the coming year: Charles Clifton, president; Thomas Henderson, vice president; L. H. Kittredge, secretary; Col. George Pope, treasurer. S. D. Waldon, of the Packard Motor Car Company, was appointed A. L. A. M. representative on the good roads central committee. The show committee of the association on the same day gave an audience to representatives of the Motorcycle Manufacturers' Association, who made a request for additional space at the Madison Square Garden Show.

Race Across Colorado Desert.

By means of a unique contrivance a White steamer was able to win the race from Los Angeles, Cal., to Phœnix, Ariz., the second week in November, negotiating the distance of 455 miles in 30 hours 28 minutes, after deducting the time spent in crossing the Colorado river and in resting the crew. The race began a few minutes after midnight, Sunday morning, November 8, and the winning car drove into Phœnix at 6:33 Monday evening, followed at short intervals by the other three contestants. The most difficult stretch of the journey was the Colorado Desert on the west side of the Colorado River. For a hundred miles the automobiles had to buck their way through fine, drifting sand, through pathless cactus and mesquite fields, torn, dry watercourses and innumerable gullies. More than any other factor the sand impeded the progress of the contestants, and in order to overcome this obstacle the crew of the White steamer provided a kind of an outrigger. A long plank was wedged in under the front and over the rear axles, extending far behind the machine. At the rear end of the plank a bicycle seat and a pair of handlebars had been fastened. As soon as the sand was reached, the mechanic left the tonneau and occupied the seat on the end of the plank. By means of the leverage provided at the rear axle, the front wheels were lifted from the ground, skimming lightly over the sand without burying themselves in it, while the traction power of the rear wheels was increased. While the other contestants often had to stop to dig the front wheels out of the deep sand, the White entry had no such trouble, thanks to the original contrivance.

The first 170 miles, from Los Angeles to Mecca, on the Southern Pacific Railroad, offered no special difficulties; the roads were in fair condition and fast time was made by all the contestants. At Mecca the cars left the road and struck out straight east through an uninhabitable desert to the Colorado River, the objective point being the small settlement of Ehrenberg. From Dos Palmos, a diminutive mining camp, to the river, water can be had at only three places; one of the springs is alkaline and another one bubbles forth hot sulphur water. Roads there are none, simply trails left by the burros of the prospectors. At Dos Palmos the contestants supplied themselves with the last gasoline, oil, water and other necessities before the Colorado River was reached. All the cars had trouble on this stretch and all of them had to spend hours in repair work. The White steamer reached the Colorado River at 9:20 Sunday night, the Elmore following two hours later and the Kisselkar arriving at 2:16 Monday morning. The Franklin entry lost the way and spent the night in the desert. The four cars crossed the Colorado the next morning in a small ferry operated by drunken Indian boatmen, paying eight dollars apiece for the trip, and, at intervals of an hour, started on the last lap of the voyage to Phœnix, a distance of 170 miles over fairly good roads on the high tableland. Near the Mule ranch the White steamer was driven into a ditch by a stampeded herd of wild cattle and had to be pulled out by a mule team. Despite the hard trip the four cars participated in the automobile races during the Territorial Fair at Phœnix.

Madison Square Garden May Be Razed.

After carrying on the Madison Square Garden in New York for twenty years as an amusement and exhibition centre, with practically no profit, the stockholders of the Madison Square Garden Company met on November 16 and decided that the building and its site should be disposed of, there being, according to their view, no prospect of the Garden ever becoming a profitable venture in its present shape. They are considering to dispose of the property to some large business interest, who would raze the building and replace it with an office building or a large store. Failing this, the stockholders are willing to sell to anyone who will undertake to continue the Garden as an amusement centre, and if there are no satisfactory offers it will be continued on the same lines as before. The present lease expires June 1 next. The Madison Square Garden has been the scene of all the large exhibitions of every nature in New York for the past twenty years, and until two years ago all automobile shows were held therein. Since that time only the A. L. A. M. and Importers' shows have been held in the Garden, the "Independents" holding their exhibition elsewhere. It is to be hoped that the building will be bought up and preserved for its purpose, there being no other building of its capacity suitable for exhibition purposes in New York.

Haynes Automobile Company Reorganized.

The Haynes Automobile Company, of Kokomo, Ind., one of the oldest firms in the automobile industry, was reorganized at a stockholders' meeting held at Kokomo on November 11. The capital stock of the company was increased from $300,000 to $600,000, and the control of the affairs of the company was vested for a period of five years in the Kokomo stockholders. We learn that as a result of this reorganization quite a number of Kokomo business men have invested in the stock of the company. While previous to the reorganization Portland, Ind., stockholders held a majority of the stock, now the Kokomo stockholders hold a controlling interest, and local control of the company's business is, therefore, assured. At the meeting the following nine directors were elected: Elwood Haynes, C. H. Haynes, Henry C. Davis, Stephen Tudor, A. L. Thalman, William Johnson and George W. Charles, of Kokomo, and W. M. Haynes and C. C. Cartwright, of Portland. These nine directors passed a resolution creating a trusteeship composed of three members, to control the business of the company for a period of five years. The trustees selected were H. C. Davis and Richard Ruddell, of Kokomo, and C. C. Cartwright, of Portland. It is the intention of the company to operate on an increased scale from now on. At present 200 cars of the Model X type are under construction.

Organization of the Herreshoff Motor Company.

A new name was added to Detroit's long list of automobile manufacturers by the incorporation last week of the Herreshoff Motor Company at Lansing, Mich., who will shortly begin the manufacture of automobiles in Detroit. The cars to be made are to be equipped with a motor designed by Charles F. Herreshoff, which has heretofore been built by a firm in Bridgeport, Conn., and which has been successfully applied to a number of high powered motor boats. The Herreshoff motor is notable especially for its light weight, being claimed to be 40 per cent. lighter than the average automobile motor of the same power. A $1,500 model is to be put out first, and we understand that deliveries are to begin January 1, 1909. The company will occupy the factory building at Harper avenue and Dequindre street, in which the E. R. Thomas-Detroit Company was formerly located. Louis Mendelsohn, formerly of the Modern Match Company, is president of the new concern, and Carl Reese, formerly of the Trussed Concrete Steel Company, treasurer. The company has very ambitious plans, expecting to turn out about 1,000 cars during the coming season, and it is stated that already 500 men are at work in the new factory. Mr. Herreshoff, their engineer, was formerly engineer of the American and British Manufacturing Company, for whom he designed motors, change gears, frames, axles, etc., in the course of which work he became thoroughly acquainted with automobile practice.

Automobiles for School Superintendents.

C. H. Hemenway, county superintendent of schools of Rock County, Wis., advocated the purchase by each county in the State of a touring car for the use of superintendents, in a strong address before the Wisconsin State Teachers' Association convention in Milwaukee last week. "The county superintendent has been the official packhorse and dray cart long enough," he said. "It is time that they be provided with an up-to-date means of locomotion. There is nothing like a motor car for this use. Many trades and professions where their need is not nearly so imperative as ours have the advantage, and we demand it also." It is now "up to" the individual counties to provide cars.

MINOR MENTION

The Sterling Vehicle Company, 411 Dearborn street, Chicago, Ill., have brought out a 1 ton truck and are looking for a factory.

The Chamber of Commerce, of Sandusky, Ohio, has had an inventory taken of the property of the Roberts Motor Company, of Clyde, Ohio, which is seeking a location in Sandusky.

The plant of the Locomobile Company of America, Bridgeport, Conn., which has been running five days a week for some time, is to be operated on full time again shortly, according to report.

The Peerless Leather Tire Company has established a branch in Oakland, Cal., in charge of E. L. Tharp, formerly traveling salesman for the Michelin Tire Company, and F. S. Cozzens, Jr.

The Acme Motor Car Company, of Reading, Pa., will build during the coming season a six cylinder model with 5 inch bore and stroke each, which will be fitted with either touring car or roadster bodies.

The Racine Boat Manufacturing Company, of 182 Jefferson avenue, Detroit, Mich., is bringing out a new car equipped with a four cylinder, four cycle air cooled motor of 22½ horse power, with shaft drive and sliding gear transmission.

The Maxwell-Briscoe Motor Company, of Tarrytown, N. Y., plan to build 9,000 cars next year, of a total value of $8,000,000. They estimate that the total American production next year will be 75,000 cars, of a value of approximately $120,000,000.

At a meeting of the Southern classification committee, held at Cincinnati last week, a number of changes were made in regard to the classification of automobile freight on lines running through the Southern States east of the Mississippi River.

The Western Automobile and Supply Company, of Colorado Springs, Col., will in the future be known as the Cascade Automobile and Supply Company, the change being made by the new owners, W. H. Martin, C. E. Stanley and F. M. Drummond.

Walter T. Haskins, of Boston, has leased the country seat of Dr. George H. Talbot in Northboro, Mass., for a term of three years, and will take possession at once and open an automobile inn. The place is located on the State road between Worcester and Boston.

The Willard Storage Battery Company, of Cleveland, Ohio, have opened an office and battery depot at 1876 Broadway, corner Sixty-second street. At this point they will take care of their battery business in New York and vicinity. The depot will be fully equipped with apparatus for assembling, charging and crating batteries ready for use. They have also arranged to take care of the charging of vehicle batteries and batteries for sparking, lighting and other purposes.

The G & J Tire Company, of Indianapolis, Ind., recently broke ground for the erection of a large addition to their factory. When completed the new building will give the company 50,000 square feet additional floor space.

It is reported that the negotiations between the Crescent Motor Car Company, of Detroit, and the Board of Trade of Goshen, Ind., have been brought to a successful termination and that the Detroit concern will locate in the old Cosmo soap works in the northern part of Goshen.

About 100 employees have been imported by the Maxwell-Briscoe Motor Company from Cleveland and Eastern cities for its Newcastle, Ind., plant. By January 1 the company expects to have 1,000 men at work, now having about 700 at work. The company is having difficulty in finding houses for its new employees.

The Carter Motor Car Corporation, of Washington, D. C., is said to be building a 30 horse power, water-cooled, shaft driven car, with roadster body, at its Hyattsville plant near Washington. The company will also build a 60 horse power, six cylinder, seven passenger "Washington" touring car, with a wheel base of 129 inches and 36x4½ inch tires.

A mounted policeman to manage traffic on the downtown streets has been appointed by the Indianapolis Police Department. The appointment was made upon the recommendation of H. H. Rice of the Waverley Company, who complained that he had frequently been penned against street curbs with his automobile because of carriages and other vehicles standing around his car.

On the 1909 Waverley electric cars a safety device is fitted which prevents the car being started up accidentally or by mischievous boys, even if the controller lever has been left in high speed position. The car will not move when the switch is turned on again, until the controller lever has first been brought back to the neutral position and then moved out again to the first speed position.

The Cleveland Automobile Show will be held under the management of a committee of the local dealers' association during the week of February 15, probably in the Armory Building. The Cleveland Dealers' Association held a meeting on November 5, at which the following officers were elected: Frank Phillips, president; Clarence Brockway, vice president; H. M. Adams, secretary, and George Waite, treasurer.

The Bendix Automobile Company, which recently decided to move its plant from Chicago to Logansport, Ind., has incorporated under the Indiana State laws with $200,000 capital stock and is now getting a factory building ready for operation. Citizens of Logansport subscribed for $75,000 of the stock, that being one of the inducements offered to have the company move. About 200 men are now employed by the company, but this number is to be increased to about 500 within a year's time.

The Davis Manufacturing Company, Sixth street, Milwaukee, expects to occupy its new engine and motor factory on January 1. The company has orders for 1,000 motors for automobiles, the majority of orders having come since election day.

The R. W. Magna Manufacturing Company, Holyoke, Mass., is bringing out a new dry cell holder to be known as the Magna quick change rigid battery holder. It is claimed that this device will prevent trouble from loose connections, and that replacements can be made very quickly.

The Automobile Dealers' Association of Southern California is endeavoring to make Los Angeles one of the important automobile racing centres of the country. The association is planning to obtain control of Ascot Park, formerly the scene of horse racing, to use it for demonstrating and racing purposes.

The Middletown Buggy Company, Middletown, Ohio, has been incorporated to make buggies and automobiles in the brick building formerly occupied by the New Decatur Buggy Company. Work will be begun at once. Col. M. W. Renwick is president, Charles B. Johnson, vice president and treasurer, and Harry H. Elwood, manager.

Prof. Warren S. Johnson, president of the Johnson Service Company, of Milwaukee, has invented a device to avoid "squeaky" springs. In building up the spring he puts thin sheets of steel between each pair of leaves. The thin sheets are of the same size as the spring leaf, but have holes punched into them, which are filled with a thick lubricant and then bolted together. All "Johnson" cars are being equipped this way. The device will be patented.

Auto Fatalities in Connecticut.

During the past weeks three fatalities were caused by automobiles in New Haven, Conn., and the chief of police has instructed the auto squad to exercise more vigilance than ever if possible for the apprehension of reckless drivers. Particular stress was laid by him on the necessity of every auto carrying rear red lights, the white shades of which shall shine in the license number and show it up plainly at night. It appears that at least in one of the above cases the motorist was entirely blameless, but such a series of fatal accidents cannot fail to arouse the public, and to decrease further the chances that Connecticut's model automobile law will withstand the onslaughts against it that will be made at the next session of the Legislature. The A. C. of New Haven is about to begin a crusade against fast driving, and called a meeting to prevent speeding on the return from the Harvard game, which last year was the occasion of several automobile accidents.

Garage Notes.

George H. Huber has sold out his garage at 245 Wyoming avenue, Scranton, Pa.

L. S. Gantz, Marshalltown, Ia., has recently taken the agency for the Lambert.

Orange Burkleo, Stillwater, Minn., has sold his garage to Roscoe Johnson and Joseph Perron.

The Auto Tire Vulcanizing Co., Lowell, Mass., have taken the City Hall Garage, formerly run by a Mr. Walsh.

The partnership existing between Hillman & Manning, Monroe, Wis., has been dissolved and the business will be discontinued.

The Brown-Hurley Hardware Co., Des Moines, Ia., are contemplating the erection of a large building for handling a full line of autos.

W. Armstrong Smith has purchased the Bridgeport Auto Co. garage at 388 Fairfield avenue, Bridgeport, Conn., from John L. Carpenter.

The Lewiston (Mont.) Automobile Co. is building a garage of native stone, 50x75 feet. The company is negotiating for the agency for Franklin cars.

The Dietrich Motor Car Co., who represent the Franklin line in Allentown, Pa., are building a fireproof garage, 50x250 feet. The building will front on three streets.

W. G. Mather, of Cleveland, Ohio, is erecting a private garage at his residence on the Lake Shore Boulevard. The building will be of reinforced concrete, one story high.

The Lindsborg Automobile Co., Lindsborg, Kan., are building a garage, and will handle supplies and do general repairing. Wm. Erickson is shop manager, and A. B. Train sales manager.

George Dorr, manager of the Northwestern Automobile Co., St. Paul, Minn., has taken out a permit for the construction of a one story addition to the company's garage on Market street.

Stuart & Ward, of Van Buren, Ind., have rented the first floor of the old Presbyterian Church building at Fifth and Branson streets, Marion, Ind., and will open a garage in the near future.

H. W. Gerlock, a machinist of Huntingdon, Pa., is erecting a garage at the rear of his foundry on Ninth and Mifflin streets. Mr. Gerlock has been engaged in automobile repair work for some time.

The United States Garage Co., Niagara Falls, N. Y., have bought out the old stand of Leon Hall & Co., on West Niagara street. They have the Buick agency, and will also carry a large stock of auto supplies.

E. D. Carlough, who handles Franklin cars in Paterson, N. J., has moved into his new building at 175 Van Houten street. The building is a one story cement structure, 25x75 feet, containing an office, show room and repair shop.

Notice of a change of name to Sears Automobile Co. has been filed by the Sears-Nattinger Automobile Co., of Des Moines, Ia. Mr. Nattinger, one of the partners of the firm, was killed in an automobile accident several months ago.

Detroit's automobile row, which formerly centered on Jefferson street, is now being re-established on Woodward avenue. Among the several new garage buildings going up on this thoroughfare is the new building of the Standard Automobile Co., on the corner of Woodward and Garfield avenues. The building is 110x190 feet, and of reinforced concrete construction.

The Gloversville (N. Y.) Garage Co. has been formed by W. Donald Hyde, Morrell Vrooman and John W. Sisson, with a capital stock of $15,000. The company plan to build a one story 50x100 foot garage, so designed as to permit of the addition of a second story when the business warrants it. The company have the agency for Buick and Ford cars for Fulton and Montgomery counties, and will endeavor to secure the agency for several other lines.

A company has been formed in Sunbury, Pa., to establish a sales agency for a number of "licensed" gasolene cars, as well as for electric. Among the stockholders of the company are Harry Seebolt, Dr. Walter Drumheller, George Rohrbach, John V. Lesher, Harry Knight, W. R. Rohrbach and W. C. Packer. The former Sunbury High School building on Front street has been sold by the School Board to W. C. Packer, and is to be occupied by the company.

Henry G. Goosman has opened a new garage and salesroom, known as the Motor Inn, at 1023 First avenue, South, Minneapolis, Minn. The building has a frontage of 55 feet on First avenue and a depth of 155 feet, and is built of white brick. A striking feature of the construction is that the main door on the First avenue side is made in the form of an automobile tire section. The garage was erected at a cost of $13,000.

New Incorporations.

Ford Motor Co., Detroit, Mich., capital stock increased from $150,000 to $2,000,000.

Crystal Park Co., Manitou, Colo.—Capital, $780,000. To construct a private automobile speedway.

Boone Auto Co., Boone, Ia.—Capital, $10,000. Incorporators, Dr. C. W. Payne and J. L. Stevens.

Darling Automobile Co., Auburn, Me.—Capital, $10,000. Incorporators, G. R. Hunnewell and V. S. Darling.

Woods Electric Garage, Chicago, Ill.—Capital, $25,000. Incorporators, Arthur L. Schwartz, George H. Foster and John F. Rosen.

United States Motor Cab Co., New York, N. Y.—Capital, $50,000. Directors, George Duell, Maurice Sussman and Thomas J. Bell.

Cameron Motor Co.—New York, N. Y.—Capital, $150,000. Incorporators, Ernest Stauffer, Jr., Arthur F. Gottbold and Harold B. Elgar.

Travellers' Garage & Auto Co., Wilmington, Del.—Capital, $5,000. Incorporators, C. R. Calhoun, George W. Smith, Jr., and John D. Calhoun.

Kissel Motor Co., Chicago, Ill.—Capital, $10,000. Incorporators, H. P. Branstetter, W. A. Johnson and E. P. Hornack. To deal in automobiles and all kinds of machinery.

Standard Automobile Station, Springfield, Ill.—Capital, $2,500. Incorporators, C. S. Everett, Joseph Seiler and L. G. Roach. To deal in automobiles and maintain garage.

Great Central Electric Co., Chicago, Ill.—Capital, $25,000. Incorporators, John S. Crowell, J. E. Haschke and F. L. Harford. To manufacture and deal in automobiles, motors and other machinery.

Gloversville Garage Co., Gloversville, N. Y.—Capital, $15,000. Directors, Morrell Vrooman, W. Donald Hyde, L. B. Sisson and John W. Sisson.

The Cope Co., Newark, N. J.—To manufacture carriages and automobiles. Capital stock, $50,000. Incorporators, M. M. Dodd, Grace G. Conley and Alonzo Church.

Nadel Manufacturing Co., Chicago, Ill.—Capital, $5,000. Incorporators, William H. Feindt, Jr., J. V. Lawrence and E. H. Spratlen. To manufacture and deal in automobile rims and other accessories.

E. E. Denniston Co., Buffalo, N. Y.—Capital, $30,000. Directors, William G. Denniston, Worcester, Mass.; Edward E. Denniston and Clyde R. Sikes, of Buffalo, N. Y. To deal in automobile accessories.

Trade Personals.

H. E. Coffin, chief engineer of the Chalmers-Detroit Motor Co., recently sailed for Europe.

Alfred Measure, formerly a traveling salesman for Morgan & Wright, has joined the staff of Alvin T. Fuller, the Boston dealer.

E. A. Myers, general manager of the Model Automobile Co., Peru, Ind., is making an extensive business trip through the Middle West.

W. B. Fewell, formerly with the Locomobile Co. of America, has joined the selling forces of the Cleveland branch of the Olds Motor Works.

J. S. Conwell, formerly manager of the San Francisco branch of the Auto Vehicle Co., has accepted the position of manager of the Maxwell-Briscoe Co. for Southern California.

Herbert A. Githens has been appointed sales manager of the G & J Tire Co., with whom he has been connected for some time as a traveling representative.

F. E. Castle, who was formerly connected with Gray & Davis, of Amesbury, Mass., has acquired an interest in the Atwood Manufacturing Co., of Amesbury, Mass., which will hereafter be known as the Atwood-Castle Co. For the present Mr. Castle will continue to make his headquarters at Detroit, Mich.

J. D. Maxwell, chief engineer of the Maxwell-Briscoe Motor Co., sailed for Europe on Tuesday to attend the Paris Show.

Russell Huff, designer of the Packard cars and member of the executive committee of the A. L. A. M. Mechanical Branch, sailed on November 17 to visit the Paris automobile salon.

B. L. Colaw, who has been handling the Great Western line of cars in Kansas City for the past two years, has recently been given additional territory, and is now handling this line exclusively.

A. S. Watson, who was formerly secretary and treasurer of the Witherbee Igniter Co., and recently handled the Imperial Roadster in New York city, has taken charge of the distribution of Oldsmobiles in Mexico.

William J. Slater, advertising manager of the Firestone Tire & Rubber Co., Akron, Ohio, has severed his connection with that company to take up the general management of the Kalamazoo (Mich.) *Telegraph*, in which he has recently become financially interested.

George B. Adams, a veteran of the New York motor trade, has become connected with the Detroit-Cadillac Co., 303 West Fifty-ninth street, New York city. Mr. Adams in 1899 was president of the Adams-McMurtry Co., which handled the Packard in New York.

Ernst H. Brandt, formerly manager of the Detroit Cadillac Motor Car Co., New York, has severed that connection to accept the management of the Eastern branch of Thomas B. Jeffery & Co., of Kenosha, Wis., which is located at 38 West Sixty-second street, New York.

R. B. Jackson, who resigned as general manager of the E. R. Thomas Motor Co., of Buffalo, on October 1, has rented the old Northern plant in Detroit, at the corner of Champlain street and Canton avenue, and will begin the manufacture of automobile parts in the near future.

George Holloway, formerly general superintendent of the Elmore Automobile Company, Clyde, Ohio, has associated himself with the Vim Motor Manufacturing Co., Sandusky, Ohio, makers of the Vim two cycle marine motor. We are informed that the company plan to manufacture two cycle automobile motors in the near future.

New Agencies.

Marion, Ind.—Buick.

Baraboo, Wis.—R. W. Prothero, Buick.

Chelsea, Mich.—George P. Staffan, Ford.

Tacoma, Wash.—F. H. Taber, Winton.

Los Angeles, Cal.—R. C. Brassy, Thomas.

New Philadelphia, Ohio.—Edward Goodwin, Buick.

Buffalo, N. Y.—Duncan H. Pierce, Pierce motor cycles.

Jacksonville, Fla.—D. H. McMillan & Co., Brush.

Milwaukee, Wis.—American Automobile Co., Babcock.

Boston, Mass.—Cushman Motor Company, 91 Church street, Lane.

Des Moines, Ia.—Sears Automobile Co., Mitchell, Stoddard-Dayton.

Des Moines, Ia.—Iowa Automobile & Supply Co., Chalmers-Detroit, Oldsmobile.

Trade Literature Received.

Ford Motor Co., Detroit, Mich.—Catalogue of Ford motor cars.

Pope Manufacturing Co., Hartford, Conn.—Folder of the Pope-Hartford ambulance and police patrol.

Stevens-Duryea Co., Chicopee Falls, Mass.—Specifications of Model XXX Stevens-Duryea runabout.

Dover Stamping and Manufacturing Co., 385 Putnam Avenue, Cambridge, Mass.—Catalogue No. 10 of automobile specialties.

Knox Automobile Co., Springfield, Mass.—A set of mailing cards relating to the successes of the Knox cars in contests during the past season.

Standard Roller Bearing Co., Fiftieth Street and Lancaster Avenue, Philadelphia, Pa.—Circular relating to the works and equipment of the company.

MOTOR VEHICLE PATENTS

Review of Specifications.

898,082. Brake for Vehicles.—William Wolfe, of Patton, Pa. September 8, 1908. Filed August 22, 1907.

This invention relates to a simple and easily operable brake for motor or other vehicles, the brake being put into service without cutting off or disconnecting the motor from the transmission gearing. Pivots or bearing boxes are fastened to the frame or some part thereof, and within these pivots works a bar or tube having at its extremities tubes bent in the form shown, so that their rear ends shall be in the same vertical plane as that of the driving wheels of the vehicle. Within the hollow portions of these tubes are rods to whose outward or rear ends are pivoted brakeshoes and whose inner or forward ends are fitted with studs which work in slots in the tubes. The tubes are fitted with coiled springs to assist in forcing out the rods when the brake is put into action. Lifting linkage is provided whereby the brakeshoes may be lifted clear of the ground and at the same time the rods caused to recede into the tubes. This linkage is controlled by a short lever to be fitted upon the footboards of the vehicle and retained in the inoperative position by means of a hook mechanism attached to the vehicle. This mechanism is so constructed that upon pressing a latch the hook separates from a stationary part against which it normally presses, allowing the lever to fly backward and downward and lowering the brakeshoes and connecting mechanism. The brakeshoes are wedge shaped and are serrated upon their lower side so as to grip the ground. A hollow is provided within the shoes whereby the vehicle wheels may ride up upon the rollers fitted within the brakeshoes and also upon the curved inner face of the shoes themselves. The brake is operated as follows: The driver pushes on the latch, releasing the short lever and allowing the mechanism to descend by gravity until the brakeshoes meet the ground over which the vehicle is moving. Instantaneously, by traction, the rods which are normally retracted, as before mentioned, within the tubes are forced under the wheels and perform the functions of a "drag," effectually stopping the vehicle. The driving wheels are clear of the road and revolve idly upon the rollers within the brakeshoes, and the driver may or may not cut off his power as desired. The raising of the short lever, causes the brakeshoes to recede within the tubes and simultaneously lift the mechanism free of the road. The short lever automatically forces the hook away from the stationary part and is held by it ready for another application.

Patents Issued October 27, 1908.

902,009. Vehicle Tire.—Freadrick A. Stall, Jr., Darlington, S. C. Filed September 12, 1907.

902,015. Tire Protective Rivet.—Edwin B. Simpson, Brooklyn, N. Y. Filed January 30, 1908.

902,045. Differential Mechanism.—Emile Aze, Minneapolis, Minn. Filed May 15, 1908.

902,072. Wheel.—Richard K. Gregory, Greensboro, N. C. Filed March 16, 1907.

902,117. Automatic Headlight Deflecting Mechanism.—Joseph J. Shipley, Washington, D. C. Filed May 17, 1906.

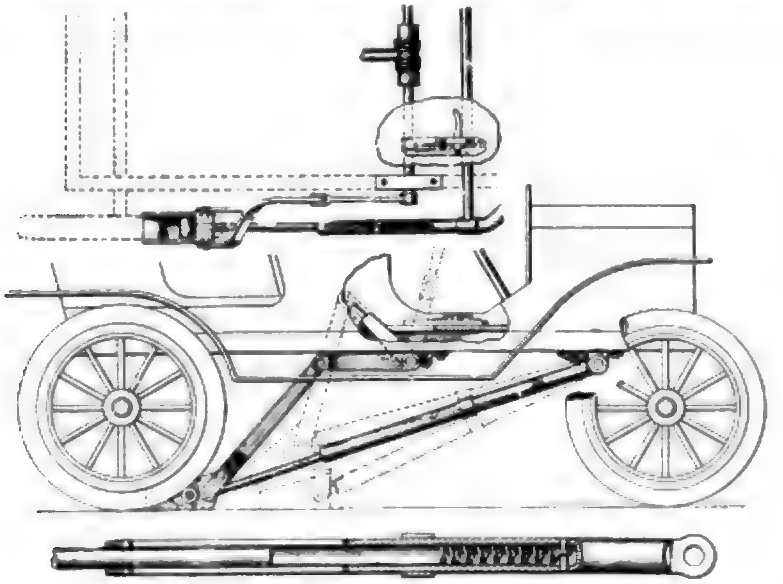
902,147. Tire.—Edwin T. Greenfield, Kiamesha, N. Y. Filed October 30, 1906. Serial No. 341,255.

902,149. Driving Mechanism for Motor Driven Vehicles.—Hans T. Hansen, Milwaukee, Wis. Filed May 29, 1905.

902,212. Sectional Tire.—Horace O. Craven, Schenectady, N. Y. Filed November 11, 1905.

909,250. Emergency Repair Device for Vehicle Springs.—Dudley P. Power, Riverdale, N. J. Filed November 10, 1906.

902,276. Tire Protector.—Francis G. Crone, Buffalo, N. Y. Filed September 11, 1905.



No. 898,082.

902,350. Engine Starter.—Louis S. Tuttle, Eastport, N. Y. Filed April 11, 1907.

902,426. Traction Wheel.—William L. Martin, Chicago, Ill. Filed January 16, 1907.

902,427. Electric Sparking Device.—Willie H. R. Mildebrath, Jacksonville, Fla. Filed January 20, 1906.

902,499. Inductor Magneto Alternator.—Leon Le Pontois, New Rochelle, N. Y. Filed October 24, 1907.

902,515. Friction Clutch.—Martin L. Williams, South Bend, Ind. Filed December 7, 1906.

902,522. Electric Circuit Controller for Internal Combustion Engines.—Charles Cuno, Oconomowoc, Wis. Filed September 19, 1906.

Patents Issued November 3, 1908.

902,550. Universal Joint.—Maurice E. Blood, Clarence C. Blood and Howard E. Blood, Kalamazoo, Mich., and Charles W. H. Blood, Winthrop, Mass. Filed July 10, 1908.

902,551. Tire Jacket for Vehicle Wheels.—James Bowie, Omaha, Neb. Filed March 30, 1908.

902,558. Speed Controlling and Reversing Apparatus for Motor Vehicles.—Harry T. Coldwell, Newburgh, N. Y. Filed February 12, 1908.

902,559. Speed Controlling and Reversing Apparatus.—Harry T. Coldwell, Newburgh, N. Y. Filed January 6, 1908.

902,560. Speed Controlling and Reversing Apparatus for Motor Vehicles.—Harry T. Coldwell, Newburgh, N. Y. Filed December 24, 1907.

902,583. Lubricator.—John C. Hill, Chicago, Ill. Filed April 17, 1908.

902,644. Connection for Inflating Tires.—Wyatt Boyd, Sabina, Ohio. Filed October 29, 1907.

902,692. Motor Carriage.—John C. Sherman, Brookline, Mass. Filed August 21, 1905.

902,782. Ignition System for Explosion Engines.—Richard Varley, Englewood, N. J. Filed October 1, 1906.

902,783. Ignition System for Explosion Engines.—Richard Varley, Englewood, N. J. Filed October 1, 1906.

902,926. Vehicle Tire.—James A. Swinehart, Akron, Ohio. Filed January 31, 1906.

902,824. Vehicle Tire.—Grant Lambright, Rutherford, N. J. Filed June 28, 1906.

902,944. Controlling Device for Motor Vehicles.—Frank S. Davis, Toledo, Ohio. Filed October 14, 1905.

902,999. Clutch.—Charles W. Pradeau, Shepherd's Bush, London, England. Filed October 7, 1907.

903,080. Road Vehicle Wheel Axle.—Luigi Granieri, Rome, Italy. Filed May 12, 1908.

903,090. Dynamometer for Explosion Engines.—Nevil M. Hopkins, Washington, D. C. Filed February 12, 1908.

903,122. Air Purifying Device for Automobiles.—Herman E. Whiting, Palmyra, N. Y. Filed March 4, 1908.

903,133. Controlling Mechanism for Engines.—Giovanni Enrico, Turin, Italy. Filed December 10, 1906. Renewed April 15, 1908.

Patents Issued November 10, 1908.

903,187. Washer.—Russell W. Guilford, Auburn, Ind. Filed January 27, 1908.

903,206. Mixing Valve.—Henry D. Lauson, New Holstein, Wis. Filed April 25, 1908.

903,256. Vehicle Wheel.—Martin L. Williams, South Bend, Ind. Filed February 12, 1906.

903,349. Steering Gear for Motor Vehicles.—Charles O. Barnes, Oswego, N. Y. Filed January 11, 1908.

903,447. Vehicle Axle.—Hazel B. Bush, Littleton, Colo. Filed June 25, 1906.

903,506. Acetylene Gas Generator.—Edwin M. Rosenbluth, Philadelphia, Pa. Filed August 29, 1907.

903,689. Air and Gas Engine.—Hugh T. Dunn, New York, N. Y. Original application filed January 22, 1902. Divided and this application filed April 28, 1903.

903,708. Vehicle Wheel.—George H. Groth, Cincinnati, Ohio, assignor of one-half to Auta N. Groth, Cincinnati, Ohio. Filed May 26, 1908.

The Horseless Age

First Automobile Journal in the English Language

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Some Jigs and Special Tools for Automobile Manufacture—II.

By Robert G. Pilkington.

A writer in these columns has for readers many thousands of the most highly skilled technical men in the world as well as those whose feet are on the lower rounds of the ladder. As much that is said in these articles will seem didactic, let it be assumed that it is for the benefit of these latter ones. The statement that a certain piece is made higher than another for a certain reason may seem obvious to one, while to another of "the younger set" it may come as a new idea, or a fresh and lucid exposition of an old idea.

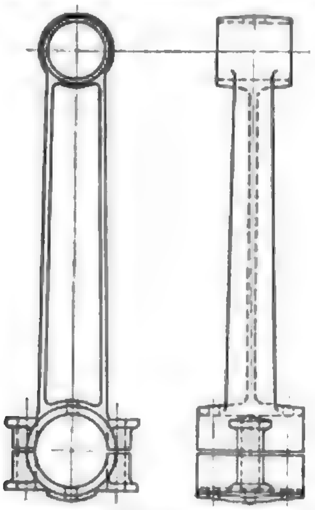
Fig. 1.

Skill and forethought in the design of special tools receive their best reward when applied to valuable material on which much work is done. The connecting rod of a multicylinder motor is a good example of this class, and will form the subject of the discussion in this paper. It will be assumed that it is an H section drop forging, in which cap and rod are forged in one piece. Fig. 1 shows the rod on which the machinery is finished. The sequence of operations will be as follows:

1. Milling sides of ends (one fixture).
2. Drilling and reaming crank and piston pin fits (one jig).
3. Straddle milling bolt and nut surfaces on head (one fixture).
4. Drilling and reaming small holes (one jig).
5. Cutting off cap (No. 3 fixture).

Many of the most experienced tool makers seem unable to give a concise and satisfactory definition of the difference between a jig and a fixture. The writer has yet to find one in the printed matter on this subject. The following is submitted as original with the writer, though it may have been published before.

A jig is a work holding device in which the machined dimensions of the work are determined by the device itself.

A fixture is a work holding device in which the dimensions of the work are determined by the setting of the machine on which the fixture is used.

The different operations are shown in Figs. 2, 3, 4, 5. It is assumed that a bushing is pressd into the upper end of the rod and die cast babbitt is used in the head, dowels being used to hold the babbitt. The first, third and fifth operations lend themselves best to a milling machine with two adjustable vertical spindles, of the class so well represented by the product of Ingersoll and Beaman & Smith. One cut should be all that is necessary, as the upper end always has clearance on the sides and the head fits against the flange on the babbitt liner. It will pay to use Novo cutters or their equivalent.

The fixture in Fig. 2 is arranged to carry eight pieces. In filling the fixture the first time after setting up pieces are put in the odd numbered positions and a "dummy" in the even numbers. The machine is set to take off the required amount and a cut taken. Before reversing the feed No. 1 rod is turned over and put in No. 2 position, No. 3 in No. 4, and so on. The hardened pads in the even numbered positions are just enough higher than those in the odd numbered ones to leave the work of the required size. After clamping down and running under the cutters a second time the rods on the even numbered positions are finished, a cut having been taken "going and coming." Odd numbered positions are again filled with rough work. All pins, pads, strips, etc., which locate the work are of hardened tool steel, unless it be the strips on the sides. These can be of case hardened machinery steel if desired. The clamps are made to bear on the web of the rod, not on the flanges.

Right here it is well to point out one or two of the mistakes that the novice in tool design often makes. He should bear in mind continually that in making tools it is, comparatively speaking, work that costs, not material. Where two important surfaces can be made to lie in the same plane they should by all means be so made. It saves resetting the tool, both for the tool maker and the inspector. It costs no more to make the pads thick than to make them thin, and by keeping the two surfaces of the casting on which the pads rest in the same plane the risk of making one mistake is eliminated.

The sides of the pads need only a rough

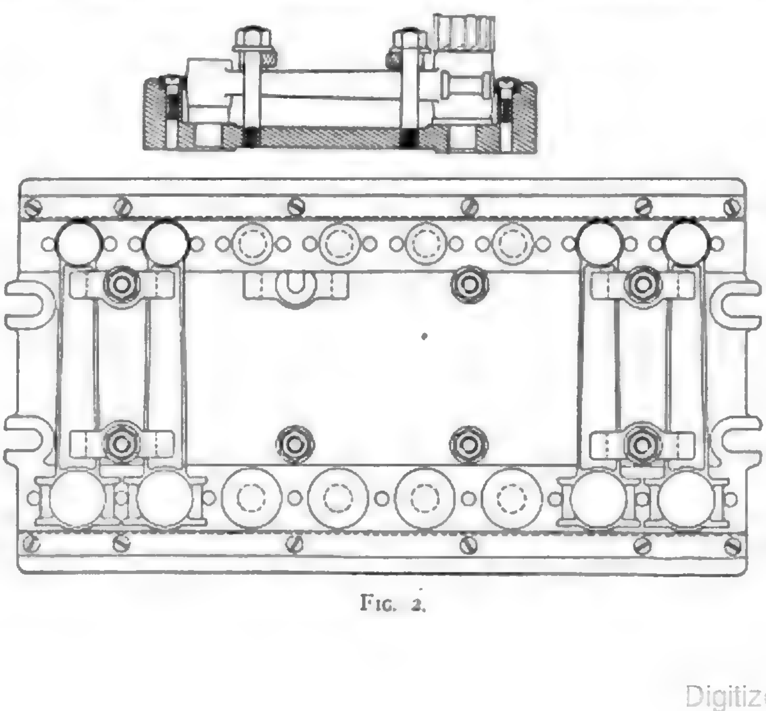
Fig. 2.

finish, and if the bar stock from which they are turned is properly centred a sixteenth is all that it is necessary to remove. The experienced designer, then, will call for sizes that are a sixteenth less than the regular bars carried in stock. Unless it is absolutely necessary to do so, sizes in whole inches, eighths or quarters should not be called for, as it generally means the unnecessary removal of stock.

There are times, however, when a litle extra work in removing unnecessary metal is justified. If the stems on the small pads in Fig. 2 are properly proportioned those on the large pads are not. But they are all press fits, and it is much better to be able to use one reamer for all the pad stem holes and to use one setting of the grinders for the stems themselves than to change both. It will save time in the end.

A gang or multiple spindle drill is a sine qua non in this work, and one of at least four spindles is required for drilling and reaming the crank and piston pin fits. Fig. 3 shows a familiar form of box jig for this purpose. The usual slip bushings for drill and reamer are provided for each end. The upper view would have been much clearer if the lid of the jig had been omitted, but this was not discovered in time to have it corrected. It can perhaps be made clearer by a little fuller explanation.

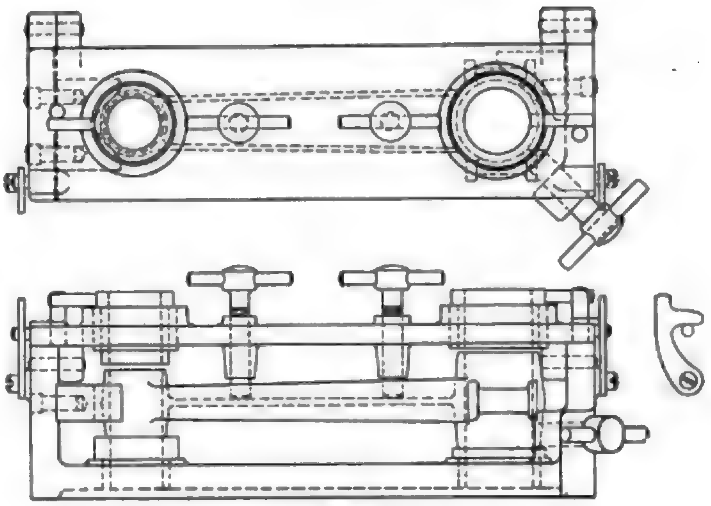
Fig. 3.

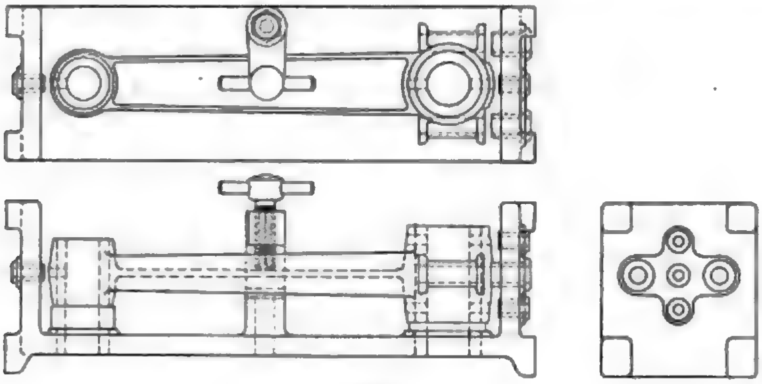
Fig. 4.

In putting the work into the jig it is laid on the lower bushings and the lid brought down and clamped by the cam hooks, one of which is shown at the right. The holding screws in the lid are then brought down lightly, followed by bringing up tight on the locating screw at the right. This forces the piston end of the rod into its V block and the crank end over against the 45 degree surface of its block. The work-holding screws are then brought down tight.

Cam hooks are not used in some shops, and a screw as shown in Fig. 4 is preferred. The under surface of the head is finished so that when tight it will stand at right angles to the slot, and is thus released by a quarter turn. The beveled head allows the lid to be brought down, even though at a slight angle to the slot. It is, however, somewhat more expensive to make. In the best designed jigs work-holding and locating screws are made to work in a case hardened sleeve, especially if the bearing is short. Advantage is taken of the long bearing on the work-holding screws here shown to omit the sleeve. If it were not for the great difference in the size of the holes one jig would serve for them all. However, the drills for the two large holes require an entirely different machine from the small ones, and are much better handled by a separate jig.

The jig in Fig. 4 will serve as a test of the accuracy of the work done on the last operation, as the pins which locate the work will not enter unless the holes are the right distance apart. It must not be supposed that the fact that the piece has been drilled in a jig makes a test unnecessary. It is far from being so. A careless cleaning of the jig after finishing an operation, a chip under the cover of a box jig, or between the jig and the drill table, the breaking of a corner off of the lip of the drill will all affect the accuracy of the work, often to the extent of its rejection.

This jig locates two holes for the cap bolts, an oil hole in each end and four dowel holes for the babbitt liners. It will be noticed that the large locating pins are hollow. This makes it very easy to clean all chips and lubricant from the jig with the air jet. The two upper dowel holes in the head are located positively by the holes in the locating pin serving instead of drill bushings. The holding screw with the T head swings on the pivot indicated by the nut, and allows the work to be lifted out. This form of jig makes it necessary for the drill press hand to keep his table clean, as a chip under any of the feet would materially affect the work. Indeed, no shop in which a systematic effort is made to keep clean omits the air jet at each machine.

For the third and fifth operations there

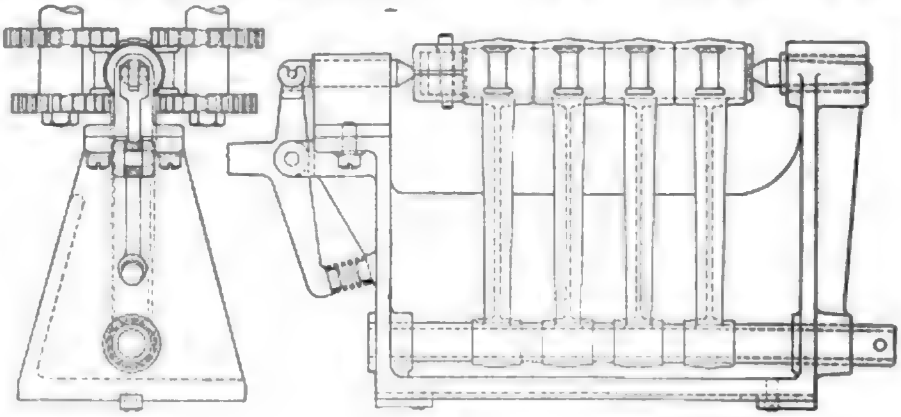
Fig. 5.

is more or less temptation to make a very simple form of fixture to take only one piece, and to run through the cutter twice, turning the piece over between cuts. The saving would occur only in the cost of the fixture, and a cumulative loss would occur as soon as its use began. The features of the fixture shown are all such as have proven satisfactory after long use. As an example note the spring tension on the live centre. Of course, it is obvious that none of the pressure of the cut is intended to be taken by this centre. The side pressure is neutralized by the use of opposing cutters, or far more so than the grinding pressure on a B. & S. grinder on which has been used this arrangement for a long time.

In setting up the work four pieces are placed on the arbor, the cap is put on the end, and the key dropped in place. After placing on the centres the locating pin is pushed through the lower ends. Note that this is one of the places where hardened sleeves may be called for to carry the locating pin. After the locating pin is in place the key in the arbor cap is tapped firmly in place, clamping the work firmly. Exactly the same procedure is carried on in the fifth operation, the only difference being that thin slitting cutters are used. While a cut is on the operator will fill a second arbor with work. The great advantage of clamping the work in this way is that in cutting apart there are no loose pieces to wedge and break the cutters, or to be marked by the teeth. One advantage of a fixture that finishes enough pieces at each filling for one motor is that it is a check on the number of perfect pieces delivered to the stock room. If the machine operator has not enough pieces to fill it full the required number of times some have been spoiled in process, and the foreman of the department should know it.

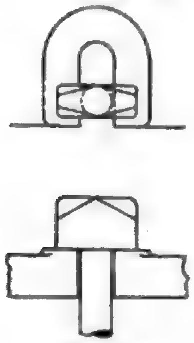

Fig. 6.

The best shops inspect work after each operation to avoid finishing spoiled pieces, and if such repeated inspection is necessary it certainly is on the connecting rod.

Our attention has been called to the fact that aluminum cannot be welded autogenously. It can be welded electrically, but this process does not lend itself well to repair work.

Limits of Precision in Automobile Design.

By Albert L. Clough.

In a recent remarkably well written advertisement of a new car, which is being brought out by one of the large companies, the following statement appears: "We just want to tell you that automobile designing and manufacturing by men such as those who have agreed to deliver the ——— cars is just as much a science—is just as devoid of elements of guess and chance—as is steamship building. * * *"

Naturally, being publicity matter, the above statement is a pretty strong one. If a heavy penalty were to be exacted for failure to meet contract specifications it is rather to be believed that there would be less likelihood of financial loss in the predetermination of the draft of a steamship or the speed of a locomotive than in the forecasting of the performance of an automobile. Nevertheless, the statement above quoted is true in spirit in so far as it conveys the idea that automobile designing has become a branch of engineering and is no longer a blindly empirical game of "hit and miss."

A statement like the above leads one to the consideration of the limitations existing in the exact design of motor cars and the general conditions which prevail in this branch of engineering. The designing engineer who lays out any piece of machinery has to secure the realization of predetermined results along two lines. He has to secure certain results as to the performance of his construction, and, at the same time, he is bound to insure other results as regards endurance. In other words, he has to produce a machine which will do what it was intended to do in the intended manner, and, furthermore, he must insure that his machine will do this work free from failure of its parts during its expected life, and be exempt from abnormal wear. He has, of course, at the same time to meet the financial limitations imposed upon him. This applies to automobiles as well as to other machines.

ROAD RESISTANCE A VARIABLE FACTOR.

A good automobile designer is undoubtedly able to predict quite closely the performance of the car which he is designing if he has at hand reliable speed and torque tests of the motor which he is to use. There is considerable available data, which can be picked up, as to the speed performances of cars with known engine power, known weights and gear ratios; which have known areas exposed to air resistance, and which employ transmission systems similar to that to be embodied in the new design. By means of careful allowances for the effects of the differences existing between cars of known performance and the car under design a pretty close estimate may be made, for instance, as to the speed of the new car on a smooth, level road.

The closer the cars of known performance agree in all essential points of design with the car under design—although the magnitudes involved may be quite widely different—the closer the prediction as to the performance of the new car is likely to be, and the larger the amount of data which the designer has been able to accumulate upon existing cars closely related in point of design with his new creation, the closer his prediction regarding the latter may become. The older the automobile art becomes the greater the body of information which is available, and the more exact such predictions, based upon such empirical data, may be expected to be.

Although the basis of performance predictions such as these is empirical, the data upon which they are founded can only be successfully employed when physical laws are applied to it in such a manner as to pass from the known case to the unknown case without serious error. The facts as to the manner in which tractive resistance increases with speed and weight are rather vague. The rate of increase of air resistance with projected area and speed is considerably more definitely formulated. Usable formulæ covering matters such as these are necessary before the performance data of existing cars can be used as a basis of figuring expected performance of a new car, the essential magnitudes involved in which are quite different from those found in the cars from which the performance figures have been taken. The designer can find in various text books formulæ involving horse power, transmission efficiency, gear ratio and other factors which purport to give the speed of a car; but in all of these formulæ which the writer has seen will be found one or more so called "constants" which are of a most elusive nature. The "constant" which is the most difficult of definite numerical expression is the tractive resistance. Its indeterminate nature is such as to render these formulæ of very doubtful value.

By a comparison of a very large amount of experimental data some approximate evaluation of these constants will probably in time be arrived at.

Automobiles do not run upon tires of uniform constitution on steel rails of definite texture, but upon tires of all degrees of resiliency upon roads or "near roads" of every description of badness. Even the "smooth level road" may vary in its "fastness" or "heaviness" to such an extent as to vary the tractive resistance so widely that the same car will run at greatly different maximum speeds upon them.

RESISTANCE OF GRADES.

When it comes to predicting the hill climbing ability of a new car somewhat closer results may be hoped for when the speed and torque characteristics of the motor to be used are available. Here it is more a matter of motor output, gear weight and transmission efficiency, and tractive resistance assumes a place of less importance in the calculations, so that any error involved in its estimation is of less final detriment.

The efficiency of standard forms of small drive and of certain forms of change speed gears, such as the lay shaft type of sliding gear set with direct drive, are beginning to be pretty well known, under all loads and speeds met with in practice, and the designer may often have at hand efficiency tests of the very transmission elements which he is to use in the newly designed car. There should be little difficulty in predicting quite closely the grade per cent. which a new car will be able to surmount on each gear, assuming a smooth road of solid surface, for the designer will have the total weight of the complete car very closely calculated in advance.

FUEL CONSUMPTION.

Fuel consumption under ideal conditions will be closely predictable from block tests of the motor, if the same carburetor to be used in practice is used in these tests. The sufficiency of the cooling system of a new car can be pretty well insured in advance, especially if the tests upon the motor to be used include a determination of the total number of thermal units rejected at full load to the jackets at the water temperature which it is desired to maintain. Radiator manufacturers possess quite an accumulation of experimental data upon the heat dissipating power of their various types and sizes, and the advice of a good manufacturer can be followed with reasonable confidence after a safety factor has been applied. Of course every manufacturer has derived from his own experience considerable radiator data on previous models of cars and the cars of other builders, and a comparison of the radiator requirements of other cars, with due allowance made for the differences in the heat to be rejected, enables a close check to be placed upon the radiator manufacturer's recommendations.

If instead of using upon the newly designed car a motor which has been fully tested out a specially designed motor is prepared for the new vehicle and every detail of the car is laid out upon the assumption that the new motor will actually deliver a certain calculated speed and torque output, the results as to the final performance of the car are likely to be very far from the expected ones.

PREDETERMINING MOTOR POWER.

Of course, if the new motor is an exact copy, except as to dimensions, of one which has been thoroughly tested out, its output may be approximately predicted.

If, for instance, a change is made only in the matter of bore, and valve areas and gas passages are changed accordingly, quite a close forecast as to the output may be made. Still, there is a difference in efficiency between large and small bore cylinders which is by no means well formulated, and this consideration and others enter into the computation which fixes the output of the new motor.

Should the bore and stroke both be changed so as to retain the same ratio the conditions may be rather favorable for a close prediction of output, but if the bore stroke ratio is largely varied the actual output is likely to be far from the calculated, even if every other factor is retained as nearly in correspondence as it may be. It is probable, however, that before very long enough data may be available to enable the designer to vary bore and stroke through wide limits with pretty definite results, and it is likely that some of the larger concerns have got together enough experimental data, from the large number of motors which they have built, to furnish a usable, empirically founded method for doing this. If the design of the new motor is not merely a reduced or enlarged copy of a motor which has been fully tested out, but differs in compression ratio, valve arrangement and setting and as to the inlet manifold arrangements or other points, its predicted output is likely to be of about the same order of accuracy as an election forecast. There is an interdependence of one changed factor upon another which creates a situation that baffles exact calculation, especially as the effect of changing any one of these factors alone is none too well known. Suppose a designer to bring out a new inlet valve and manifold design, and at the same time to change his compression ratio. Are the laws of the flow of gas through more or less complicated passages sufficiently well formulated to enable him closely to predict the exact proportion of the piston displacement which will be filled, at atmospheric pressure, at the working speed of the motor and with a given valve timing, and also the temperature of that gas at the instant of ignition? If not, what will be the accuracy of his calculations of the thermal units liberated per working stroke, and what will be the fate of his computations as to the effect of the changed compression, which are based upon the assumption that the initial pressure and temperature of the inspired charge are unchanged? This is merely one example out of many that could be cited. If the output of a new motor designed upon lines new to his company is to be predicted with any sort of accuracy, his best resource is to find a motor somewhere which is as nearly as possible like his proposed one in all respects, and to have it tested out and even to have changes made upon it, if practicable, to make it correspond more closely to his ideas. Its performance when the changes have been made will furnish the basis for computations covering changes in dimensions and slight differences in other respects that are likely to be "within a row of apple trees."

PERFORMANCE TESTS OF MOTORS.

It is quite customary for a manufacturer to get out the motor for his new car well in advance of the fixing of the features of design of the car upon which it is to be used and to make thorough speed and torque tests before the rest of the car is definitely settled upon, except in a general way. If motors are to be bought a thorough test of a sample engine is made in advance of the laying out of the whole car, in cases where any definite predetermination of the finished vehicle is demanded.

(To be concluded.)

Motorists' Liability Laws in European Countries.

The German Reichstag is at present discussing a bill which makes motorists responsible for any damages done by their cars, except where they can furnish proof that the party damaged caused the accident by his negligence, etc. This legislation reverses the old Roman law, according to which the party suffering the damage has to furnish proof that the party accused was responsible for the damage. A similar law has been enforced in Austria since August 9, 1908. We learn from an article on the subject in the *Allgemeine Automobil-Zeitung* that the first legislative attempt to regulate the liability of motorists in case of accidents was made in Switzerland. In that country a bill was presented by one branch of the Legislature to the other on December 15, 1902, according to which automobiles were to be placed under the liability regulations applying to railroads. In Belgium a bill was presented to the Senate on November 13, 1906, relating to the responsibility of automobile owners and drivers for damages done by them. Finally a bill was introduced in the French Chamber of Deputies in October, 1907, which also related to the liability in connection with accidents due to automobile traffic. None of these several bills has, however, become a law so far.

The Austrian liability law exempts vehicles which are incapable of exceeding a speed of 25 kilometres per hour (16 miles per hour) on a level road, according to the findings of the automobile inspection committee in the particular district. These vehicles must carry a round plate about 2½ inches in diameter, with the inscription "Maximum 25 km." All insurance policies issued previous to the date of application of the new law became at once null and void, and since that time the premiums have increased 250 per cent.

This enormous increase in the rates of premium has only recently been announced, and has been the cause of strong protests on the part of motorists. The Physicians' Automobile Club of Vienna has bound all its members to terminate their insurance immediately the increased rates go into effect, and have petitioned the other motorists' organizations in the country with the object of forming a mutual insurance company. As an illustration of the great expense caused motorists by the increase in the premium rates it is mentioned that the insurance premium on an 8 horse power business runabout, which formerly was 95 crowns per year, is now not less than 327 crowns, and even then the owner must assume 10 per cent. of the risks, and in no case less than 100 crowns.

The Knight Engine.

By F. E. Watts.

Probably nothing that has occurred in the automobile industry for some time past has aroused as much curiosity as the adoption of the Knight engine by the Daimler and Minerva companies. Coming at this time, when most of the well known and successful companies in this country are afraid of adopting anything which departs in the least from what has come to be considered accepted practice, the announcement has excited a great deal of speculation, mostly adverse. Many of our most prominent engineers are openly skeptical as to the merits of the Knight engine, and it will take considerable demonstration in contests and upon the road before the older heads in the industry will believe all the rosy reports which have come to us from across the water.

The writer has followed the progress of the Knight engine with interest for the past two years, and is unable to see that the designers of the English Daimler Company have made any sweeping changes in its construction. It may be, however, that there are sufficient changes in details, which are not shown by the photos and sections which have come to hand, to account for the reported marvelous increase in horse power.

The Knight engine is an ordinary four cycle pure and simple, and the only respect in which it differs from common design is in the use of thin sliding sleeves of cast iron to perform the functions of the usual poppet valves. This mechanism was adopted primarily to do away with valve noises. The first thoughts which come to the experienced engine designer when looking at sectional drawings of this engine relate to the difficulties of lubrication. There is about three times as much wall surface to be oiled as in the usual type of cylinder of the same size, and the surfaces between the sleeves and between the outer sleeve and the cylinder wall must be lubricated without there being sufficient range of movement to the rubbing parts to distribute the lubricant. Apparently these difficulties have been overcome, but most of us will feel more sure of the matter when the engine proves successful in the hands of a wide variety of private users. Difficulty would also be expected in conducting the heat from the piston through three layers of cast iron and three oil films to the jacket water.

The weight of a pair of sleeves for the 38 horse power engine made by the Daimler Company is given as 16 pounds; as their travel is in the neighborhood of an inch, judging from the old Knight engines, their inertia would be a somewhat serious matter if they were in phase with each other and with the piston. But as these movements do not correspond either in velocity or time of reversal, although they sometimes correspond in direction, it is probable that these effects will not be noticeable.

During the explosion and compression strokes, when the side thrust of the piston is greatest, the sleeves move in the same direction as the piston, and the effect of this action is to reduce the rubbing speed of the piston when the wear is most serious.

It is doubtless partly because of this movement that offsetting has not been found advantageous in this engine. But it should also be considered that the offset used was excessive, being one-quarter of the stroke. While the proper offset for any engine depends upon a large number of factors relating to its design and use, an offset of one-quarter stroke is excessive for almost any condition, and there is no doubt that so much offsetting might materially throw a four cylinder engine out of balance. But to promiscuously condemn all offsetting, as has been done in some of the articles which have emanated from the Daimler factory, is ridiculous.

For the Daimler (Knight) four cylinder engine, having a bore of 4.882 inches and a stroke of 5.118 inches, the following test results are given:

R. P. M.	Piston Speed.	Horse Power.	Horse Power Per Square Inch of Piston Area.
1,000	855	50	.67
1,200	1,023	61	.81
1,500	1,285	72	.96
2,000	1,710	85	1.13

Columns 2 and 4 are calculated. The figures are only approximate, the power for 2,000 r. p. m. being less than 85. In Fig. 1 these results are plotted in curve A. Curve B is from a pretty good American motor, having its valves in pockets all on one side. Curve C is from a well known air cooled motor having valves in the head. Point D is from a water cooled motor, with valves all on one side. Point E is from a well known European motor, having its valves on opposite sides. All of these show great inferiority to the Knight in power delivered per cubic inch of space swept by the piston.

In comparing two engines of the same size, using the same fuel and working upon the same cycle, it will be seen that one may give more power than the other for any or all of three reasons:

1. From using more fuel per cubic inch of piston displacement.
2. From using its fuel more efficiently.
3. From better mechanical and fluid efficiency.

The Knight system of valves gives a larger and quicker opening than has been found practical with poppet valves. The passages are much shorter and more direct, so it probably handles its gas more efficiently. As the timing is practically the same as that of a standard engine it probably gets a larger charge. As its combustion space is about the same as that of a motor with valves in the head, it probably gets a high explosion pressure and efficient expansion. And this may perhaps be aided by the fact that scavenging is probably rather more complete than usual, since inlet and exhaust ports are on opposite sides, giving the nice gas action noticeable in engines with valves so placed.

The gas is probably handled with less loss of power than in most engines, there being less "wire drawing." One would expect the mechanical efficiency to be less than with poppet valves, but if the lubrication of the sleeves is good it may be nearly the same. Carburetion conditions should be the same in both types. So on the whole we should expect an engine of the new type to give more power than the old, especially upon high speed; but whether this advantage will overbalance the evident difficulties in lubrication and cooling remains to be seen.

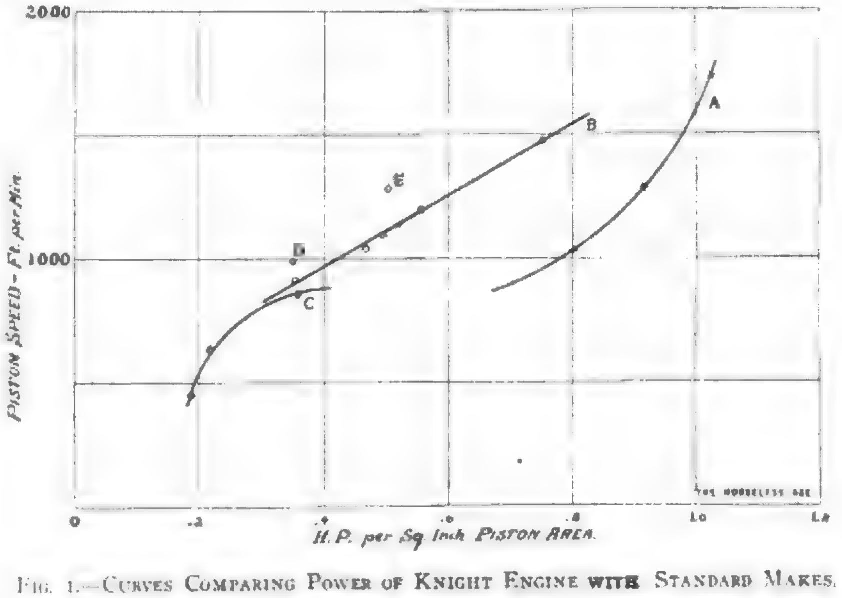

Fig. 1.—Curves Comparing Power of Knight Engine with Standard Makes.

Piston Valves for Gasoline Engines.

By J. S. V. Bickford.

Attention to these has been turned in England by the Daimler Company, of Coventry, taking up Mr. Knight's "Silent" engine, in which the piston is encased by two hollow trunks which constitute the valves. The analogy between such valves and piston valves is sufficiently close to warrant inquiry.

Probably people have been scared of the consideration of piston valves by the trouble which small valves of this design have given in steam engines. A solid piston valve working in a steam engine with superheated steam will leak "small potatoes" in about a month, as I have found out to my cost, and as I believe Mr. Clarkson has discovered. Why they should cut and wear in this way is obscure, but the fact is indisputable. On the other hand, a large firm of valve ring makers informed me that they could not recommend any of their patent packings at the time (two years ago) for such small piston valves as 2 inch. The trouble is that the rings, if they are of the ordinary piston ring type, collapse in passing over the ports and cause leakage. Further, it is well known that the slide valves used in the original gas engines gave trouble through wear, and taking these facts together probably the early inventors considered that it would not be expedient to waste time considering and experimenting with the piston valve.

A few moments' thought, however, will show that the conditions are by no means the same in an internal combustion engine and the steam engine. In the steam engine the piston valve if used is always exposed to the full pressure of the steam, and if the rings collapse when crossing the port this results in steam leaking direct into the exhaust port, thus resulting in very heavy leakage of steam. In the gasoline engine the conditions are different. When the admission port opens there is no pressure whatever, and when the exhaust port opens the pressure is at its lowest. This may still, however, be about 40 pounds per square inch, but if the rings do collapse at this point and allow leakage to take place the only effect is to make the point of opening of the exhaust port earlier, which makes no practical difference to the working of the engine or to the power developed, and could easily be allowed for in the design.

Further, it must not be forgotten that piston valves have been successfully used in small gasoline engines, and to the best of my knowledge have always given trouble in steam engines, which shows practically that the conditions are not the same. In many two cycle engines the main piston is used to uncover the exhaust and admission ports, and I have never heard that this arrangement gave trouble. If, then, it will work in the case of the main piston, it should work in the case of a piston valve which will be commensurable with the piston itself. That is to say, a 4 inch piston would have a piston valve not much less than 2 inches in diameter.

These considerations would lead us to expect that a piston valve could be used in an internal combustion engine.

It is now pertinent to ask whether there would be any advantage in using such a valve, in the face of the known success of the ordinary mushroom valve. The points of advantage are possibly quicker closing, less noise and perhaps positive action. That is to say, the valve could be closed by an eccentric instead of a spring, and the spring would therefore be done away with.

SILENCE A MINOR ADVANTAGE.

I do not consider that the point of silence is an important one. In the ordinary type of valve, where the lifter is provided with a fibre cap, as is now commonly the case, it is only under the most favorable circumstances that the valves can be heard at all. When one is traveling slowly before the wind the valves can be just heard like the ticking of a clock, and it would certainly not be a remunerative investment to complicate an engine to get rid of this noise. The point of quicker closing is, however, more important, especially at high speeds. Consider a spring operated valve for a moment. An ordinary valve of a 4 inch cylinder will weigh with cam roller and lifter close on 1 pound, and about the strongest spring which can be safely used is one of 50 pounds, so that the force tending to close the valve is fifty times its own weight. The lift will be about three-eighths of an inch and the diameter 1½ inches. How long will it take a valve weighing 1 pound to close under the influence of a 50 pound spring, the fall being three-eighths of an inch? The formula is $S = \frac{1}{2} a t^2$, where S is the distance in feet, t the time in seconds and a the acceleration in poundals (one-thirty-second part of the weight of 1 pound), and I work out the value of S as approximately one-one hundred and sixtieth part of a second. At 1,000 revolutions per minute the engine does one revolution in one-sixteenth part of a second, so that in the time that the valve is closing it will do, if this calculation is correct, one-tenth of a revolution, or one-fifth of a half revolution. This does not fortunately mean one-fifth of a stroke, as the piston travels a comparatively small distance during the first part of the revolution of the crank, starting from the top dead centre. It is obvious, however, that the distance is by no means negligible, and when the velocity of the engine increases to 2,000 revolutions the piston will travel close on to half a stroke while the valve is closing, and the discrepancy becomes serious, not only on account of the waste of gases but also on account of exhaust gases blowing into the induction pipes. Here, then, is one reason for using a piston valve opened by an eccentric. Further, there will be no shock. It is difficult to estimate what the shock of opening a mushroom valve is at high speeds, but it must be considerable, while in the piston valve the motion starts gradually and then increases, so that the valve is moving at a considerable velocity when the port opens.

LARGE ECCENTRICS.

There is, however, one difficulty in these valves when worked by an eccentric, in that the eccentric has to be of rather an abnormal size to obtain the desired lift and timing. The valve has to be open approximately through half of one revolution of the engine, and this will mean in an Otto cycle engine that the valve must be open during one-quarter of the revolution of the cam shaft or eccentric shaft. Further, in order to gain quick opening and to have a sufficiently large port, it would be doubtful if less than three-eighths of an inch lift could be used, and one-half of an inch would be much better, as the valve would open much more quickly if it overshot the port by one-quarter of an inch. Calculation will show that with one-half an inch lift under these conditions, that is to say, with a limit of half an inch from the opening of the port to the limit of travel of the piston valve, we shall have to have an eccentricity of 1¾ inches, and with a shaft of 1 inch diameter this means an eccentric sheaf of close on 5 inches diameter, which is approaching the cumbersome, and would possess quite a considerable weight of its own. This weight could, of course, be perfectly balanced by weights on each side of the eccentric.

The point of positive action would lead to greater reliability of the engine, other things being equal, for it is by no means unknown for a valve stem to stick in its guide and lead to a temporary stoppage which may necessitate the removal of the valve for cleaning purposes.

LUBRICATION.

There will be a further point to consider, however, and that is lubrication. A mushroom valve needs no lubrication, or, at any rate, does not get any, but piston rings must have oil, and the point must be carefully thought out. In all probability the valve would be of the piston type if it were to be used on an ordinary four stroke engine, with two valves (inlet and exhaust) to each cylinder, and this valve would then run in an open bottomed trunk communicating with the crank chamber, which would be lubricated by splash exactly as the pistons of many engines are lubricated. In any case this method would possess the advantage that all past experience of lubricating trunk pistons would be applied to it, and one would be saved from the more or less perilous paths of lubrication experiments, which are always a little uncertain because one cannot get inside the cylinder to see what is taking place.

On the whole, then, the question of piston valves for gasoline engines is certainly worth considering, and investigations in this direction might well yield profitable results.

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Dealing with Cylinder Carbon Deposits.

The carbonization of piston heads and the surfaces of the combustion spaces of vehicle motors is a condition which is generally regarded as inevitable after extensive service. The average user is fully aware that his motor, while in use, is gradually accumulating carbon incrustations, and probably in some cases attributes to carbonization operative defects which are due to other causes. Nevertheless, a deal of trouble is occasioned by these deposits, the presence of which is recognizable by well known symptoms. As with most other evils which afflict the motor, methods of prevention and of cure are both desirable of application. The avoidance of too rich or imperfectly gasified fuel mixtures and the employment of a not excessive quantity of a grade of oil which is as free as possible from a tendency to produce solid residue are obvious preventive measures.

Chemical analysis of these incrustations has shown them to contain considerable proportions of silica, the obvious source of which is fine particles of sand drawn in as dust with the mixture. It has been proposed to provide a chamber around the carburetor inlets, provided with baffling plates, among which the air circulates as it enters. These baffling plates it is proposed to coat with some adhesive substance which is expected to catch and hold the dust particles which would otherwise enter the cylinder, and which would be periodically washed off the plates. It is doubtful, however, whether this remedy would be found of practical application.

Any means which can be employed to keep down the temperature of the central portions of the piston heads, where the deposit is usually at its worst, is recognized as a measure tending to reduce the rate of carbonization.

Notwithstanding all preventive measures deposits will form in the course of time, and the method of their removal may be either mechanical or "chemical." Scraping out these deposits is a perfectly sure method, but if thoroughly done involves the taking down of the motor and a considerable amount of hard work, and results in some loss of use of the car.

The majority of motorists utilize the so-called chemical method by occasionally treating the cylinders with kerosene, which seems to keep down the incrustations to a very considerable extent. Scraping is, as a rule, finally resorted to after a long period of service.

Quite recently there have appeared upon the market compounds known as "decarbonizers," which, when applied to the combustion spaces of a motor, according to certain directions furnished therewith, are supposed to remove all accumulations from the metallic surfaces by a purely solvent action, often described as "chemical."

Experience has shown that some, at least, of these decarbonizers possess decided merit, much superior to that of kerosene, and that they do cause the breaking up and separation of these accumulations and lead to their expulsion from the cylinders, leaving the parts in a relatively clean condition.

The so-called "carbon deposits" are in all probability by no means pure carbon and silica, but are decidedly carbonaceous, and probably consist of carbon and silica particles bound together by hydrocarbons of a heavy and heat resisting nature, which have been produced by the "splitting," under heat, of the lubricating oil. It is reasonable to suppose that these decarbonizers contain substances which exert a solvent action upon this hydrocarbon binding material, the solution of which leads to the disintegration of the deposits. As there is no substance known which can actually dissolve carbon or enter into combination with it at ordinary temperatures, it is presumed that the above action is the one which actually takes place.

Naturally, the proprietors of these decarbonizers do not divulge their composition, but it is not unlikely that ether, benzol or other powerful solvents enter into the composition of some of them.

It can hardly be doubted that the periodical used of a good decarbonizer will keep down carbon deposits almost completely, without injury to the motor, and will obviate the necessity for the use of the scraper, with its attendant inconvenience.

Commercial Car Drives.

Practical experience of an enormously costly nature, not only to the parties directly concerned but to the commercial vehicle business at large, has finally impressed upon the minds of both builders and users that the speed of large commercial vehicles must be very low. Probably it cannot much exceed one and a half times that of horse drawn vehicles performing the same service, if any degree of economy is to result.

The problem of securing a sufficiently low gear for such vehicles, when driven by gasoline engines operating at rotative speeds comparable with those employed in pleasure car practice, is a serious difficulty which besets the designers of such trucks.

If chains are to be used for the final drive a previous reduction is demanded between the engine and countershaft, and this usually takes the form of a speed reducing bevel gear pair between the change speed gear and the sprocket countershaft. The full reduction cannot be effected in practice by the sprocket ratio, as the front sprockets either become too small or the rear sprockets too large for practical use.

If shaft drive is to be used—and the tendency in this direction in pleasure car practice is likely to be reflected in commercial work—the necessary gear reduction is with difficulty obtainable from a gear set giving direct drive on the high speed. A multiple thread worm pair seems to be the only manner in which a sufficiently low gear can be secured by a single reduction. The bevel gear becomes impractically large or the bevel pinion becomes unworkably small, if an attempt is made to effect the desired reduction by means of the usual final bevel drive arrangement. The double reduction final drive furnishes an alternative to the worm arrangement. The large bevel gear of the usual driving pair may be mounted upon a short countershaft parallel with the axle, upon which is a small spur pinion meshing with a larger spur gear fast to the differential casing. In this manner, or by a modification thereof, a very wide range of gear may be obtained.

It may reasonably be expected that designers of shaft driven commercial cars will be divided as to the merits of the worm drive and the double reduction axle arrangement, and considerable experience will be required to finally settle the question of superiority. Manufacturers are rather slow to take up the worm drive, as its application on the large scale is only very recent, and very careful proportioning is required if failure is to be avoided. Nevertheless, this form of drive gives splendid results when properly designed, and the theory and practice involved is being rapidly worked out and becoming known to engineers.

The double reduction axle, of course, involves only time honored mechanical arrangements and no newly adopted transmission elements. Furthermore, the widespread adoption of rear axle change speed combinations upon pleasure cars renders the designer less hesitant than formerly as to the location of gear combinations at this point.

It is probable that the double reduction final drive weighs more than the worm arrangement for the same service, and a certain loss is inseparable from the employment of each additional gear pair.

Development in this field may be watched with interest, as the noisiness of chain driven trucks is hardly in accord with modern ideas of fitness.

The Adoption of the Small Four Cylinder Motor.

The popularity of any type of construction is not always explicable by logical considerations; indeed, very often that mechanism which would seem the only reasonable one to employ is relegated to the background, while something far different becomes the accepted standard. At this stage in the progress of the automobile industry it is fast becoming a question whether the opposed cylinder motor, which seems the logical type to employ for many purposes where from 10 to 15 horse power is needed, is not to be quite largely superseded by small four cylinder constructions.

Most of the new small cars which are soon to be placed upon the market have four cylinder engines, some of them with as small as 3 inch bore. Even in the high wheel, solid tire machines, where the opposed motor has up to the present held almost undisputed sway, the small four cylinder engine is being tried out. Several four cylinder machines of this class are now undergoing preliminary tests.

It may be that this state of affairs is the result of the education of designers to the increased flexibility and general handiness of the four cylinder motor, and that many designers do not feel satisfied when driving anything else. But it is a question if a designer may not become overeducated in this and other respects. It would seem as though the advantages which the four cylinder motor has to offer over the opposed or the single cylinder vertical for small power were not commensurate with the increased wear, lubrication and ignition expense. But, as we stated at the beginning, there is no logical method of forecasting the trend of popular favor, and it may be that the four cylinder engine will prove most popular for all classes of pleasure vehicles.

A Possible Cause of Tail Light Failure.

A tail light which won't stay lit is one of the most exasperating things a motorist has to contend with. It is particularly troublesome because, as usually located, the driver cannot ascertain whether the lamp is lighted without stopping the car.

Cheap tail lights almost always give trouble, but occasionally even the best of oil lamps will keep their owner busy. Not long ago a motorist was encountered who was having a great deal of trouble with his tail light going out, although he had a good make of lamp. After long pondering over this trouble he finally came to the conclusion that the lamp was extinguished by the fumes from the exhaust. It is very possible that this was the true solution of the mystery. The products of combustion could extinguish such a lamp in either of two ways—by creating such a powerful draft past the lamp that air would be drawn away from the inlet openings, so that there would not be sufficient oxygen to support the combustion of the oil; or by being thrown against these openings and entering the lamp in sufficient quantities to extinguish the flame.

Probably it is very rarely that tail lights are extinguished in this manner, but it would seem to be one of the possibilities which should be investigated by anyone who is having trouble of this nature.

The Use of Trailers.

A truck frame is usually designed to carry a given maximum load, with a liberal allowance of strength for torsion and bending stresses due to spring action, and to the many knocks and shocks it receives in use over rough roads. The effects of the possible use of heavy trailers are seldom considered. Although trailers are not generally used in this country, there have been a number of instances where trucks of 4 or 5 tons capacity have been called upon to haul trailers with equal weights over heavy roads.

If these trailers are carelessly attached they may cause excessive stresses in certain parts of the truck mechanism, and since these parts were not designed to withstand such work, they are apt to break and at best will be shortlived.

Where connection between the truck and trailer is made in such a manner that there can be considerable "slack" the sudden taking up of this slack, as in starting, adds to the tension on the connection that due to the inertia of the loaded trailer. This force may subject the joints of the frame to stresses of such magnitude and direction as they were not designed to withstand, and so loosen the riveting. Once these rivets are loosened it does not take long to develop sufficient play to make the vehicle useless.

In the usual side chain driven construction, if trailers are used, the chain struts have to stand up under a much higher compression load than they were meant to take. If they are well designed, however, with short and sturdy sections to guard against bucking, they should be able to do the work without injury.

It is customary to attach the trailer to the rear end of the main frame of the vehicle. So when the starting strain comes the front spring shackles and their bolts have to take the force of inertia of the springs and axle, and the front spring clips must resist the inertia of the axle. Similarly, the fastenings which secure the body to the frame must withstand the effects of the body and load. With a poor towing arrangement, or an unskillful driver, these forces may become very considerable. Where a machine is used for work it was not intended for results are almost always poor.

The Motor Situation in the Province of Ontario.

By F. E. Watts.

Although Ontario is a large province, having an area of about 222,000 square miles, it is the southeastern peninsula, bounded by Lakes Huron, Erie and Ontario and by the St. Lawrence River, and comprising perhaps one-fourth of the total, which we usually have in mind when we mention this name. This part of the province is the most thickly populated, has the best roads, and contains most of the cities and towns. It is about the only portion where the motor car is used to any extent. The country is for the most part gently undulating, although there are some pretty steep hills. The climate is much the same as in our Northern States; however, in the northern and eastern parts of the peninsula there are more snow and cold weather than is usual here, while in some parts of the country lying along Lake Erie the winters are rather milder than in similar latitudes in the United States.

There are some fine stretches of road, particularly in the vicinity of Toronto, and the average will compare rather favorably with ours.

While there is considerable manufacturing, agriculture and lumbering are the most important occupations. Ontario farmers work mostly upon a rather small scale, occupying themselves mainly with market gardening and fruit raising, and consequently are thrifty and well to do rather than rich.

The use of the automobile is about such as would be expected under the conditions we have just outlined. American cars of moderate power seem to be most popular The home product appears to be a close second. English built cars are rather less in evidence than would be expected, and there are comparatively few French machines. The distance from a supply of spare parts appears to have hurt the sale of European cars.

Toronto, which is the only city of any size, has wide and well kept streets, which compare favorably with those of American cities of similar pretensions. The main streets are paved with asphalt, as are also some of the principal cross streets. Many of the others are paved with brick.

At the time of my visit, about the middle of October, there were practically no closed cars operated upon the streets, and I saw only one electric vehicle.

FEW COMMERCIAL VEHICLES.

Only a few commercial vehicles are used. There is one baking company which uses a truck for bread delivery; and a truck is employed for hauling pianos by one of the dealers in musical instruments. Two trucks are kept in service by the Canada Cycle & Motor Company, makers of the Russell car, whose factory is located at Toronto Junction. They use these cars the year round, although it is sometimes very difficult to get through the snow between the Junction and the city.

This company, by the way, have quite a sizable factory, and make touring cars which are among the most popular in this section of the province. They make practically every part of their machines, and are about the only Canadian company to do this. Besides their pleasure cars, they manufacture a considerable number of bicycles, and turn out a limited number of commercial vehicles. They build two sizes of these latter, viz., a 4 ton truck and a 1,000 pound delivery wagon. Most of their commercial cars are sold in Australia and other British colonies.

It is stated that while the work of introducing trucks is slow, many of the leading stores of Toronto have seriously considered their adoption, and that the only thing which has prevented them from purchasing is the heavy snowfall. Owing to the snow, it would be impossible for them to discard horses, since they could not be sure of reaching suburban customers during three months of the year. There is some probability that these stores may adopt trucks for a part of their work.

TORONTO DEALERS.

Among Toronto dealers might be mentioned the Dominion Auto Company, who handle Stevens-Duryea, Maxwell and other well known cars; the Canada Cycle & Motor Company, who sell the Russell; Ford Motor Company of Canada, Ltd.; Hyslop Brothers, agents for the Cadillac and Darracq, and the McLaughlin Motor Car Company. This last is a branch of the McLaughlin Carriage Company, and handles the Buick cars, selling them under the name of McLaughlin. During the past year they have sold between 100 and 200 of these cars. Some were shipped over from the United States in parts and put together in their Canadian shops; others were imported ready to run. They claim that this year they will market in the neighborhood of a thousand cars, including their motor buggy model.

Among Toronto repair shops might be mentioned that of the Hutchinson Brothers, who also conduct a very successful school for drivers.

Not far from Toronto is the little city of Hamilton, beautifully situated upon an arm of Lake Ontario. Conditions there are probably very nearly typical of those in the cities of Ontario outside the capital. Not nearly as many cars are in use there as in most of our cities of about the same population. Indeed, the auto seems to be used there now to about the same extent that it was used on this side of the boundary three or four years ago. Such cars as the Packard, Ford, Franklin, Oldsmobile, Russell and McLaughlin are in evidence on the streets, most of them being recent models. There are several foreign cars in use, one of them being a six cylinder Napier, which had arrived the day before my visit. I noticed one of the old Pierce stanhopes, still apparently doing good service, and one or two curved dash runabouts.

The main streets in Hamilton have asphalt pavement, kept in fairly good condition. I was told by chauffeurs that the roads in the vicinity are very good during the summer months. There are several agencies and garages in the city. The Canada Cycle & Motor Company have a branch; A. P. Goering handles the Ford, Buick and Oldsmobiles. The Jackson Company have an agency, and the McLaughlin Company are building a salesroom, as their present building is filled with their display of carriages and sleighs.

The only use of an auto for commercial purposes in Hamilton is that of a Jackson car, converted into a delivery wagon and used by a baking company for delivering bread. The Hamilton Brewing Association are said to be in the market for a 7 ton truck, to be used in hauling beer to the depot, and it was stated that there are several other companies who are looking into the matter of mechanical haulage and only need a little urging to become purchasers.

SPEED REGULATIONS.

Speed regulations are similar to those in the United States, the legal limits being 15 m. p. h. in country districts and 8 to 10 m. p. h. in cities, according to the section. In some sections of the province these regulations are rigidly enforced, while in others the officials are more lax. In Hamilton, for instance, a speed of 15 m. p. h. is commonly allowed. The regulation requiring drivers to wear badges is not strictly enforced, but the rules regarding the use of lights are rigidly lived up to.

For some little time past a strong spirit of opposition to automobiling has been developing in some of the rural districts. This sentiment has grown to such an extent that I was assured that bills will be brought before the Legislature at its coming session which, if passed, would practically prohibit the use of the motor car. This proposed legislation will be patterned after the oppressive laws of Newfoundland and New Brunswick. It is not thought, however, that there is any danger of these measures being passed. Considerable of the responsibility for this adverse sentiment is laid at the door of motorists from the United States, particularly to those who "burn" the dust on the road between Buffalo and Detroit.

Generally speaking, the Ontario farmer has not yet begun to buy cars. He still drives into town behind a good horse, or a pair of them, seated in a well painted, neatly kept buggy. Such being his mode of locomotion, he is logically the aggressive enemy of the speeding automobilist. As before stated, he is thrifty rather than wealthy, and the task of separating him from a couple of thousand hard earned dollars for an automobile has proved beyond the persuasive powers of most salesmen. With the advent of the low priced cars of family carrying capacity it is very possible that he may become a factor in the market.

As there are few cars used by farmers, there has been little call for the motor buggy, but it is deemed that the time has come when its sale can be pushed to advantage. Besides the buggy which will be introduced by the McLaughlin Company, preparations for the manufacture of a machine of this class are being made by the Windsor Carriage and Wagon Works, of Windsor, a small town across the river from Detroit. In the nearby town of Walkerville is situated the Canadian branch of the Ford Motor Company. This was established some time ago with the idea of assembling cars for Canada and other British colonies. It is understood, however, that the scheme has never proven as economical as was expected.

The automobile trade in Ontario has never known such a boom as it experienced in more thickly settled countries; but, on the other hand, it has not undergone such a reaction, although it has been rather quiet there for the past six months. The market is fairly good at present and promises to show a sustained and healthy growth.

The Advantage of an Automobile to a Physician in His Practice.

By R. F. Medrick, M.D.

The means of transportation is an ever interesting subject for every twentieth century person who appreciates that the world doth move and who wants to move with it. Twelve years ago a physician did not consider anything but a horse and carriage as the means of conveying him daily from place to place to visit his patients. Now the horse and carriage is hardly considered and the automobile is accepted as the best all round instrumentality we can employ, not only for village and city visits but especially for calls at a distance. In arriving at this conclusion there are many items, such as the first cost, cost of running supplies, upkeep, delays on the road, fast time, etc., to be taken into consideration. I shall consider the various items according to the utility of the automobile to a physician in his daily practice and incidentally in recreation.

The item of first cost is one which has played a large part until recently, and has prevented many physicians from getting automobiles. This obstacle has been entirely removed, for nowadays one can purchase a light, suitable new automobile as cheaply as a good horse and suitable carriage together with the necessary equipment, such as harness, whips, blankets, etc. The purchase price of automobiles is becoming more reasonable, while the prices of good horses are as high as they were ten years ago, and at that horses seem to be more scarce.

The cost of supplies seems also to be in favor of the auto. An eminent veterinary surgeon has said that 14 miles a day is a day's work for a horse, day after day. It will cost 25 cents a day, at present prices, to supply a horse with oats, while an automobile will cover from 15 to 20 miles on 1 gallon of gasoline at 15 cents per gallon. The lubricating oil and electricity for the automobile cost far less than the hay and straw for the horse.

COST OF UPKEEP.

The cost of upkeep is rapidly disappearing as a prohibitive item. Many physicians refused to use an automobile two or three years ago on account of the tremendous expense of the upkeep. The manufacturers now have the mechanism worked out to a higher degree of refinement, so that the machinery acts more perfectly and breakage is rarer. Mechanics in the garages are more familiar with the various makes of machines and garages are more universal. In this connection the driver is a large factor. He, after becoming more familiar with his iron steed, does not expect as much intelligence of it as he did of his horse, and has learned also that it is quite as necessary to feed it its water, oil and gasoline. He has learned where to look for its heaves, its spavins and interferences, and to correct the difficulty of a corroded or displaced part, whereas he formerly was obliged to send for a mechanic and wait on the road till the latter arrived from some distant garage. I have used the same automobile for the last four years, and each year thus far have spent less for repairs and parts, and, incidentally, obtained better results. The rubber equipment of the wheels has probably been the largest item of expense. This, too, with experience of the operator and better goods on the part of the manufacturer, has been greatly reduced. The automobile, when not in use, doesn't cost anything for nourishment or care, while the horse must be given his food and drink thrice daily and requires other care.

The price of new rubber goods for 1909 is less than one-half of what it was formerly. Better roads, which have been brought about largely by the influence of the automobile, also share in reducing this large and expensive item. Under corresponding circumstances, such as distance covered and prevailing prices, the cost of maintenance of the horse and carriage or horses and carriages—for one auto will do more work than two horses—with their repairs, shoes, harness, blankets and wagon, will exceed that of the auto with its electricity, engine and tires.

MORE CONVENIENT.

In convenience the automobile is far superior to the horse and carriage. The car itself doesn't require as much attention daily as the carriage; whereas the engine requires far less than the horse. It can be filled with enough water, oil and gas in fifteen minutes to last one day at least, and oftentimes two or three days, whereas it takes a horse forty-five minutes three times a day to consume enough to carry it through the twenty-four hours. With the machine charged in the morning with gasoline, oil and water, the latter two of which need not be replenished oftener than once or twice a week, one has simply to turn the crank once or several times, then start off, and in five or six minutes one is at his destination a mile distant, where the auto is brought to a standstill without thought of looking for a tie post or a caretaker or concern as to noise, etc. The physician's attention can be placed undividedly on his patient, there being no necessity for concern as to the comfort or safety of his rig, for the auto doesn't get scared or break loose or feel discomfort from the heat, cold or flies. The call over, the engine is turned over and the physician is off for as many such visits as the occasion requires. There isn't any attention necessary at dinner or supper time, and at night the auto is run into its garage and left alone without further care. If during the night a distant call comes in, one repeats the simple manœuvre, which takes much less time for the physician and his sick patient than getting out a horse and carriage, either at home or a boarding stable. It is not necessary to favor the automobile up hill or down hill, warm days or cold days, or before and after feeding and watering it. Thus a physician can accomplish more work in twenty-four hours with an automobile than with a horse or horses, and also have more time for meals, recreation and with his family. For instance, I am now making trips 10 miles in the country, the latter 7 miles of which is a gradual ascent till I reach an altitude of 900 feet higher than here. This trip I make in 45 minutes each way with a single cylinder runabout, with about one-half the road in wretched condition, as the top dressing is worn off and the bed of large stones is very uneven. On this trip the machine consumes one gallon of gasoline. It takes a horse an hour and a half each way, and with the horse one has to consider his legs, his wind and heat of body. Upon your return the horse cannot be fed or watered for some time without harm or driven further with safety. The warmer the auto the better it works. The warmer the horse the less you must work him.

I am also making a distance of 12 miles, the last 4 of which is constantly up hill with several grades of 7 per cent. This I make in forty-five minutes up and thirty-five minutes down. Also another of 9 miles, the last one mile of which is a heavy grade, in about thirty minutes each way. Thus a large practice is brought within the scope of a small one; or a practice requiring an assistant can with the auto be accomplished by one man, greatly to the gratification and financial benefit of the physician and the better satisfaction of his patients. Upon these longer trips I usually take one or more members of my family. This has a tendency to reciprocate for the evening hours which our calling requires us to spend away from our homes.

SELECTING A CAR.

In general, the points to be considered in selecting an automobile for a physician, who, of necessity uses his auto in all kinds of weather, are simplicity of machinery, protection of the same, power of engine and weight, and construction of carriage. In simplicity of machinery I find that the fewer cylinders, consistent with the power required, the better. There are fewer spark plugs and valves to be kept clean, less gas and oil are required, less electricity is required, and it is easier to locate trouble when it occurs. The machinery should be protected from dust, mud, water, snow and ice. This is well accomplished by having the engine under the hood and the power transmitted by a shaft drive instead of a chain. These elements clog up the chain and other movable parts, and often short circuit the electricity. It is a mistake to carry much superfluous power in a runabout. Even a single cylinder machine is capable of traveling as fast on the level up or down hill as one should ride with safety; a multiple cylinder engine does the work more evenly, but with greater cost and trouble. In this connection it may be stated that the shaft drive is better protected, though it requires more power of the engine. The weight of the engine and carriage is important. The lighter the car the easier to get it in motion, the better it will climb the hills in proportion to the power of the engine, and the wear and tear on the tires is less, being in inverse proportion to the weight they carry.

In construction I prefer a long wheel base and long, full elliptic springs for ease of riding. I use a top in all kinds of weather. My first automobile was with interchangeable tonneau and deck board. While this arrangement was very serviceable for various uses, the inconvenience of changing, on account of the emergency character of a physician's work, often causes him to be carrying the tonneau, which is cumbersome in appearance and also makes him the victim of a sudden heavy storm.

One other point: There are many narrow and tortuous roads in the country, which is gradually becoming more popular with wealthy people for summer homes. These people employ large, powerful automobiles, and also speed-mad, reckless drivers, which elements make it even dangerous for one to drive a horse that has any spirit or life at all in such regions; and as a means of self-protection one must needs employ an automobile himself.

COLD WEATHER CONDITIONS.

In cold weather an anti-freezing solution put in the water system of a water cooled machine will prevent the troubles experienced by allowing the water to freeze. My experience teaches me to add the solution at the time of the first frost and not to wait for freezing weather, for in times past it has frozen while I slept. The cold weather has its effect also upon the tires. There seem to be less punctures in cold weather, and with good roads there is uniformly less tire trouble, for the tires do not become so highly heated and blowouts are less frequent. To this statement I would add two exceptions. When the roads are rough from frozen mud and ice they cut and grind out the rubber, thus weakening it, making "blowouts" more likely. A highly heated garage causes too great a change in temperature when the machine in use is subjected to very cold, sometimes zero, weather. The great difference in temperatures causes so much expansion and contraction that blowouts are more frequent. My observation has been that those having moderately heated or unheated garages have had less tire trouble in winter, though they do have more trouble in starting their engine after standing all night.

STALLED BY A TRIFLE.

To illustrate the importance of one understanding every working part of his machine, I may state that last October I was obliged to send three blocks to a garage for a machinist to come with an automobile, prepared to tow my machine to the shop, for when "turning her over" there wasn't any compression whatever, and I was at a loss to know where the trouble was, as it was different from anything I had ever had happen before. Upon examination the machinist found that a rod had jumped out of the groove of a wheel onto the rim thereof and thus kept the intake valve open all the time. He knocked it back into the groove, and we both drove away under our own power. Last month I had the same thing happen on the Hawk's Nest Road, which is all the name implies, about 5 miles out of town. Instead of being stalled myself, and consequently blocking the road for others in both directions till a machinist could come this distance, I simply raised my deck board, spied the displacement, knocked the rod into the groove, turned over my engine and in twenty minutes was home.

CONFLICTING REQUIREMENTS.

When I witness the magnificent runs made by my single cylinder runabout it makes me feel that she is a wonder and that I haven't any need for a larger or more powerful machine for business purposes, for seats for two are enough and I can travel as fast as one ought to ride. It is nice, however, for a physician to have a tonneau car, so that upon long trips he can be accompanied by members of his family, for, on account of the nature of his work and being on duty all of the twenty-four hours, he has but little time to associate with them.

I have used the same runabout for the last four years, and each year have had less trouble and expense and more uniformly satisfactory results. The previous year I used an interchangeable tonneau and deck machine of the same make with much satisfaction. It is more serviceable and less trouble, however, for pure business purposes to have your runabout with top ever ready for service and for protection from heat and storms.

I have used a high wheel machine with cable drive some, and find that they ride less easily on rough roads; and while they are less apt to tire trouble on the road, the tire seems to wear out sooner than the pneumatic.

One more point which may be worthy of consideration is this: There is a saying that "it is easier for a physician to ride into a practice than to walk into one." It may said further that "it is easier for a physician to automobile into a practice than to walk or drive into one."

Rubber-Asphalt Roadways.

According to a report from Consul General Robert P. Skinner, experiments, covering periods of six years, have been made with this pavement in several cities throughout France, including Paris and Lyons, and as far as can be ascertained have given good results.

In the city of Marseilles a satisfactory experiment was made upon the Prado a number of years ago, and this spring three or four public places were similarly paved, these areas, however, being devoted to pedestrian traffic exclusively. Innovations of this kind make slow progress in France, but from the character of the men interested in the company and the increasing importance of the work undertaken rubber-asphalt paving must be regarded very seriously as a substitute for the more usual form of asphalt paving.

At the present time most asphalt paving involves the use of costly installations for the heating of the powder, a considerable amount of material, and a special class of laborers, all of which tend to increase the cost. Under the new process it is possible to make cold applications of asphalt, which are said to possess all the advantages of hot compressed asphalt without its drawbacks.

The material under description is a product resulting from the association of asphalt and rubber. Asphalt is a carbonate of lime impregnated with bitumen, with which rubber combines under certain conditions, thus effecting the cohesion of the calcareous molecules. This product is claimed to be more plastic and more adhesive than pure asphalt, and to resist higher temperatures. To obtain the combination of bitumen and rubber they must be energetically mixed in special devices, in which the asphalt, reduced to fine powder, is in the presence of rubber swelled and softened by a solvent. The material thus obtained is a brown powder, darker than the original asphalt, and it suffices to compress it in order that it shall set and harden rapidly.

It is alleged that when asphalt is applied hot the heat of the application, coming into contact with a concrete foundation containing more or less humidity, vaporizes the water contained therein, and the steam, by its force of expansion, escapes, thus destroying the compactness of the combination. This inconvenience does not present itself in the system under designation, which permits the application of a much thinner layer of asphalt and one which unites itself with the concrete, constituting a solid mass. The observations of this form of pavement satisfy those interested in the subject that the completed surface resists ordinary wear more satisfactorily than any other.

RUBBER-ASPHALT PAVEMENTS.

Rubber-asphalt must be applied upon a foundation of first-class concrete, consisting of 440 pounds of good Portland cement and 1 cubic meter (35.31 cubic feet) of pebbles and sand, the proportions being one-third of sand to two-thirds of pebbles. The thickness of the foundation should vary from 15 to 20 centimeters (5.90 to 7.87 inches), and it should be rammed with the back of shovels used in this work, and given the exact form which the roadway is intended to have, without the necessity of making later additions of concrete to bring the surface to its proper proportions. The surface of the concrete should be regular, so that the layer of asphalt may have a uniform thickness. This foundation should remain three to five days, according to the season, until it has acquired a sufficient hardness to support the ramming of the layer of asphalt. The surface of concrete having been well cleaned, is covered with a thin coating of special material, which is laid on with a brush, upon which the rubber-asphalt powder is lightly sprinkled. Shortly after these preliminary operations the uniform layer of rubber-asphalt powder is spread to a thickness of 3.5 to 4 centimeters (1.37 to 1.57 inches), which is compressed progressively by means of a rammer. This done, the surface may be opened immediately to travel. It is said that by this process the top-dressing of asphalt, when laid on hot, may be one-half the thickness necessary when the asphalt is laid on cold.

As the process is covered by a patent, and exploited by a particular company, it is impossible, of course, to describe the system otherwise than in these somewhat general terms.

Coming Events.

November 26—Grand Prize Race, Savannah, Ga., Automobile Club of America, New York City.

November 28 to December 13—Paris Pleasure Vehicle Show.

December 22 to 29—Paris Commercial Vehicle Show.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 1 and 2—Endurance Run from Philadelphia to Wilkes-Barre and return, Quaker City Motor Club, Philadelphia, Pa.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

Pope Reorganization Plan Approved.

Following a hearing on the proposition held on Monday of last week, Vice Chancellor Howell, of New Jersey, on Thursday, authorized the sale of the plant and other assets of the Pope Mfg. Company, exclusive of the cash on hand and in bank, to the reorganization committee for $1,500,000. The insolvency proceedings, which began on August 14, 1907, will now probably be speedily ended. Up to the present creditors have received 75 per cent. of their claims, and the remaining 25 per cent. is to be paid out of the proceeds of the sale of the plant. It is expected that all of the factories which are involved in this deal will continue to be operated by the reorganized company.

At the hearing on Monday of last week, W. C. Fischer, counsel for T. H. O'Connor, a stockholder having 100 shares, objected to the sale on the ground that it was not necessary to enable the receivers to pay off the debts of the company and that the sale would reduce the value of the stock held by his client.

Vice Chancellor Howell, in commenting on his authorization of the sale, pointed out the risks involved in the carrying on of such a business as that of the Pope Manufacturing, from which he drew the conclusion that investors would probably not consider any proposition looking to the taking over of the company's plants as a permanent investment. Such circumstances, said the Vice Chancellor, limit the persons who would be likely to entertain the idea of purchasing the property to an extremely small number and go almost to the extent of demonstrating that the present owners of the properties, the stockholders, are not only the natural and logical bidders, but must be almost the only bidders. Further than that, the court is always anxious to avoid having any business operated under its control longer than is absolutely necessary to pay the creditors and preserve the property from destruction, and always looks with favor upon business arrangements whose object is to relieve the court from that responsibility. The Vice Chancellor then went on to say:

"I think it appears by the testimony that the property which the reorganization committee desires to purchase is worth, as it stands, as a going business, as between a willing purchaser and a willing vendor, somewhat more than the sum offered by the committee, but it is apparent that the value of the property is not sufficient to pay the whole of the first preferred stock, which I understand to be preferred to the other issues, both as to capital and to dividends, and that for the purposes of this motion we may disregard the second preferred stock and the common stock. The committee reorganizations represent all the outstanding first preferred stock except 245 shares, one hundred shares of which belong to the objector. Under these circumstances I do not think that the discrepancy between the offer and what the court might, from the evidence, consider the actual value as a going concern to be, is so great as to lead the court to reject.

"The discrepancy may be affected by the business considerations above stated, by the financial conditions of the country, by the business conditions of the automobile and bicycle trade or by a dozen other matters which enter into a large business operation of this character.

"Again, the total outstanding first preferred stock of the Pope Manufacturing Company is $2,345,500. The objector's holdings amount to 100 shares of the actual par value of $10,000. While the holder of a single share has the same legal right to object to this sale that he would have if he held a great majority of the stock, yet he does not appeal to the court with as great favor, for the reason that the very great majority of his fellow stockholders have decided upon the proposition with a judgment very different from his. And particularly is this true in this case, in which the objector does not go to the trouble of giving the court any information concerning the facts from his own standpoint."

Stilson Motor Car Co. Report.

The following certificate of condition was presented at the annual meeting of the stockholders of the Stilson Motor Car Company, Pittsfield, Mass., on October 29, by Treasurer Herbert M. Stilson, and filed on October 31:

Machinery and fixtures	$8,475
Cash and debts receivable	3,875
Manufactures and merchandise	29,943
Patent rights	10,000
Profit and loss	4,378
Total	$56,671
Capital stock	33,700
Accounts payable	19,350
Floating debt	3,621
Total	$56,671

Advance Freight Rates to California.

According to advices from San Francisco the freight rates on automobiles from the East to California will be increased from $25 to about $40 per car, according to weight, on January 1 next. The present rate is $6 per 100 pounds, and as cars generally weigh from 2,000 to 3,000 pounds, the freight charges range from $120 to $180. The new schedule will provide a minimum charge of $150 per car. From the New England States the rate will be $8 per 100 pounds, and from New York, Pennsylvania, Ohio, Michigan and Indiana $7 per 100 pounds. This will increase the freight charges per car shipped to California from $30 to $40. California dealers are trying to profit by this increase in rates by seeking to induce purchasers to place their orders now, so as to get the advantage of the present lower rates. Cars are generally sold to customers in California at list prices, plus freight.

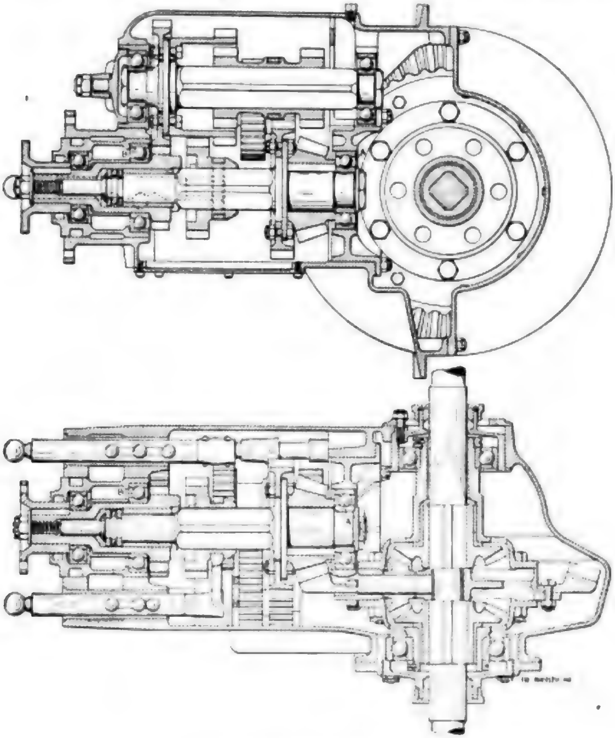
NEW VEHICLES AND PARTS

The Stearns 15-30 Horse Power Model.

This new product of the F. B. Stearns Company, of Cleveland, Ohio, is primarily intended for a town car, and for this purpose is sold with the landaulet body shown in the illustration. The peculiar horse power rating is due to the use of a double nozzle carburetor, the engine being rated at 15 horse power on the small and 30 horse power on the large nozzle. The motor is of 4½ inch bore by 4⅝ inch stroke. All four cylinders are cast together, but have ample water spaces between them, which permits the use of three annular ball bearings upon the crank shaft.

Stearns 15-30 Horse Power Model Landaulet Body.

The valves are all on one side, operated in the usual manner. The crank case is of the barrel type, cast from aluminum and heavily ribbed underneath to insure stiffness. The bearing seats are split on their upper sides and the outer ball race is held in place by a stud with nut for clamping. The radiator is carried upon the front end of this case, so motor and accessories form a compact unit. This radiator is of the honeycomb type. The water is pumped directly into the front end of the jacket, which surrounds the valves; at the point of entry it divides into two portions, one part being allowed to disperse through the jacket directly, while the remainder passes through a straight copper tube which lies between the cylinder barrels and the passages below the exhaust valves through which the hot gases escape. There is an opening in this tube opposite each exhaust valve, so that the seats are kept cool by a constant supply of water direct from the radiator.



Stearns Change Gears.

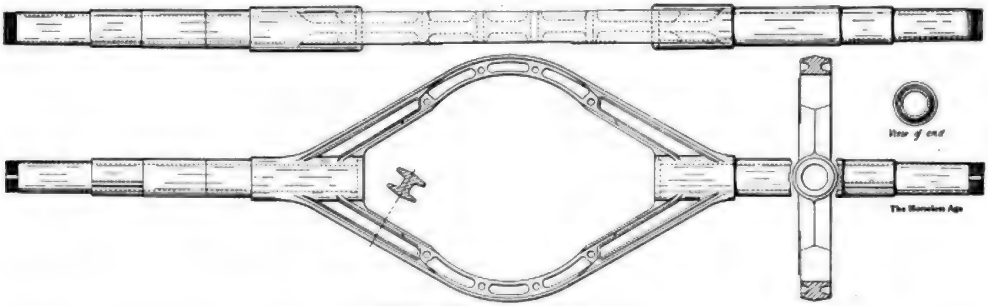
Ignition is by the new Bosch double system, comprising both a magneto and a battery. Lubricant is supplied by a four feed Lavigne oiler, driven by helical gears. The latter feeds the oil onto the connecting rods, which are made with H section, to catch this lubricant. They are bushed with Parsons white brass below, and with hardened steel above. The lower bearing is a particularly good job, its cap being secured with four bolts, while connecting rod and bushing are split upon slightly different planes, to form an additional means of maintaining alignment.

A multiple disc clutch is used. The drive to the rear axle is through a propeller shaft, with a single universal joint. This shaft is enclosed in a torsion tube of large diameter, globe jointed to the frame at its forward end.

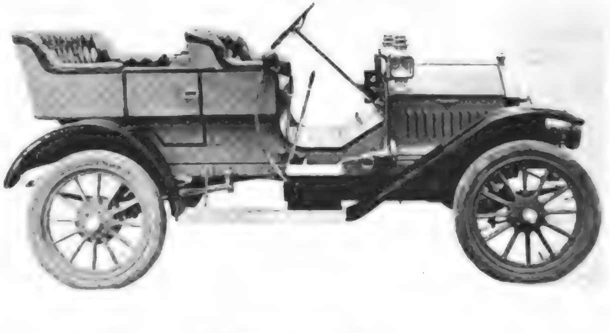
The change gear is carried on the rear axle. It gives three forward speeds and a reverse, on the selective system. By a novel arrangement of parts this gear is made very compact. There is no bearing at the large end of the bevel pinion; the short, stubby pinion shaft being carried between bearings A and B. Gear C is cut on the end of a cylinder which is large enough so that gear D can slide inside it. These two expedients allow the case to be made considerably shorter than would the usual design. The change gear case is of aluminum, with a large inspection cover at the rear of the bevel gear housing. This housing has a finished cylindrical surface which fits into the machined loop of the forged piece which forms the weight carrying member of the rear axle, and is fastened to the forging with eight bolts. As will be seen from the figure, this axle member is drop forged, the central portion being forged to I section, while the ends are left roughly round, of approximately the size desired, and are afterward bored, turned and key seated for the reception of the axle shafts and the mounting of wheels, brakes and spring seats. The finished product is a stiff, light axle.

The front axle is an I section forging. Semi-elliptic springs are used all around. The front springs are shackled at their rear ends in this model, although it has been the custom of the Stearns Company for some years past to shackle such springs at their front ends and hinge them at the rear. This change in practice seems to have been brought about rather by a desire to give the car a conventional appearance than by a conviction that the new arrangement is superior to the former one.

The frame is of the conventional dropped pressed steel type. Both sets of brakes act on rear wheel drums. The wheel base is 116 inches and the tread is standard. All the details of this new car are worked out and finished with the same painstaking accuracy which has always characterized the Stearns product.



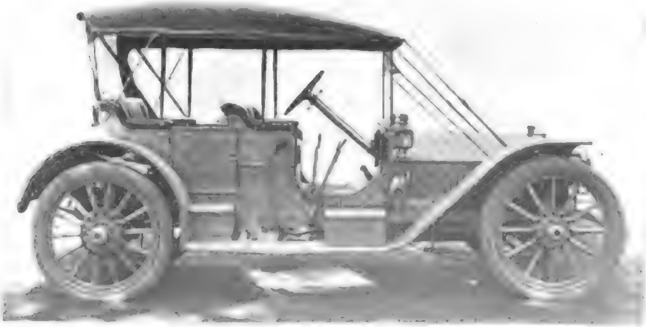
Stearns Rear Axle Forging.



Oldsmobile Model 20.

Oldsmobile Model 20.

This new model is a small four passenger touring car selling at a low price. It has a 91 inch wheel base, standard tread and 30 inch wheels shod with 3½ inch tires. The motor is 3¼ inch "square," with individual cylinders and valves in the head. It uses jump spark ignition, with Remy low tension magneto and dry cells. The change gear is of the planetary type with pedal control for low and reverse, the high speed clutch, which is a leather faced cone, being operated by a hand lever. Thirty-six by 1½ inch springs are used in front and 37x1¾ inch full elliptics at the rear. The front axle is of the tubular type, with ball bearings, and the rear axle is of the semi-floating type with Hyatt roller bearings. The frame is of pressed steel with side channels 3x1½x⅛ inch section. Steering is by worm and nut gear.



Special Oldsmobile Six Cylinder Car with Toy Tonneau and 42 Inch Tires.

A SPECIAL OLDSMOBILE.

The illustration shows the special Oldsmobile model mentioned in a recent issue. It has a six cylinder, 4¾x4¾ motor, three speed and reverse selective change gear, and full floating, pressed steel rear axle. Its wheel base is 130 inches and the tread is standard.

The principal point of novelty is the size of the tires, which are 42 inches in diameter. It will be noticed from the illustration that there is a hub bolt for each spoke, the inner hub flange being of large diameter to accommodate both circles of bolts.

The Hess Steel Castings.

Henry Hess, of 2100 Fairmount avenue, Philadelphia, Pa., has secured the American rights for a German process of making steel castings, and pending the establishment of a foundry here will import castings from the foundry in Germany. These castings range from dead soft to shelf hardening steel, and can be made in any section or shape with a guarantee of having the castings solid $\frac{1}{32}$ of an inch below skin, we are informed. Castings can be made to any specification, some automobile castings, however, being ready stocked. Photographs and blue prints received show axles, crank shafts and cases, steering cases and exhaust manifolds with integral preheaters, etc., made by this process.

The Hess-Bright High Tension Magneto.

The Hess-Bright Manufacturing Company, of Philadelphia, have taken the United States agency for a German make of high tension magneto which is here illustrated, both assembled and in parts. In this magneto the high tension current is generated in a coil separate from the armature, but enclosed within the magneto housing. This permits of better insulating the coil, it is claimed, than if it was wound directly on the armature. One of the claims made for this magneto is that the spark remains uniform in intensity throughout the whole range of timing, which is unusually large, viz., 65 degrees, and can be made still larger if desired. The advantage of uniformity of spark regardless of time adjustment is of particular importance from the standpoint of easy starting, as in starting the motor the spark must be retarded so as to do away with the possibility of back kicks, and a strong spark when the engine is being cranked by hand at a low speed saves unnecessary cranking. It is claimed that a sufficiently hot spark is obtained from the magneto at as low a speed as 40 r. p. m.

As other high tension magnetos, the Hess-Bright device is provided with a safety spark gap in the secondary circuit, and this safety device is at the same time used as an indicator of spark trouble. The gap can be observed through a small glass window at the top of the magneto, and whenever the ignition system is not working properly a spark can be seen through this window. If the trouble is with one of the spark plugs this device also permits of readily locating the particular faulty plug. For stopping the operation of the magneto when it is desired to stop the motor a cable connection is provided on the magneto from which a cable may be run to a switch on the dashboard. The magneto is fitted with Hess-Bright ball bearings, and requires only a minimum attention to its lubrication. The insulating head and cover are made of hard rubber.

The Myhtib Tire Specialties.

The Myhtib Composition Company, 284 Asylum street, Hartford, Conn., have placed on the market a composition for painting pneumatic tires when the car is stored for the winter or when the wheels are jacked up for any length of time. They sell an outfit comprising a 2 pound cake of Myhtib composition, an 8 ounce bottle of Myhtib preserver and one brush. The composition is solid and flexible at ordinary temperatures, and is melted and applied when hot. The coating thus produced on the tires is claimed to be airproof, waterproof and heatproof, and is claimed to preserve the life and resilience of the rubber. The coating thus produced is referred to as the Myhtib tire overcoat, and is also especially recommended for spare tires.

The same company also manufacture the Myhtib inner tube patches, which are claimed to be made from the best quality of rubber, and are already cemented so that they can be applied instantly. It is a much cleaner job to put on one of these patches than where liquid cement has to be used, and it is claimed to take only three minutes' time.

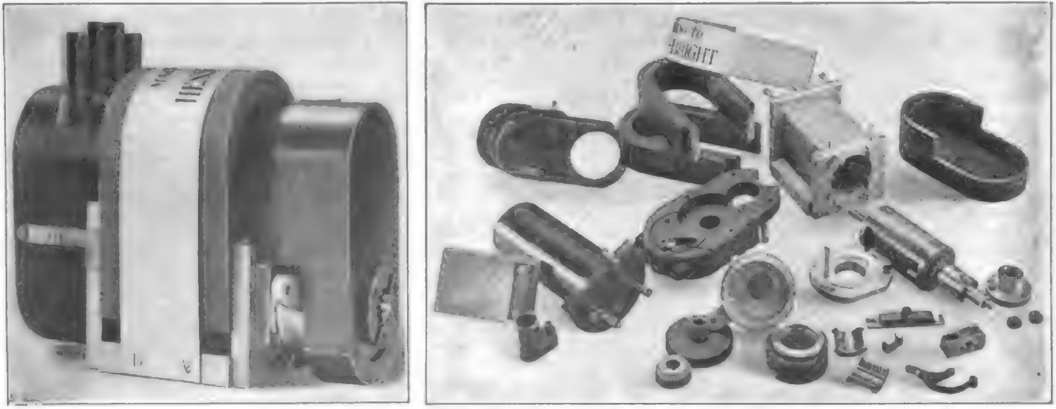
Book Review.

"Magnetos for Automobilists—How Made and How Used." By S. R. Bottone. Published by Crosby Lockwood & Son, London. (D. Van Nostrand Company, New York.) Price, $1.

This work explains in detail the theory of magneto generating machines and the construction and operative functions of the various parts. The author is known as the writer of a series of books on electrical subjects for amateurs. In the present volume he develops the theory of electro-magnetic induction, describes a number of historical apparatuses for generating currents by mechanical means, and then proceeds to a description of the individual parts of the modern ignition magneto. The work is illustrated with thirty-five line cuts, which are for the most part of a rather crude character, however.

Petroleum Prospecting in Borneo.

Vice Consul John Wardrop, of Sandakan, sends an extract from the *British North Borneo Herald* regarding the formation of a syndicate to prospect that East India colony for petroleum. It includes the two present operating companies, one of which increased its output from 64,500 tons of crude petroleum in 1901 to nearly 500,000 tons in 1905. Its shipments of refined products in 1906 were 123,642 tons of kerosene, 154,056 of liquid fuel, and 16,614 tons of benzine. Petroleum in Borneo is contained in regular occurrences of oil belts of narrow widths, but of very great lengths. It is the intention of the consolidated concern, which has a capital of $51,098,250 gold, to further exploit the island and extensively develop this industry. The *Herald* adds: "Borneo oil is exceedingly rich in valuable paraffin wax, for which there is a large market all over the world, while almost all the benizne now produced in Borneo is shipped to Europe and the United States."



ASSEMBLED—THE HESS-BRIGHT HIGH TENSION MAGNETO—IN PARTS.

COMMUNICATIONS

A Problem in Compression Calculation.

Editor Horseless Age:

Will you kindly answer for me the following query:

I have an engine of 4½ inch bore by 4 inch stroke, which shows 60 pounds compression. I want to increase the compression to 80 pounds by lengthening the connecting rods. How much longer should they be to give the desired results?

In the issue of November 11 E. Mallinckrodt asks some questions regarding a cam shaft. If he wishes to increase the length of time the valves are held open he can do so to a small extent by using larger rollers on the push rods if they are of the type that have rollers. I have never seen this method spoken of before, but have seen it used with good results.

John D. Green.

[It is know nthat the compression pressure follows approximately the law

$$\left(\frac{v_1}{v_2}\right)^{1.35} = \frac{p_2}{p_1},$$

where v_1 = original volume
v_2 = final volume
p_1 = original pressure
p_2 = final pressure.

The original pressure we may take to be 14 pounds per square inch, or a little less than atmospheric. In your present engine the final pressure is 60 pounds per square inch gauge, which is equal to 74.7 pounds absolute, and the ratio $\frac{p_2}{p_1}$ is, therefore, $\frac{74.7}{14} = 5.34$. The ratio of volumes

$$\frac{v_1}{v_2} \text{ is } \sqrt[1.35]{5.34} = 3.47.$$

Let x be the ratio between the cylinder displacement and the compression space, then the ratio of volumes before and after compression is evidently $\frac{x+1}{1} = 3.47$, from which it follows that $x = 2.47$. If now you consider the compression space to be an extension of the working part of the cylinder, that is, of exactly cylindrical form and the same diameter as the sylinder bore, the height of the compression space bears to the length of piston stroke the same proportion as the piston displacement to the compression volume. The height of the compression space is therefore $^4/_{2.47} = 1.62$ inch.

You want to change the length of the connecting rods so you will get a compression of 80 pounds gauge = 94.7 pounds absolute. The ratio of pressures will then be $^{94.7}/_{14} = 6.77$, and the ratio of volumes $\sqrt[1.35]{6.77} = 4.12$. Proceeding as above we find that the ratio of length of stroke to height of compression space is now 3.12. The height of the compression space is therefore $^4/_{3.12} = 1.28$. Consequently the piston must move further out into the compression space by the difference $1.62 - 1.28 = .34$ inch ($\frac{11}{32}$ inch), and the connecting rod must be made that much longer—Ed.]

Ignition Query.

Editor Horseless Age:

I have a single cylinder car the ignition of which was formerly operated from four dry cells; now I have to use six. Can you tell me why? Wtih four cells the vibrator works as usual, but no spark shows at the plugs, or only a fitful one now and then; sometimes they look a little brighter, but generally they are streaky and thin. Please tell me what becomes of the sparks generated by the vibrator when the latter works and when no sparks show. Is it possible for the vibrator to work and not to induce a spark? Sometimes very small sparks show at the platinum contact points, but not often. Is this as it should be? I have filed the points flat, and they make a good contact.

I have read that sparks show if the condenser is broken down. Does the condenser break down in a good coil? By connecting the coil with a battery of four cells I generally get a spark of one-quarter inch, but sometimes it is not more than one-eighth inch in length. The sparks seem to be streaky and not continuous. Is this right? With six cells I get a very much better spark.

The coil is of standard make, for a single cylinder engine, with a switch in front. The garage people tested it for me and said that it was all right. My cells show 11, 12, 11 and 20 amperes respectively. I tested the cells, examined and sandpapered every connection, took out and examined the primary cables, cleaned the commutator and switch, tightened all connections and insulated the primary wiring from all iron. The high tension cables I examined inch by inch for leaks.

This I did by placing them in a two foot length of gas pipe, connecting one terminal to the pipe and one to the cable, my idea being that I would see the spark leak through when the coil was operated. However, the current seemed to leak through in some manner so it could not be seen, in every two foot length of the cable. I also tried the return cable, and that showed exactly the same. My method proved a failure; the whole eighteen feet of cable all seemed to leak. I hung up the cables and gave them both a heavy coat of shellac. I next tried telephone wire in my car, and that worked the same way as the cable.

I can hardly believe that my cables are short circuited (grounded) in the car, for I have changed them end for end, with no difference in the result. By what method can I tell for sure whether my cables leak when in the car? Can you suggest something which will enable me to know what the matter is with my ignition? Does it make any difference in which direction the high tension current flows through the platinum contact points? Does it make any difference which way the current flows through the primary circuit from the batteries? My wiring is as it has always been, that is, as it was installed by the maker.

J. R. Chalker.

[If the vibrator operates properly, it is a sign that there is nothing wrong with the primary circuit, as the current must flow through the primary winding in order to magnetize the core of the coil and operate the vibrator. The trouble might then be either in the condenser, in the secondary winding or in the secondary connections (cables). To determine whether it is in the secondary cables, remove the latter from the coil and connect two short lengths of bare or insulated wire to the secondary terminals of the coil, bending these wires so that their ends are one-half inch apart. Now operate the coil, and if there is a continuous series of sparks between the wires, the coil is all right and the trouble must be in the secondary connectors. A gap of one-half inch in the atmosphere is about as easy to bridge for a high tension current as a gap of one-thirty-second inch under a pressure equal to the usual compression pressure. If you do not obtain a steady succession of sparks under these conditions, the trouble is in the coil. Either a portion of the secondary may be short circuited, or there may be a puncture in the condenser. If you prove by the above experiment that the trouble is with the coil, it is probably the best plan to buy a new coil at once, as it is generally very difficult to repair coils.

Your test of the cables as to their insulation is of no value. It is quite possible for the vibrator to operate without creating a spark in the secondary system; in fact a spark will only occur if the ends of the secondary wires are brought close enough together. It is dangerous to operate the coil without having the ends of the secondary fairly close together, as you evidently did in your cable tests, as then the pressure in the secondary winding may become excessive and break down the insulation. It is not at all impossible for the condenser to break down, even in the best make of coil, for everything succumbs in the course of time. The object of the condenser is to prevent sparking at the vibrator contact points, and generally when the condenser is broken down violent sparking occurs at these points. It is, of course, possible for only a portion of the condenser to become ineffective, and the sparking at the vibrator contacts would then be not so strong, and the effect on the strength of the secondary spark smaller.

It does not matter which way the current flows through the secondary circuit, and there is also no difference in which direction the primary current flows through its circuit, so far as the strength of the secondary spark is concerned. However, owing to the fact that there will always be some sparking at the vibrator contacts, one of these contacts, the positive one, or the one from which the spark jumps, will wear away the most.—Ed.]

Effect of Salt Solutions on Aluminum.

Editor Horseless Age:

Regarding the discussion in your November 11 issue of chlorine salt solutions as anti-freezing solutions for use in automobiles, I want to bring out an important point that has been overlooked—a point that I believe has great significance, and one that should condemn it as a general proposition. I have made quite exhaustive tests with chlorine salts as anti-freezing solutions, and following are my opinion and my reasons for arriving at such an opinion:

My principal tests have been with calcium chloride ($CaCl_2$). This solution is not any more injurious to iron, brass, rubber, solder, or fibre packing than pure water is, and in these tests I concluded it would be an excellent mixture to use in automobiles, and applied it to my machine, not giving aluminum any consideration or thought. I used it for about a month when the affinity for aluminum and chlorine came to my mind, so I took off one of the aluminum water castings and found it in very bad shape. So I saw at a glance the seriousness of my oversight. From a personal observation I found that about 75 per cent. of the automobile manufacturers use aluminum alloy castings in some part or another of their water system, so the danger of letting such solutions get abroad without warning to the public would cause irreparable damage. What applies to calcium chloride solution will also apply to a solution of common salt ($NaCl$), and below I will give you the chemical equation as a means of substantiating my statements:

$$\overset{\text{Common Salt.}}{6NaCl} + \overset{\text{Water.}}{6H_2O} + \overset{\text{Aluminum.}}{2Al} = \overset{\text{Aluminum Chloride.}}{Al_2Cl_6} + \overset{\text{Caustic Soda.}}{6AaOH} + \overset{\text{Hydrogen.}}{6H}$$

$$\overset{\text{Cal. Chloride.}}{3CaCl_2} + 6H_2O + 2Al = Al_2Cl_6 + \overset{\text{Cal. Hydroxide.}}{3CaO_2 H_2} + 6H$$

These equations show the chemical disturbances very clearly, but when I adopted it as a solution for my auto the only thing that seemed to be in my mind was the problem of proving the solution an alkali, and as a means toward that end I made the solution alkaline with lime water, as that was the only base that was available to me that was not chemically affected by the solution, and as a guarantee that it would stay so I used a small amount of phenol phthalein as a coloring for the test. This chemical, like litmus, changes color on the change of the liquid from base to acid, and vice versa. It is to looking after this small and unimportant matter that I attribute the losing sight of the all important point in the case.

So as a general proposition chlorine salts will not do for automobile cooling systems, but can safely be applied to any cars not having aluminum in the water system.

For the benefit of owners of cars that are not so affected I will give some data that I have collected through my experiments and investigations regarding calcium chloride ($CaCl_2$) solutions. Using a Fahrenheit thermometer, add 2½ pounds of calcium chloride to 1 gallon of water, and the freezing point will be 3 degrees above zero; 3 pounds will give 4 degrees below zero; 3½ pounds will give 11 degrees below, and 4 pounds will give a freezing point of 19 degrees below zero. This table refers to crude ($CaCl_2$) calcium chloride. The person purchasing must get the crude product if this table is to apply, as the refined product has about 50 per cent. water of crystallization, and consequently would weaken the mixture correspondingly. I have purchased this salt as low as 3½ cents per pound.

I prefer calcium chloride to common salt for this use because it is more deliquescent, and its affinity for water is much stronger; necessarily its evaporation is very slow and hard to excite. Again, I don't consider it advisable to make a mixture stronger than 3½ to 4 pounds to the gallon, because at the freezing point of that mixture (if ever it should be reached) the ice formed takes the form of a snow and has none of the bursting qualities of water.

Jas. H. Davidson.

Magneto Troubles in the Vanderbilt Race.

Editor Horseless Age:

In an effort to definitely establish the true cause of the loss of the position of supremacy attained by the Chadwick car in the late Vanderbilt race, which was first reported to have been the burning out of a magneto, we have ascertained that neither of the Bosch magnetos in use on the Chadwick car during the race burned out. A report circulated to that effect has been proved absolutely false, and has since been denied by the Chadwick Engineering Works, who founded their first belief on erroneous information.

A searching investigation clearly proved that nothing but malicious interference in the mechanism of the magneto, by a willful hand, with the apparent object of disabling either the magneto or the car, was responsible for the trouble of the Chadwick car.

With reference to the Renault and Matheson No. 7, both of which experienced ignition trouble during the Vanderbilt race, as was stated in the various trade papers, it is the general opinion that these cars were, during the race, equipped with a Bosch magneto, because this magneto is the standard equipment on cars of these makes. For reasons thus far not ascertained another make of magneto was substituted in this particular instance for the Bosch standard equipment. In the case of the Renault car, according to the printed statements, this substitution was accomplished the very night before the race.

It is thus evident that wherever ignition trouble was reported the Bosch product was not responsible. In all other cars where Bosch magnetos were employed ignition gave, as usual, splendid results. We would ask you to give this letter the prominence it deserves, in correction of previous statements to the contrary in various publications.

Bosch Magneto Company,
Otto Heins, Vice President.

Wants Glidden Tour to Pass Through Kentucky.

Editor Horseless Age:

I am making an effort to have the Glidden tour pass through Kentucky next year and write to ask you to publish an article in your paper about it. I have just received a letter from Frank B. Hower saying there is a chance that the tour, on the return trip, will pass through Kentucky from Louisville to Cincinnati. Bardstown is an old town surrounded by distilleries where the famous Nelson County whiskey is made; near here is Federal Hill, where the song, "My Old Kentucky Home," was written. Then they can go to Gethsemane, where they Abbey of Gethsemane is located; then they can go to Mammouth Cave; then they can go to Perryville, where the battle of Perryville was fought; then to Lexington, where the fine stock farms of the blue grass region are situated; then to Cincinnati. The road along this route from Bardstown to Perryville, to Lexington, to Cincinnati, is good. I don't know about the road at Mammoth Cave. I received a letter from Charles J. Glidden saying it would afford him a great deal of pleasure to have the tour go through Kentucky. The Kentucky and the Indiana State Automobile associations favor the plan, and *Collier's Weekly*, which is largely interested in the Lincoln Memorial Farm, at Hodgesville, wants them to come to Kentucky. The Lincoln Memorial Farm will be dedicated as a national park in February by President Roosevelt.

Claude W. Wilson.

[We believe that the main factors which should decide the selection of the route for the Glidden tour are the roads and the possibilities of the country passed through as an automobile market. Besides there should, of course, preferably be a certain shifting of the scene of the tour from year to year, or, in other words, it should not be held always over the same course, though there may be no change in the relative importance of different sections of the country as automobile markets. But we do not believe that historic associations, or even such attractions as the source of a famous brand of whiskey, should have any weight in the selection of the route, as the Glidden tour is not properly a tour at all, but a contest for commercial supremacy, and those who take part in it have no time to give to the enjoyment of scenery or to historical reflections. Kentucky has never been included in the itinerary of any previous long distance event, and for this reason has some claim to recognition. Possibly it may also be a good field for the sale of automobiles, and those who want to see the coming Glidden tour lead through the State might do well to compile some figures regarding the number of automobile sales there in recent years, and any information regarding the prospects for the future, and have it ready for presentation to the chairman of the A. A. A. contest committee after it has been definitely decided to hold the tour next year.—Ed.]

Queries.

Editor Horseless Age:

Will you please tell me where I can get air cushion seats for automobiles?

Also what conditions affect starting on the spark? Some days my Cadillac, Model G, will start on the spark almost every time, while perhaps the next day it will do it only a small part of the time, or not at all, and then resume the trick again. All this without any change in the carburetor, or anything else. Why the difference with no appreciable change in the weather? What effect on the mixture have damp air and cold air, and why? E. H. B.

[Pneumatic seat cushions can be obtained from the Pneumatic Manufacturing Company, 3 South street, New York.

The difference in the action of the engine with respect to its response to the "starting on the spark" operation is probably largely due to differences in tightness of cylinders. There is always a charge in one of the cylinders when the motor stops, but in the course of time this charge leaks out through any openings there may be around the piston, at the valves and other points, and air filters in to take its place. It is conceivable that not all the cylinders are equally tight, and it may happen that the final charge just before the engine stops is drawn one time into the tightest cylinder and the next time into the least tight cylinder. The tightness of one and the same cylinder may also change slightly from day to day, in consequence of differences in the rate of feed lubricant to the cylinder or of the valves becoming slightly leaky, owing to carbon particles on their seats, etc. It is also not impossible that atmospheric conditions may have an influence on the certainty of starting on the spark. It is known that when the temperature of a gasoline air mixture is reduced below a certain point, the gasoline will condense and settle on the walls of the vessel in which the charge is contained, and it is then, of course, impossible to cause an explosion by producing a spark in the vessel. Moist air will not hold gasoline vapor as well as dry air and would therefore be expected also to unfavorably affect the possibility of starting on the spark.

We do not remember having seen any records of systematic experiments carried on regarding the causes which affect the possibility of starting on the spark, and the above remarks are based entirely on theoretical considerations.—Ed.]

Thinks That Tire Prices Have Been Too High.

Editor Horseless Age:

Will you allow me to express my opinion in relation to your article: "The Rising Price of Crude Rubber"?

In the beginning of 1906 the Michelin Tire Company, of France, decreased voluntarily the selling price of tires to about $42 for 34x4½ shoes. At that time the Michelin factory was selling more tires than any other manufacturer, and its goods had acquired a world-wide reputation. I believe that if those French manufacturers at that time, when there was an abundant market for all their products, felt that they could reduce the price, it is quite reasonable to suppose that even at that reduced price there is plenty of margin of profit to the honest manufacturer. At that time we were paying here in the United States $75 for tires of the same size but of inferior quality.

The whole policy of most people connected with the automobile industry has been to bleed the consumer for all that he could stand, regardless of the future of their business. I, for one, have been one of their early victims and even now I have to pay for renewal parts prices so absurdly higher than what similar articles are sold for in other industries, that I ascribe it only to the ignorance and helplessness of the average automobile owner, that such a condition of affairs be accepted at all by so many dupes. L. H. Baekeland.

The J-B Metallic Isothermal Cooling System.

Editor Horseless Age:

A new invention relating to a system for cooling explosion motors has been brought out in France. This invention is no longer in the theoretical stage, but has already been perfected and has given really remarkable results in practice. At the coming Paris automobile show several motors fitted with this cooling system will be exhibited, among others one of 60 horse power, which proves that this system may be applied to motors of the highest horse power. It is certain that this invention will be one of the most interesting innovations of the "Salon," together with a new hydraulic transmission system.

The invention has for its object to keep at a certain predetermined value the walls of the combustion chamber of an explosion motor, or of any other machine subjected to the action of heat. Water, which is generally employed for cooling motors, possesses the highest specific heat, and about 60 per cent. of the heat liberated in the cylinder is carried off by the circulating water. The use of water or air is avoided by taking advantage of the principle of fusion.

When a solid body is heated at a constant pressure it fuses at a fixed temperature, which is called the point of fusion, and once the fusion has commenced the temperature ceases to increase and remains equal to the temperature of fusion until the latter has become completed. For instance, if the temperature were not to exceed 212 degrees a certain alloy would be chosen which has a specific heat of 0.049, or about one-twentieth the specific heat of water. It is possible to produce alloys for any desired temperature limit, and it remains for the manufacturers of motors to decide at what temperature they will maintain their cylinder walls.

This alloy is poured into a jacket which is prolonged to such an extent that a portion of the alloy always remains in the solid state, or below the temperature of fusion. The specific heat being only one-twentieth as great as that of water, the loss through the cylinder walls will only be 3 per cent. of the heat liberated, consequently there is no need for tanks, radiators, pumps, piping and fans.

By this process the use of water and air for cooling is avoided by surrounding the cylinder with an alloy whose fusing temperature corresponds to the temperature of most efficient operation of the motor, the system being based on the principle that the temperature remains constant until the fusion has been completed, and a sufficient quantity of the alloy being provided so that a portion of the same always remains in a solid state. The same system may be applied to steam engines running on superheated steam, remembering that the maximum temperature of the steam must be limited, in order to avoid trouble with the lubrication and from excessive friction.

R. Henry.

[The above argument of our correspondent is based on entirely false premises. It is necessary to carry off a great percentage of the heat liberated by the burning charge—the percentage being usually stated at about 50—because that proportion of the heat passes into the walls, and if a lesser proportion is carried away by the cooling medium the walls will soon overheat, lubrication cease and the pistons stick. This proportion of the heat does not pass into the walls because there is water or any other particular cooling medium on the outside of these walls, but because of the temperature difference between the walls and the burning gases. The loss of heat is directly proportional to this temperature difference. The maximum temperature of the burning gases is probably not far from 3,000 degrees Fahr., and the temperature of the walls with water cooling may be taken as 200 degrees Fahr., so that the temperature difference is something like 2,800 degrees. With some other cooling medium you might possibly maintain your cylinder walls at a temperature 100 or 200 degrees higher, in which case your temperature difference would be only 2,700 or 2,600 degrees. The loss through the walls would then be one-twenty-eighth or one-fourteenth less, instead of being almost eliminated, as would appear from your argument.

Owing to the low specific heat of the alloys which you propose to use, an enormous weight would be required to carry off all the heat that would pass through the jacket. Also the only possible method of carrying off the heat passing through the walls of the combustion chamber has been found to be by convection, and as it would undoubtedly be very difficult to energetically circulate the molten metal, we cannot see how such a cooling system could be practical. —Ed]

Indiana Good Roads Advocates Organize.

Definite steps for forming a permanent organization of the Indiana Bureau of Good Roads were expected to be taken at a meeting scheduled to be held in Indianapolis on November 24. Invitations were sent out over the State asking all advocates of better roads to be present. The temporary officers of the association have been R. A. Brown, president; George C. Pyle, secretary, and F. I. Willis, treasurer. These, with J. C. Crabill and W. H. Roberts, have constituted the temporary committee. About fifty people have paid membership fees to this committee. The bureau proposes to effect a complete revolution in the system of Indiana road building. The Indiana Legislature will be asked to create a State Highway Commission and make a substantial appropriation for the work. It is believed that the work can not only be done more cheaply than it is being done now, but that far better results can be accomplished. Since the 3 miles road law has been in effect in Indiana about $8,000,000 a year has been expended on good roads in the State. Much of this has been wasted from improper knowledge as to the most scientific methods of road building.

Philadelphia's Motor Bus Line in Receivers' Hands.

A petition in bankruptcy was filed last week against the Auto Transit Company, of Philadelphia, by attorney for the Electric Storage Battery Company, of Philadelphia, creditors for $10,000. George McCurdy and the Commercial Trust Company were appointed receivers, and required to file a bond of $150,000. The troubles of the Transit Company were probably brought to a head by the recent insistence of the city authorities of Philadelphia on the payment of overdue taxes. The company was capitalized at $1,000,000, of which $300,000 was preferred and $700,000 common stock. It operated a line of electric motor buses on Broad street, and was organized by Charles Berg, who promoted similar enterprises in Chicago and Detroit, all of which were shortlived. Besides the claim of $10,000 of the Electric Storage Battery Company, other claims against the Transit Company, which up to the present has spent about $380,000 in the equipment and operation of the service, amount to about $70,000. Immediately upon the filing of the application all the buses of the company were run into the barn at Thirty-first and Dolphin streets, where they will remain until the receivers decide upon their course of action. The receivers have since issued a statement to the effect that the court's order does not permit them of operating the buses.

Remington Stockholders Must Pay Assessments.

The United States Circuit Court of Appeals, at Utica, N. Y., in the case of Henry R. Carpenter vs. L. N. Southworth, trustee of the defunct Remington Automobile and Motor Company, on November 16 rendered a decision sustaining the decision of Judge Ray of the District Court of the United States, made about a year ago, to the effect that the Ilion stockholders of the defunct automobile company must pay up the unpaid balance on their stock subscriptions. The action was brought by Henry R. Carpenter, of Ilion, N. Y., who paid his share of the assessment, which amounted to about $1,250, but afterward discovered that there was a clause in the affirmation of Judge Ray's decision, by the Circuit Court of Appeals, which he thought would enable him to get his money back. His action failed, however, and it now seems that the other Ilion stockholders will also have to pay their assessments, which amount to about $75 a share.

New York Taxicab Strike Officially Called Off.

The strike of the chauffeurs of the New York Taxicab Company, which began on October 3 last, was officially called off at a meeting held on the night of November 17 at the strikers' headquarters, on West Fifty-third street. Only 49 out of the original 500 men who went out were present at the meeting, the remainder having resumed their places in the employ of the company during the last three or four weeks, or have found positions with rival concerns. It was announced at the meeting that the strike had failed, and it was resolved to return to work under the conditions of employment that were in effect before the strike, with such modifications as the company would grant. The company has taken the men back under the original conditions of employment, which were printed in our issue of November 11.

Ohio Registrations.

A report of the automobile department of the Ohio Secretary of State's office, filed Tuesday of last week, showing the business done from the time the act went into effect, June 11 last, until the close of the fiscal year, November 15, gives the total receipts for the five months as $56,102.10. Of this, $50,004 was derived from the registration of 10,474 motor vehicles of private owners; $2,468 from 175 certificates issued to manufacturers and dealers; $3,572 from 1,786 chauffeurs' badges, and $58.10 from duplicate tags and badges. There will be a noticeable increase in the number of registered automobiles after January 1, as owners in cities which required an annual license who had paid their license for the year before the State law went into effect, were exempted from the operation of the State law until the city license expired.

Statistics of United States Petroleum Output for Last Year.

The petroleum production of the United States in 1907, says the Geological Survey, was characterized by a total output far in excess of any previous year, and an unparalleled accumulation of stocks, in spite of which the price of all grades of oil was kept at a high level. The sensational developments were the great increase in the new Illinois field and the phenomenal yield in Oklahoma, together with increases in both quantity and price in California. The total product was 166,095,335 barrels in 1907, an increase over 1906 of 39,601,399 barrels, or more than the total product of petroleum in any year up to 1889. The total value increased from $92,444,735 in 1906 to $120,160,749 in 1907. The average price decreased only slightly. During 1907 a total of 18,855,691 barrels of oil were consumed as fuel by the railroads of the United States, as against 15,537,677 barrels in 1906. Most of the oil consumed was crude oil.

Spare Wheel Prospects.

The *Motor* of London contains the following: "The wonderful success of the Stepney spare wheel in this country led to the formation of the Stepney Spare Wheel of America, Ltd., a year ago. The report of the gentleman who was appointed as general manager in the States showed that he estimated a sale of 3,000 wheels a month at £5 apiece, and figured on a net profit of £102,888 per annum. Whenever we come across these delightful figures in a prospectus there comes before our eyes the vision of the chairman at the annual meeting explaining why the house of cards went all to pieces. Mr. Drayton, the chairman of the American Stepney Wheel Company, fulfilled the dream on Friday last, and explained that contracts had had to be cancelled to avoid the risk of bad debts, the rim making plant had been put out of operation for months owing to a series of breakdowns in the rollers, the spare wheels had not proved strong enough for America's bad roads, and had had to be strengthened (we seem to remember that the bad state of the American roads was urged, in the prospectus, as a reason why the spare wheel would sell freely), infringement had gone on merrily, and there had been trouble with the Rim Association and with tire makers. The total sales in the year had been 7,000 wheels (many at cut prices). There will thus be no £102,888 to distribute dividends from this year, but, as the chairman says, the business is now thoroughly well organized and he is confident of the future, we will look for a figure nearly as handsome next year."

Commercial Applications.

Commercial Motor Vehicle Development in New York City—III.

By H. H. W.

DRY GOODS.

Rothenberg & Co., 34 West Fourteenth street, used several electric trucks about three years ago to supplement their regular horse service, but after about one year's service disposed of them because of want of reliability and high maintenance expense. All of their delivery service is now done by horses.

Rogers, Peet & Co., Thirty-fourth street and Broadway, clothiers, are using three gasoline delivery wagons which they contract for from a concern in the city. They have had this service about eight months, but have found that, while to them the new service is more economical than an equal horse service, the cars are not as reliable as horses.

Saks & Co., Thirty-fourth street and Broadway, installed a motor vehicle delivery service some time ago, but owing to the fact that it didn't give satisfaction they discontinued it, and all their deliveries are now made by horses.

The Siegel-Cooper Company, Eighteenth and Nineteenth streets and Sixth avenue, made some time ago what they consider an exhaustive test of the motor vehicle delivery service, and consider that, at present at least, the motor vehicle is not as well adapted to their needs as horses. Somewhat over a year ago they purchased the best that the market then afforded in the commercial line, trying out both light and heavy trucks of both gasoline and electric types, but failed to obtain reliable service from any of them. For the present at least all of their deliveries are being made by horses.

Stern Brothers, West Twenty-third street, do not believe that there is any saving in the use of motor vehicles for general delivery purposes, and therefore use horses exclusively for this kind of service. For heavy loads and long hauls they think that the motor vehicle has the advantage, and for this work they are using one electric truck, one 2 ton American gasoline truck and a French car, with satisfactory results. No figures are available, however, as to operating costs.

John Wanamaker, Tenth street and Broadway, used several moter vehicles in his delivery service, but found them too expensive to operate and discontinued their use, all his deliveries being now made by horses.

Clarence Whitman & Co., white goods, 30 Leonard street, have had in use three electric trucks of 1,000 pounds, 2 tons and 3 tons capacity respectively, for over four years to do all of their trucking, and during this time have obtained very satisfactory service from them. No figures of operating costs are available, but they state that these trucks have proved more efficient and economical than an equal horse service. They are housed in their own garage and charged from the Edison circuits. The hauls are mostly short, and the trucks average about 15 miles per day. No difficulty has been found in operating these trucks throughout the winter, as the snow has never been too deep to stall them.

CARPETS, RUGS, ETC.

Kent-Costikyan, Oriental rugs, 437 Fifth avenue, have had a 1 ton gasoline truck in use about four years, and during this time it has given very good satisfaction. It is used for all of their deliveries throughout the city, and also makes deliveries to points in New Jersey. No figures are available as to operating costs, but they state that it is considerably cheaper to operate than an equal horse service, and much more efficient.

W. & J. Sloane, 884 Broadway, have used motor vehicles for over six years to supplement their horse service on heavy and long hauls. Their present equipment consists of four 2 ton electric trucks, which have been in use since 1902, and two 3 ton gasoline trucks, which have been in use since 1906. The electrics are used in the Borough of Manhattan only, making deliveries as far uptown as 125th street. The gasoline trucks do the suburban deliveries, working up through the Bronx, on Long Island and to New Jersey. These trucks are housed in their private garage, where entire care is taken of them. A complete charging plant is installed for the electrics, the current being obtained from the Edison mains. No figures are available as to operating costs, but they state that in the case of the electrics the cost of operation is about equal to that of horses, and with the gasoline trucks somewhat lower. The four electric truck chasses will shortly be replaced by four 3½ ton chasses. These new trucks have a single motor drive to countershaft and thence by side chains to the rear wheels, instead of a positively geared double motor drive. They expect that these new trucks, fitted as they will be with antifriction instead of plain bearings, will prove more efficient than the old models.

FLORISTS.

Charles Thorley has had in use for about two years a touring chassis fitted with a special body and equipped with solid tires. This car is used to supplement his regular horse delivery service, being used on all long hauls and for special deliveries. The average load carried amounts to about 1,500 pounds. No exact figures are available as to operating expenses, but about $15 would cover the total cost of operating the car per day. This is a class of service in which economy over horses is not a controlling item, but rather quickness and efficiency, and the car has given them very satisfactory service.

FURNITURE.

George C. Flint Company, 43 W. Twenty-third street, used an electric truck about two years ago, but because of the unsatisfactory service that they obtained from it have discontinued its use. No figures are available as to operating costs, etc.

R. J. Horner & Co., 61 West Twenty-third street, are using two gasoline trucks of 2 tons capacity each, one truck having been in use for three years and the other about one month. These trucks are used to supplement their regular horse delivery service, being used for long hauls, making deliveries to all suburabn points, a day's work averaging about 60 miles. These cars are considerably more expensive to operate than horses, but the facility with which long runs can be made they consider well worth the added expense. The trucks have given satisfactory service, the only objection to them being that they get out of adjustment easily. They are housed in the West Twenty-fourth street building, where entire care is taken of them.

GROCERIES.

The Acker, Merrall & Condit Company have had in use for over four years three electric trucks of 1, 3 and 4 tons capacity, respectively. They are used to supplement their regular horse delivery service for long hauls, and used in this way have given satisfaction. No figures are available as to operating expense. They are taken care of in their own gaarge.

Austin, Nichols & Co., 61 Hudson street, have used an electric truck for some time to supplement their horse delivery service, but no details are available as to use or operating expense.

Park & Tilford have used both electric and gasoline trucks in their delivery service, but they consider that in the present state of development, at least, both types are unsuitable for their use, and have discontinued the use of the trucks, all their trucking and deliveries being now done by horses.

R. C. Williams & Co., 56 Hudson street, have had a 5 ton electric truck in use for over five years, which during this time has proven fairly satisfactory. No data is available, however, as to its use or operating expense.

HARDWARE.

Hammacher, Schlemmer & Co., 133 Fourth avenue, have used electric trucks for about six years to supplement their regular horse delivery service. At present they have in use two 3 ton electric trucks which are used for long hauls. No data is available as to operating expense, except that the trucks have not proved as satisfactory as had been expected.

The McCabe Hanger Manufacturing Company, 425 West Twenty-fifth street, have had in use for over five years two electric trucks of 1 and 2 tons capacity, respectively, and during this time have obtained very satisfactory service from them. These trucks are used to the exclusion of the horse, and Mr. McCabe states that he wouldn't go back to horse service again. The trucks do all the general hauling and deliveries in New York city, and also make trips to New Jersey as far as Newark and neighboring cities. The 1 ton truck is the faster of the two, and is geared for a speed of 12 miles an hour, the battery having sufficient capacity to supply current for 30 miles. The 2 ton truck, which is used on all long hauls, has a speed of 7 miles an hour, but the battery has sufficient capacity for 50 miles. The trucks are stored at the factory, where entire charge is taken of them. Some of the batteries have given remarkably long service, one in use at present having already seen sixteen months' service, but some other batteries did not last longer than nine months. No data is available as to operating expense, but Mr. McCabe states that the service is considerably more economical than horse service, besides being more efficient.

The John Simmons Company, 110 Centre street, have in operation three motor trucks as follows: One electric truck of 4 tons capacity, which has been in use for about eight years; one gasoline truck of 1¼ tons capacity, which has been in use about four years, and one gasoline truck of 3 tons capacity, which has been in use about two years. The electric is used for all trucking to and from the docks because of the rule prohibiting gasoline trucks thereon, and the gasoline trucks are used for general delivery and long hauls to supplement their regular horse delivery service. No figures are available as to operating expenses, but they consider that the motor vehicle is somewhat more expensive than horse service, but for some classes of work sufficiently more convenient to more than offset this. These trucks are housed in their own garage, the electric being charged from the Edison mains.

LUMBER.

T. G. Patterson, shooks and boxes, Fifty-fifth street and Twelfth avenue, has had in use for about two months one 3 ton gasoline truck. This truck is used for general delivery purposes throughout New York city and also New Jersey. So far the truck has given very satisfactory service, but it has not been in use long enough to draw definite conclusions as to operating expenses, therefore no figures are available. It is taken care of by one of his men at the plant, where he has facilities for making all ordinary repairs. The body is of the platform type to accommodate the bulky load that boxes make, although the load is frequently composed of shooks, which make quite a heavy load.

I. C. Williams & Co., Twenty-fifth street and Eleventh avenue, had an electric truck in operation for about a year, but found that it was not adapted to their use because of upkeep expense, and therefore have discontinued its use. No figures are available as to operating expenses during the time it was in service.

ORIENTAL GOODS.

A. A. Vantine & Co., 879 Broadway, have used electric delivery wagons for about three years and have obtained very satisfactory service from them during this time. The equipment consists of five electric delivery wagons and one electric truck. These cars are used for general delivery purposes in New York city, to supplement their horse service, and the truck is used for such goods that are too bulky for the smaller cars. The cars are taken care of by a neighboring firm, who store, wash, repair and charge them. They have handled this service in a very systematic manner, to which undoubtedly is due the success they have had. They keep a monthly expense account which shows the mileage of the cars, current consumption, repairs and the fixed storing charges. Extracts taken from this account show that for the month of January, 1908, the cars traveled a total of 3,177 miles at a cost of $517.51. During April the mileage amounted to 2,683 miles at a cost of $291.84, and during July the mileage was 2,168½, at a cost of $441.94. These figures do not show the depreciation of the batteries or tires. As with other users, both the batteries and tires give on an average twelve months' service.

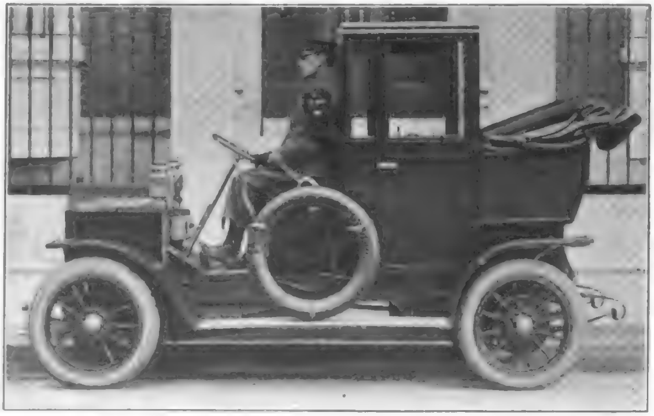
PRODUCE.

John Kelley & Sons, Vesey and Washington streets, dealers in fruits and vegetables, have had in use one 1,700 pound gasoline delivery wagon for about fifteen months and one 2 ton truck for about eight months, and have obtained very satisfactory service from both of them during this time. At present these cars are used to supplement their regular horse delivery service, being used for all long hauls, making deliveries to all points in Greater New York, and in the summer time to the summer resorts on Long Island. No figures are available as to operating expenses, but they state that the service is considerably more economical than an equal horse service, and they plan to eventually do away entirely with their horses. The cars were used all last winter with perfect satisfaction, and make an average of between 50 and 60 miles a day.

The New Cabs of the New York Transportation Company.

The New York Transportation Company have recently put into service a number of taxicabs of a new model, one of which is illustrated in the accompanying photograph. The cabs, which are built throughout by the Atlas Motor Car Company, of Springfield, Mass., are fitted with a two cylinder, two cycle, water cooled motor, the bore being 4½ and the stroke 4½ inches, giving 22 horse power at normal speed. Circulation is by thermo-siphon to a honeycomb radiator at the front of the car. Lubrication is by mechanical oiler, with leads to the various bearings. Jump spark ignition is provided, with dry cells as the source of current. The change gear is of the planetary type, giving two speeds forward and one reverse, the high and low speeds being controlled by a lever at the side of the driver, who sits on the left side, the control system being moved bodily over to that position. The drive is by a jointed shaft to the live rear axle, which is fitted throughout with roller bearings. The front axle is tubular, roller bearings being also provided on the steering pivots. Both front and rear springs are of the three-quarter elliptic type. A foot brake is located on the transmission, and there are internal expanding brakes upon the rear hubs, these latter being also pedal actuated. The wheel base is 96 inches and the tread 56 inches. Thirty inch wheels with 3½ inch Goodyear detachable tires are fitted all around. Twelve gallons of gasoline are carried in a tank located on the frame.

The body is of the landaulet-limousine type, and can accommodate four people comfortably within, with considerable knee-



New York Transportation Company's New Atlas Taxicab.

room. Cushions, seat backs and arm rests are finished in leather, and the ceiling is in hardwood. Contrary to usual coach building practice, the top lining has been done away with, on the score of cleanliness, the joint at the head and standing roof junction being so shaped as to be weatherproof. Hammer cloths, curtains and fittings are also in leather, while the floor mats are of rubber. Cleaning is thus as easily carried out as in the case of a street railway car, which has been one of the aims of the company. The space beside the driver's seat is slatted, and is intended for carrying luggage. The usual spare tire, horn and dash lamps are fitted. The taxameter is the company's standard instrument, the Kosmos, and is driven by snail gear from the near side front wheel. The cabs are painted in the standard green color.

The uniform of the drivers is designed for hard service, and consists of cloth Norfolk suit and puttees, with regulation service shoes. The cap is modeled on that of the German army, and the overcoat is a long waterproof cloth ulster, combining warmth with light weight. The company insists that its drivers be properly clothed and that its rolling stock be at least equal in appearance to that of private vehicles.

Commercial Notes.

There is some talk of establishing a taxicab service in Lafayette, Ind.

The Auto Express Company, of Detroit, Mich., expect to have twenty taxicabs on the streets of that city next year, and have just given an order for the tires and demountable rims.

The Kansas City Taxicab Company was organized at a meeting at the Coates House on November 16 with a capital of $100,000. It is being promoted by G. E. Rodgers, who plans to build a garage at 3315 Troost avenue.

As an evidence of the growth of the commercial motor vehicle business in Indiana it is reported that one Indianapolis concern has sold more than fifty cars of this type during the season just closing. Of this number eighteen have been sold to Indianapolis concerns. It is expected that the commercial vehicle business will be unusually good in Indiana next season, as a number of companies have based orders for additional cars on the experiments conducted with the trial cars purchased this season.

The tests of motor trucks for the purpose of selecting the makes to which premiums are to be paid by the German War Office began on November 9. All the vehicles which started belong to the type of light army trucks having a maximum useful load capacity of 4 tons, and a maximum weight empty of 3½ tons. The truck must be capable of hauling behind a trailer with a useful carrying capacity of 2 tons, and must be equipped with a 30 horse power motor. Either steel or rubber tires may be fitted, the daily mileage required being 56 in the former and 75 in the latter case.

Horse Power Formulae.

(Paper read by G. H. Baillie before a commission appointed by the British Royal A. C. and the Incorporated Institute of Automobile Engineers.)

There has been so much desultory discussion this year in the papers and out of them about the merits of the D^2n rating and various horse power formulæ (chiefly about the demerits of the former when used, as it never was intended to be used, as a horse power formula), that it seemed likely to prove useful to try and concentrate the discussion so that some conclusion might be derived from it. Moreover, a short time ago the Society of Motor Manufacturers and Traders formed a sub-committee to consider the question of a rating formula, and this committee have now issued a report in which are collected and examined a large number of proposed formulæ, and which is full of much algebra and useful information.

I will allay apprehension at once by saying that I am not going to propose a new formula. I had one once, but it is now so much out of date that I repudiate it myself. I am going to do what I hope may be more useful, and certainly cannot be less useful, that is, to give a basis for the discussion by trying to determine the object for which a formula is wanted, and what conditions it ought to satisfy.

First, I would point out that a formula is required for at least two quiet distinct purposes, and the fact that these two purposes have not been clearly distinguished in the report of the Society of Motor Manufacturers and Traders detracts, I think greatly, from the value of their report.

The two purposes are:

(1) To enable any one to ascertain the horse power of an ordinary car engine from its dimensions. A formula for this purpose I will call a "nominal horse power formula."

(2) To afford a basis upon which engines can enter for competitions. A formula for this purpose I will call a "competition horse power formula."

The difference between the two purposes is briefly this—a nominal horse power formula has merely to take into account what *is* done with an engine in current practice, while a competition horse power formula has to take into account what *can* be done with an engine if it be built specially to suit the formula.

In an engine for touring cars merit is not measured by horse power alone. There are other characteristics which an engine must have if it is to sell. Touring car engines, therefore, will not be built specially, so as to have a large horse power according to the formula, if thereby these other characteristics essential to touring car engines be sacrificed. Consequently it does not matter what dimensions are used in the formula, whether bore or stroke or cylinder capacity, or any of them to any power, so long as the formula does give the horse power with fair accuracy in most cases.

On the other hand, in competitions such as races or hill climbs, horse power may for present purposes be said to be the one and only thing to be considered, and engines may be built specially for such competitions, and may have certain characteristics regarded as essential in touring cars sacrificed to obtain the maximum horse power possible. Engines built with this end in view are liable to become "freak" engines and it seems to be the general opinion that a competition horse power formula should not encourage freak designs. This at any rate is one of the conditions which the committee of the Society of Motor Manufacturers and Traders considers essential. In this connection, the term "freak engines" has to be taken rather broadly as covering not merely real freaks, such as engines with three pistons per cylinder, or with stationary crank shafts, but any engine that is constructionally unsuitable for use in a touring car.

Personally I am not sure that the discouragement of freaks should be an essential condition of a competition horse power formula, because discouraging freaks means discouraging originality, and a freak, if well diluted and taken in moderation, is generally a useful tonic to those too much addicted to following their neighbors. However, as it is the general opinion that a competition horse power formula should not encourage freaks, I will assume this to be one of the conditions of a good formula. This means that any factor which can be unduly exaggerated to gain horse power must be included in the formula, or in some way limited by it.

Before going further, I wish to speak about the most important part of the whole subject, and that is its nomenclature. There has been apparently much difference of opinion between really competent people on the question of formulæ, but I believe that most of what seems to be difference of opinion is really difference of definition. If the same thing is called by different names, and different things by the same name, a discussion brings little gain and much loss—of temper. I will, therefore, baptize the different kinds of formula I shall speak about, and I do so without pretending that my names are good or suitable ones, or suggesting in any way that they should be adopted permanently, but solely to ensure the same thing being called by the same name in this discussion, and I would strongly urge on speakers to adopt my names and suppress their own views on christening until, as a result of the discussion, we have found out what it is that we want to christen with a permanent name.

Horse Power Formula.—A formula of any kind which purports to give the horse power, either indicated or brake, either maximum or at any particular speed, of a petrol engine. For instance, $\frac{PLAN}{33{,}000}$, which gives with absolute accuracy the indicated horse power of a two cylinder petrol engine is a horse power formula. So also is the proposed Society of Motor Manufacturers and Traders formula, which purports to give the maximum British horse power with a certain degree of accuracy from entirely different data.

Nominal Horse Power Formula.—A formula which purports to give the maximum British horse power of a petrol engine from any data which are easily ascertainable without testing the engine. I have taken the name from old steam engine practice. This is, of course, a particular form of horse power formula.

Competition Horse Power Formula.—A nominal horse power formula with such data as to discourage freak designs as far as our present knowledge goes.

As an example of the requirements of the two kinds of formulæ, the nominal horse power formula and the competition formula, I will take the factor of stroke, as this is the main bone of contention in all formulæ discussions. It is the omission of stroke that has brought so much abuse on the D^2n formula, and it is stroke which is the new factor introduced into the proposed Society of Motor Manufacturers and Traders' formula.

There is, of course, no question that the horse power of an engine can be greatly increased by increasing the stroke or the ratio of stroke to bore, and a competition horse power formula must therefore take this factor into account. In the proposed Society of Motor Manufacturers and Traders' formula, taking an engine with the stroke equal to the bore, increasing the stroke by 50 per cent. increases the power by 17 per cent. only. I should imagine that the power could be increased far more than this, and that the formula was in this respect only a step better than the D^2n formula. So much for the effect that increase of stroke can have. Now the question is, what effect does it have in actual practice in touring car engines?

The evidence I have been able to collect shows that the horse power does not increase with increase of the ratio, but rather tends to decrease. And, in fact, if the parts are constructed always on the same lines as regards material, factor of safety, bearing surface, etc., it is not difficult to see the reason why the horse power does not increase.

The evidence I refer to is the exhaustive series of tests made by the Automobile Club Federation on the maximum horse power of 96 engines in November, 1906. The evidence is rather out of date, but it is the only evidence of the kind available. I referred to these tests in a paper I read before the Royal Automobile Club early this year, and showed curves between the horse power and the ratio of stroke to bore for all these engines. I again produce the sheet of curves to show that, with very few exceptions, the horse power increases as the ratio decreases; at any rate, down to a ratio of 1 or 0.9. I might add that I wrote to M. Lumet, of the Automobile Club Federation, who had control of the tests, to ascertain if the figures could be regarded as reliable and independent, and was assured by him that they were so.

In default of any later evidence of actual practice, I think it may be concluded that for ordinary touring car engines a nominal horse power formula is more accurate if the ratio of stroke to bore be omitted. At the same time it is even more certain that in a competition horse power formula it should be included, and, I think, given more weight than in the proposed Society of Motor Manufacturers and Traders' formula.

Returning now to the Society of Motor Manufacturers and Traders' report, which is a very useful text, the third paragraph gives a list of factors which a "completely satisfactory formula" should take into account. These are:

(1) The effect of multiplying the cylinders.

(2) The effect of size of cylinder upon the "mean pressure equivalents to the British horse power."

(3) The dependence of the maximum piston speed practically attainable upon the ratio of stroke to bore.

(4) The effect on mean pressure of varying compression ratio.

(5) The effect on mean pressure and engine speed of the nature and mode of ignition adopted.

It seems to me that this by no means completes the list for so high an ideal as a "completely satisfactory formula." There are other factors which materially influence the horse power, and, in fact, influence it more than some of those mentioned, and it is a little difficult to understand on what basis those mentioned have been selected. As an instance, the effect of the time occupied in the explosion stroke, that is of the speed of the engine, on the mean pressure is very considerable, and this does not seem to have received any attention in the report.

Other factors which have a material effect on the horse power are, for instance, the size of the valves, the steepness of the cams, the weight of the reciprocating parts, the size and shape of the induction and exhaust pipes. All these can be varied so as to increase the horse power, but generally only at the expense of features—silence, durability, cheapness, etc.—which are essential in touring car engines, but of little importance in engines for competitions. A nominal horse power formula need not take these factors into account, but a competition horse power formula which omitted them would encourage freak designs.

(To be concluded.)

List of Exhibitors at the Grand Central Palace Show.

VEHICLE EXHIBITORS.

Acme Motor Car Company.
American Motor Car Company.
Austin Automobile Company.
Atlas Motor Car Company.
Anderson Carriage Manufacturing Company.
American Motor Truck Company.
S. B. Bowman Automobile Company.
Brush Runabout Company.
Buckeye Manufacturing Company.
Benner Motor Car Company.
Black Manufacturing Company.
Bristol Engineering Company.
Chadwick Engineering Works.
Cartercar Company.
C. G. V. Import Company.
Cameron Car Company.
Coates-Goshen Automobile Company.
Cleveland Autocab Company.
Commercial Truck Company of America.
De Luxe Motor Car Company.
Dayton Motor Car Company.
De Dion Bouton Selling Branch.
De Dietrich Import Company.
De Lannay-Belleville Company.
Delahaye Import Company.
Ford Motor Company.
Fiat Motor Company.
Geeth Automobile Company.
Grabowsky Power Wagon Company.
Gramm-Logan Motor Car Company.
Gyroscope Automobile Company.
Holsman Automobile Company.
Hotchkiss Import Company.
Hart-Kraft Motor Company.
Inter-State Automobile Company.
Isotta Import Company.
Jackson Automobile Company.
Kiblinger, W. H., Company.
Kissel Motor Car Company.
Lancia Import Company.
Lane Motor Vehicle Company.
Lansden Company, The.
Mack Brothers Motor Car Company.
Marion Motor Car Company.
Maxwell-Briscoe Motor Company.
Midland Motor Company.
Mitchell Motor Car Company.
Moline Automobile Company.
Moon Motor Car Company.
Mora Motor Car Company.
McCue Company, The.
Middleby Auto Company.
National Motor Vehicle Company.
Nordyke & Marmon Company.
Oakland Motor Car Company.
Overland Auto Company.
Omar Motor Company.
Owens Company, R. M.
Pennsylvania Auto-Motor Company.
Pittsburg Motor Vehicle Company.
Panhard & Levassor.
Palais de l'Automobile.
Regal Motor Car Company.
Reo Motor Car Company.
Rapid Motor Vehicle Company.
Reliance Motor Truck Company.
Renault Frères Selling Agency.
Simplex Motor Car Company.
Speedwell Motor Car Company.
Schacht Manufacturing Company.
Sultan Motor Company.
Welch Motor Car Company.
Wayne Works.
York Motor Car Company.

OTHER EXHIBITORS ON MAIN FLOOR.

Automobile.
Automobilia.
Trade Topics.
Auto Trade Directory.
Blue Book.
Cycle and Auto Trade Journal.
HORSELESS AGE.
Lazarnick, Nathan.
Motor Age.
Motor.
National Surety Company.

New England Automobile Journal.
Travelers Insurance Company.
Accessory Exhibitors on First Gallery (Members Motor and Accessory Manufacturers.)
Ajax-Grieb Rubber Company.
American Ball Bearing Company.
American Electrical Novelty Manufacturing Company.
Atwater-Kent Manufacturing Works.
Atwood Manufacturing Company.
Autocoil Company.
Auto Improvement Company.
Badger Brass Manufacturing Company.
Baldwin Chain and Manufacturing Company.
Bowser & Co., S. F.
Breeze Carburetor Company.
Briscoe Manufacturing Company.
Brown-Lipe Gear Company.
Byrne, Kingston & Co.
Coes Wrench Company.
Columbia Nut and Bolt Company.
Connecticut Telephone and Electric Company.
Consolidated Rubber Tire Company.
Continental Caoutchouc Company.
Cowles & Co., C.
Cramp & Sons Ship and Engine Building Company, Wm.
Diamond Chain and Manufacturing Company.
Diamond Rubber Company.
Dixon Crucible Company, Joseph.
Dow Tire Company.
Edmunds & Jones Manufacturing Company.
Electric Storage Battery Company.
Empire Automobile Tire Company.
Firestone Tire and Rubber Company.
Fisk Rubber Company.
G & J Tire Company.
Gabriel Horn Manufacturing Company.
Gilbert Manufacturing Company.
Gemmer Manufacturing Company.
Goodrich Company, B. F.
Goodyear Tire and Rubber Company.
Gray & Davis.
Gray-Hawley Manufacturing Company.
Ham Manufacturing Company, C. T.
Harris Oil Company, A. W.
Hartford Rubber Works Company.
Hartford Suspension Company.
Heinze Electric Company.
Herz & Co.
Hess-Bright Manufacturing Company.
Hoffecker Company, The.
Hyatt Roller Bearing Company.
Jones Speedometer Company.
Kokomo Electric Company.
Leather Tire Goods Company.
Light Manufacturing and Foundry Company.
McCord Manufacturing Company.
Merger, C. A.
Michelin Tire Company.
Morgan & Wright.
Mosler & Co., A. R.
Motsinger Device Manufacturing Company.
Motz Clincher Tire and Rubber Company.
National Battery Company.
National Carbon Company.
National Coil Company.
Never-Miss Spark Plug Company.
N. Y. & N. J. Lubricant Company.
Oliver Manufacturing Company.
Pantasote Company.
Pennsylvania Rubber Company.
Pittsfield Spark Coil Company .
Randall-Faichney Company.
Rands Manufacturing Company.
Remy Electric Company.
Republic Rubber Company.
Sager Company, J. H.
Shaler Company, C. A.
Shelby Steel Tube Company.
Smith Company, A. O.
Spicer Universal Joint Manufacturing Company.
Splitdorf, C. F.
Sprague Umbrellas Company.
Standard Roller Bearing Company.
Standard Welding Company.
Stewart & Clark Manufacturing Company.
Swinehart Clincher Tire and Rubber Company.
Timken Roller Bearing Axle Company.
Veeder Manufacturing Company.
Warner Gear Company.
Warner Instrument Company.
Weed Chain Tire Grip Company.
Westchester Appliance Company.
Wheeler, F. H.
Whitney Manufacturing Company.
Witherbee Igniter Company.
Motor and Accessory Manufacturers.
Other Accessory Exhibitors—First Gallery.
Miller, Charles E.
Newmastic Tire Company.
Exhibitors on Second Gallery.
Automobile Club of America.
American Automobile Association.
American Motor League.
Automobile Supply Manufacturing Company.
Allen Auto Specialty Company.
Anderson Forge Machine Company.
American Thermo Ware Company.
Alexander & Co., H. T.
Austro-American Separator Company.
American Metal Hose Company.
Automobile Co-operative Association of America.
American Thermos Bottle Company.
Bosch Magneto Company.
Bretz, Company, J. S.
Briggs, William M.
Brown Company, The
Brown Manufacturing Company, John W.
Brownell Motor Company, F. A.
Buda Foundry and Manufacturing Company.
Burnett Compound Spring Incorporation.
Burrowes Company, E. T.
Brandenburg & Co.
Comptoir d'Innovation Pour Automobiles.
Downing, Charles J.
Driggs-Seabury Ordnance Corporation.
Dayton Rubber Manufacturing Company.
Elite Manufacturing Company.
Ennis Rubber Manufacturing Company.
Empire Auto Top Company .
Excelsior Battery Company.
F. R. V. Auto Parts Company.
Flentje, Ernest.
Federal Manufacturing Company.
Geissler Brothers.
Garage Equipment Company.
Healy Leather Tire Company.
Hill Manufacturing Company, The
High Wheel Auto Parts Company.
Hydraulic Oil Storage Company.
High Frequency Ignition Coil Company.
Jeffrey-Dewitt Company.
Johnson & Co., Isaac G.
Keystone Lubricating Company.
Lavalette & Co.
Lutz-Lockwood Manufacturing Company.
Long Island Auto Supply Manufacturing Company.
Motor Vehicle Publishing Company.
Merchant & Evans Company.
Monitor Manufacturing Company.
Miller & Sons, William P.
Metal Stamping Company.
Marko Storage Battery Company.
Myers, J. L. & A. J.
National Retail Automobile Dealers' Association.
National Auto Top Company.
New Department Manufacturing Company.
Noonan Tool and Machine Works, A. S.
Philadelphia Timer and Machine Company.
Perfection Wrench Company.
Pneu l'Electric Company.
Polson, W. F.
Rushmore Dynamo Works.
R. I. V. Company, Inc.
Reeves & Son, Paul.
Royal Equipment Company.
Stromberg Motor Device Company.
Standard Leather Washer Manufacturing Company.
Spare Motor Wheel of America, Limited.
Snell, Irving.
Salman & Co., John A
Stanley & Patterson.
Safety Device Company.
Sireno Company.
Seamless Rubber Company.
Troy Carriage Sun Shade Company.
Travers Blowout Patch Company.
Vanguard Manufacturing Company.
Wilkinson Company, John S.
Wetherill Finished Casting Company.
Zeglen Bullet Proof Cloth Company.
Allen Fire Department Supply Company.
Duffy Grease Company.
Easton Carbon Works.
General Storage Battery Company.
Nathan Novelty Manufacturing Company.
Quincy-Manchester-Sargeant Company.
Smith Manufacturing Company, I. J.

New Incorporations.

Paton-Henderson Automobile Co., Omaha, Neb.—Capital, $50,000.

Oklahoma Motor Co., Oklahoma City, Okla.—Capital stock increased from $25,000 to $75,000.

Lackawanna Automobile and Taxicab Co., Scranton, Pa.—Capital, $10,000. Incorporator: Edward Conrad.

Michigan Automobile Co., Minneapolis, Minn.—Capital, $10,000. Incorporators: W. M. Wright and others.

Automobile Coaching Co., Boston, Mass.—Capital, $20,000. President, Nicholas Rommelfauger; treasurer, Paul G. Tilenius.

Economy Motor Buggy Co., Joliet, Ill.—Capital, $60,000. Incorporators: J. C. Flowers, H. L. Thompson and J. F. Beurette.

Adirondack Motor Car Co., Sandy Hill, N. Y.—Capital, $10,000. Directors: M. O. Kasson, George N. Hey and G. H. Ingalsbe.

Norris Motor Co., Cambridge, Mass.—Capital, $50,000. President, Wesley S. Young. To manufacture and sell automobiles and accessories.

Non-Blowout Auto Tire Co., Newark, N. J.—Capital, $500,000. Incorporators: Edward D. Kirhols, Frederick R. Tyrell and Robert S. Terhune. To manufacture non-blowout automobile tires.

Pioneer Motor Car Co., Muskogee, Okla.—Capital, $10,000. Incorporators, C. E. Chenevert, C. T. Chenevert, A. B. Roberts, J. S. Weeks and E. J. Phelps.

Morgantown Automobile Co., Morgantown, W. Va.—Capital, $10,000. Incorporators: I. C. White, W. M. White, C. S. White, P. L. McKeel and C. M. McKeel.

International Automobile Co., Chicago, Ill.—Capital, $20,000. Incorporators: E. C. Haynes, C. E. Hall and J. W. McDaniel. To manufacture and deal in automobiles.

Hitchcock-Banks Motor Car Co., Providence, R. I.—Capital, $25,000. Incorporators: Henry D. Banks, Alva S. Hitchcock and Henry P. Eldredge, Jr. To deal in automobiles.

Standard Automobile Station, Chicago, Ill.—Capital, $2,500. Incorporators: S. C. Everett, Joseph Seiler and L. G. Roach. To deal in automobiles and maintain a garage.

Reading Taxicab Co., Reading, Pa.—Capital, $20,000. Directors: Hunter Eckert, Harry O. Koller, W. Daniel, William Seyfert and Joseph S. Shearer, Jr. To operate taxicabs, motor cars and other vehicles.

Middletown Buggy Co., Middletown, Ohio.—The officers are: President, M. W. Renwick; vice president and treasurer, Charles B. Johnson; manager, Harry H. Elwood. The company was formed for the purpose of making automobiles and buggies.

Trade Personals.

Victor Breyer, a French automobile journalist, and who is said to be the delegate of the A. C. of France to the Savannah races, arrived in New York last week.

David Ferguson, chief engineer of the George N. Pierce Co., of Buffalo, who has just returned from a European trip, comments upon the tendency toward the adoption of the shaft drive and upon the discarding of ball bearing crank shafts.

Robert L. Winkley, who was connected with the Pope Manufacturing Co. for a number of years, has been appointed New England representative for the Matthews-Northrup Works, of Buffalo, N. Y., with headquarters at 221 Columbus avenue.

LEGISLATIVE and LEGAL

Recent Legal Decisions.

By Xenophon P. Huddy, LL. B.

PROSECUTION OF SPEEDERS ON MORE THAN ONE CHARGE.

Frequently an automobile driver is arrested for overspeeding, and when formal complaint is made against him, he not only faces a charge of exceeding the speed limit, but sometimes is held to answer another accusation of "dangerous driving." Especially is this the case where there were aggravating circumstances connected with the alleged offence or the arrest.

Necessarily in many instances the operation of an automobile at a great speed on the public highways, constitutes "dangerous driving," but where the public prosecutor complains against the defendant for dangerous driving and has him convicted on that charge, it is not within his power to convict the accused on the charge of exceeding the speed limit, notwithstanding the fact that in America, particularly New York city, this is the custom of the District Attorney's office. This practice is illegal for the following reason:

If the court takes into consideration the speed of the automobile on the hearing of the dangerous driving charge, and if the defendant is then prosecuted on the second charge of violating the speed limit, he is placed in jeopardy twice, which is prohibited by all our State constitutions and the common law. This is also the law in England.—See Welton vs. Tanebourne (Div. Ct. Eng. 873, Vol XXIV, Law Times Rep. No. 36, p. 873).

DRIVING ON RAILWAY TRACKS.

Where a person has the right to use the tracks of an electric railway company, by running an automobile thereon, he must use care and caution in so doing, and if he knows that a car is coming from the rear, he must use more than ordinary care and caution, and he is guilty of contributory negligence if he fails to do so.—Watts vs. Stroudsburg Passenger Railway Company, 34 Penn. Co. Ct. 377.

HORSE VEHICLES AND AUTOMOBILES JUDICIALLY COMPARED.

In Watts vs. Stroudsburg Passenger Railway Company, 34 Penn. Co. Ct., Rep. 377, the Court says:

> The use and operation of the ordinary vehicle drawn by a horse, or horses, has been known for so many years that every man is charged with knowledge as to the movement of such and the ordinary speed, and, therefore, a horse or horses and wagon happening to be on the track of an electric railway, the motorman on an electric car is bound by the knowledge of how fast the horse, or horses, can, or will, ordinarily travel, and he must operate and control his car with that fact taken into consideration.
>
> The movement of an automobile has no such certainty. The movement of the ordinary horse is from a slow walk of about 2 miles an hour to a trot or pace of probably from 6 to 10 miles an hour, the latter speed very rarely, however, being reached when a horse is traveling between the tracks of an electric railway company.
>
> The speed or movement of an automobile is anywhere from a few miles an hour to anywhere between 12 and 30 miles an hour. It is within common experience that they glide off and in tracks, run behind electric cars and then turn off the track, run around the cars and run on the track again and easily keep ahead of a car moving at an ordinary speed, and, when occasion requires, they easily move at a rate of speed which the trolley does not often obtain.
>
> The ordinary man knows that it is not easy for a person to get out of an electric railway track with a horse and wagon, nor can it be accomplished, ordinarily, quickly. The horse cannot move fast over the tracks, and the wheels of the wagon are apt to slide; and it it also within the common knowledge of people living in communities' where automobiles are used that they can easily turn in and out of electric railway tracks and do it quickly.

STATUS OF PASSENGER OR GUEST.

In Chadbourne vs. Springfield Street Railway, in the Supreme Judicial Court of Massachusetts (October, 1908, 85 N. E. 737), it was held that where plaintiff, who was inexperienced in the operation of an automobile, was injured, while riding as the guest of an experienced driver, in a collision between the automobile and a street car, the driver's negligence, if any, was not imputable to her. On this point the court said:

> The question of the plaintiff's due care was for the jury. She seems to have conducted herself as an invited guest of the driver of an automobile or other vehicle naturally would do. She trusted him as to the running of the machine; that is, she did not attempt to interfere with his management of the automobile. In view of her inexperience, and of what might have been found to be the skill and experience of the driver, the jury might well have thought that this was a wise course on her part. Nor was there any relation of agency between her and the driver, such as of itself would affect her with negligence on his part. She had no right to control him. There was no mutuality in a common enterprise between them. It cannot be said as matter of law that she ought to have warned the driver against turning out from behind the car which he had been following, especially in view of the fact that he was turning both in the direction required by statute (Rev. Laws, C. 54, Sec. 2) and in the only direction in which the width of the bridge afforded room for him to pass that car. And she had a right to rely somewhat on the acquaintance with the road which she might presume that he had.
>
> Accordingly, we need not consider whether it can be said that Reed's conduct was, as matter of law, negligent. Even if this were so, the plaintiff's own due care was for the jury. (Schultz vs. Old Colony St. Ry., 193 Mass., 309, 70 N. E., 873, 8 L. R. A., N. S. 597, 118 Am. St. Rep., 502; Miller vs. Boston & Northern Street Ry., 197 Mass., 535, 83 N. E., 990.)

This decision is worthy of note because it illustrates the general judicial attitude now prevailing as to mere passengers and guests in vehicles. We cannot imagine any reason why the ordinary American rule that, in the absence of agency or mutuality in a common enterprise, the negligence of a driver is not imputable, should not apply to persons riding in an automobile. Indeed, it would seem that the substantial reasons for the rule would apply with particular force because the average woman and a very large number of men know nothing about the machinery and operation of such motor cars, and therefore are under even less duty to look out for their own safety than if riding in carriages drawn by horses. It is a matter of some interest, however, to have the doctrine of imputed negligence—or rather absence of imputed negligence—authoritatively determined as to these comparatively modern vehicles.—*Reported in New York Law Journal*

IMPORTANT MASSACHUSETTS DECISION.

In Commonwealth vs. Kingsbury, 85 N. E. Rep. 848, the Supreme Judicial Court of Massachusetts held that the regulation of the use of automobiles on particular roads, even to their complete exclusion therefrom, is within the police power, with a view to the safety of the public. It was also held that statutes authorizing municipalities to regulate the use of automobiles are a proper delegation of the police power. The court, in the opinion, says:

> Automobiles are vehicles of great speed and power, whose appearance is frightful to most horses that are unaccustomed to them. The use of them introduces a new element of danger to ordinary travelers on the highways, as well as to those riding in the automobiles. In order to protect the public great care should be exercised in the use of them. Statutory regulation of their speed while running on the highways are reasonable and proper for the promotion of the safety of the public. It is the duty of the Legislature, in the exercise of the police power, to consider the risks that arise from the use of inventions applying the forces of nature in previously unknown ways. The general principle is too familiar to need discussion. It has been applied to automobiles in the different States with the approval of the courts.

PERSON NOT DRIVING CONVICTED OF SPEEDING.

A person who is prosecuted for driving an automobile at a speed dangerous to the public may be convicted, although it may appear that he was not actually driving at the time, but was in fact aiding and abetting the commission of the offense.—Buford vs. Sims (67 L. J. A. B. 655; [1898] 2 A. B. 641). Du Cros vs. Lambourne, Law J. Rep. 1907 (K. B. D.) 50.

EXCLUDING AUTOMOBILES FROM CERTAIN WAYS.

"It seems too plain for discussion that, with a view to the safety of the public, the Legislature may pass laws regulating the speed of such machines (automobiles) when running upon the highways. The same principle is applicable to a determination by the Legislature that there are some streets and ways on which such machines should not be allowed at all. In some parts of the State where there is but little travel public necessity and convenience have required the construction of ways which are steep and narrow, over which it might be difficult to run an automobile, and where it would be very dangerous for the occupants if automobiles were used upon them. In such places it might be much more dangerous for travelers with horses and with vehicles of other kinds if automobiles were allowed there.

"No one has a right to use the public streets and public places as he chooses, without regard to the safety of other persons who are rightly there.

"In choosing his vehicle, everyone must

consider whether it is of a kind which will put in peril those using the streets differently in a reasonable way.

"In parks and cemeteries and private grounds, where narrow roads with precipitous banks are sometimes constructed for carriages drawn by horses, it has been a common practice to exclude automobiles altogether, chiefly because of the danger of their frightening horses.

"The right of the Legislature, acting under the police power, to prescribe that automobiles shall not pass over certain streets or public ways in a city or town, seems to us well established both upon principle and authority."—Per the Supreme Judicial Court of Massachusetts, in Comm. vs. Kingsbury, 85 N. E. Rep. 848, citing Comm. vs. Stodder, 2 Cush. (Mass.) 562, 4, Am. Dec. 679.

Legal Notes.

The Pennsylvania Motor Federation is now circulating a petition for signatures which will be presented to the next State Legislature, and will ask for an appropriation of $3,000,000 for the improvement of existing roads and for a constitutional amendment authorizing the issuing of $50,000,000 bonds for road building.

Samuel E. Campbell, the New Haven dealer whose car ran over and caused the death of the Rev. Dr. Morgan week before last, has been held criminally responsible by the coroner, and a charge of manslaughter is to be brought against him. The coroner found that Albert P. Lee, chauffeur for David H. Clark, was not criminally responsible for the death of Frederick T. Case.

The agitation for a revision of the Connecticut automobile law has been continued since the several automobile fatalities in New Haven to which we referred in our last issue. The New Haven authorities are greatly in favor of a law which permits them to regulate speed locally. A speed limit of 8 miles is generally mentioned as desirable for New Haven, which is the lowest speed limit which has ever been enforced in any of the large Eastern cities.

The Mora Motor Car Company, of Newark, N. Y., have instituted a suit against Howard M. Whitbeck, of Lockport, N. Y., to recover $100, which they claim to be due them for repairs made to Whitbeck's car. Whitbeck claims that he kept the car in a garage, and that it was taken out by other parties without his consent, who damaged it, and the owner of the garage brought it to the Mora Motor Car Company for repairs. He claims that the garage owner should pay for the repairs.

The licenses of two more Massachusetts chauffeurs have been revoked by the State Highway Commission, viz., those of James Sinnott, of Lawrence, Mass., and John Lardner, of Boston. A charge had been made against these drivers that they operated an automobile recklessly on the Haverhill road in Amesbury on October 21. An investigation by an agent of the highway committee proved this charge to be well founded, and also showed that the accused drivers at the time of the offense were in an unfit condition to operate an automobile safely.

Those portions of the downtown streets of Detroit where traffic is thickest have recently been placarded with the following notice: "Slow moving vehicles must keep near to the right hand curb." It is intended by this regulation to keep street cars, automobiles and other swiftly moving vehicles near the centre of the street, so that the two classes of traffic will not interfere with each other as much as at present.

Judge Sadler, at Carlisle, Pa., on November 16 decided that in order to make arrests under the Pennsylvania speed law it must first be proved that the offender has traveled a full mile in less than the minimum time fixed by the law. In the case in question the constable had timed the driver over a measured course of one quarter of a mile. Judge Sadler also decided that justices have no right to issue warrants outside the county in which the offence is committed; that the action is civil or penal and not criminal, and that the Commonwealth cannot be a party to the proceedings.

Club Notes.

The Chicago M. C. will hold its annual meeting on December 9, and the following list of nominations has been presented: Thomas J. Hay, president; David Beecroft, first vice president; Paul Picard, second vice president; Frank H. Trego, secretary-treasurer.

The West Virginia State A. A. will be represented at the general annual meeting of the A. A. A. in New York on November 30 by four delegates, viz., one delegate at large, and one from each club belonging to the association, the Ohio Valley A. C. of Wheeling, the Monongahela A. C. of Morgantown and the Martinsburg A. C.

The Tide Water A. A., of Norfolk, Va., at its recent annual meeting elected the following officers for the ensuing year: W. M. Whaley, president; C. H. Bull, first vice president; J. M. Gibbs, second vice president; C. L. Young, secretary and treasurer. The association on the same day gave a banquet at the Loraine Hotel to celebrate the completion of its third year of activity.

The Long Island A. C. will hold its annual meeting on Wednesday, December 2, at which the annual election of officers will be held. The nominating committee has presented the following nominations: President, Frank G. Webb; vice president, Wm. Schimpf; secretary, Herbert G. Andrews; treasurer, Chas. C. Cluff. Governors for the term of two years, Alfred Wilmarth, Dr. A. C. Howe and Charles Jerome Edwards.

At its meeting on November 17 the newly formed San Francisco Motor Club elected the following officers: President, Fernando Nelson; first vice president, Charles S. Howard; second vice president, William M. Klinger; secretary, Frank S. Carroll; treasurer, C. E. Starratt; the above, with N. J. Pentergast and H. M. Goldberg, directors. W. R. Johnson received a vote of thanks for his work in causing the organization of the new club. The roll of charter members will be kept open until December 8, the date of the next meeting of the club.

New Gasoline Storage Regulations for Denver.

Insurance agents in Denver a short time ago received a communication from M. J. Burns, manager of the Rocky Mountain Board of Fire Underwriters, relating to stricter regulations regarding gasoline lighting systems and the storage of gasoline in buildings. Regarding gasoline storage and sale the communication says:

"The maximum amount of gasoline permitted for sale in building, without charge, must be limted to 3 gallons, to conform to city ordinance. More than 3 gallons and not exceeding 60 gallons may be kept on one lot, when contained in approved tank, sunk entirely 3 feet below the surface of the ground, without charge, which also conforms to city ordinance. All agents should discourage the use of storage of gasoline inside of buildings and limit the element of danger so far as possible."

Show Invitation to Carriage Dealers.

The show committee of the Grand Central Palace Show has decided to extend an invitation to 2,200 carriage dealers, requesting their presence at the show which is to be held in this city during the first week in January. Upon presenting the invitation these dealers will be provided with a badge, which will give them all the privileges of the show. The 2,200 dealers are said to represent the leading firms in the business, all having a capital stock of over $50,000. This action of the show committee is a recognition of the fact that the carriage dealers have recently become a rather important factor in the automobile business.

Charles Gunther and J. E. Murdock, of Cleveland, Ohio, are planning to establish an automobile service between Sharpsburg, Winchester, North Middletown and Bethel, Ky. They claim to represent a Cleveland syndicate, which owns sixty automobile stage routes in various States, twenty passenger cars, fitted with 90 horse power motors, being used on these lines.

New Agencies.

Middletown, Ohio.—A. B. Shetter, Cadillac.

Castlewood, S. Dak.—J. J. Bennett, Ford.

Grand Forks, N. Dak.—H. W. Sims, Buick.

San Antonio, Tex.—Barclay Andrews, Buick.

Providence, R. I.—Dutee Wilcox Flint, Ford.

Mankato, Minn.—H. P. Perrin & Son, Maxwell.

Contra Costa and Alameda Counties, California.—Hugo Muller, Overland.

Providence, R. I.—Hitchcock-Banks Motor Car Co., 179 Aborn street, Knox.

Detroit, Mich.—C. B. Fear Automobile Co., 844 Woodward avenue, Gyroscope.

Washington, D. C.—Pope Automobile Co., 817 Fourteenth street, Oldsmobile.

DEALERS' ITEMS

Some Conditions in the Second Hand Automobile Business.

People dispose of their automobiles for various reasons. One very frequent reason is that they are disappointed in the car's performance. This does not necessarily mean that the car is poorly built, but probably that the user expects too much from it. One case which recently came up was that of a coal dealer, who purchased a 20 horse power car of foreign make and had auxiliary seats fitted so as to carry seven on a chassis designed for five. When the overloaded car would not take a 6 per cent. grade on the high speed the dealer was disgusted, and disposed of it for $500. Another user of a 12 horse power car expected the vehicle to go six months without overhauling, and when it failed sold it for what the second hand dealer would give, which was practically nothing. Such cases are of very frequent occurrence. A third case was that of a man who wanted to use his runabout as a family car, racer, delivery wagon and towing machine. It served all of these purposes for a short time and then balked. Now it is in poor condition and for sale.

Users occasionally suffer financial reverses, and that is another reason why they sell their cars. Speaking from experience, automobiling is not a cheap pastime, especially when a large car is used. Most "sports" or would-be sports go in for large cars, and are surprised at what it costs them to keep them up. This is true of the "sporty" professional man as well as of the business man with similar inclinations. Small car users "get hit" occasionally by not figuring the cost of maintaining the car and have to sell. The carburetors on many cars in this country help to swell the stock of the second hand market, they being far from economical in the use of fuel. Another item of expense which is not much figured on by prospective car users is that of tires. Most of the users who sell out sooner or later are those who are eternally in a hurry—who rush in learning to run the car, and who in driving it from place to place always try to "get there" in the shortest possible time. The tires wear out quickly and so does the mechanism, and the user sells to the second hand dealer, unless he has some friend who is foolish enough to buy the car from him. The second hand dealers invariably give the lowest prices for cars which have been driven recklessly, unless they handle them upon a commission basis instead of buying outright.

One of the oldest reasons given for selling, and one which was very popular some years back, is that the owner is going to travel abroad. This means to Weehawken, Staten Island or some other point across the water. One of the aforementioned reasons is the real one, and when the "going abroad" reason is given, the car can in most cases be figured on as in poor shape. New ideas have sprung up since the "going abroad" reason was popular, and it is not given so frequently now.

Many cars are thrown on a second hand market because the owner has purchased a later model or another and larger car. Such cars are usually good bargains, and, unless of peculiar design, sell fairly well. Probably a greater number of cars have been disposed of for this reason than for all other reasons combined. It has been estimated that there are more second hand cars in good condition running in this country than cars in the service of their original owners.

In the majority of cases the second hand dealer does not deal directly with the owner of the car to be disposed of. The car is taken to the agent, who notifies the dealer, and the prospective customer receives the demonstration direct from the dealer. It is customary in such cases for the agency to give a guarantee of the car's condition. Then comes the question of "commissions." The agent must get his for placing the car on the market. The dealer must get his for selling the car. Both the former owner and the purchaser pay their part of these commissions, the owner by not getting what he would have gotten if he had sold direct through the dealer, and the purchaser paying a sum which buys the car and at the same time pays both commissions. In his own interests the dealer endeavors to eliminate the agent from the sale, and if he succeeds in this it is to the advantage of both purchaser and seller in such cases. When there are three or more parties to the deal usually neither the buyer nor the seller benefits from it.

In some cases it is impossible for the second hand dealer to personally obtain knowledge of bargains, etc., and to do business he must employ an agent or "tout." This, of course, is legitimate, but the "tout" as a rule "milks" both parties and charges for information, as well as getting a commission on sales. The chauffeur who has a car to dispose of also claims his share of "graft," 10 per cent. being his usual charge. Should the dealer wish to advertise, he is obliged to go to an advertising agency, who collect a "commission" both from the dealer for placing his advertisement and from the publication in which it appears. Then there are also the police to "fix," and in case the premises are located in a large city, the district leader, who looks for "a present." It is thus evident that the second hand business is not one of large profits.

Of course, this grafting also benefits the dealer financially. Accessories makers having surplus stocks or unsalable designs are constantly offering concessions to the dealer to place these goods on the cars he sells, the price generally being the actual cost of manufacture, the dealer selling at 20 per cent off list. Chauffeurs out of positions also pay commissions to the dealer to obtain new positions for them. "Companies carrying their offices in their hats" also pay the dealer for the privilege of transacting business in his building or garage. The renting of desk room for the same purpose to legitimate concerns is another but not a frequent source of revenue.

It must not be supposed that, even though the returns may balance or overbalance the money paid out for graft, the second hand dealer approves of grafting. On the contrary, if the business could be conducted on a legitimate commission basis, the dealer would actually get considerable profit. The graft charges keep down the profits and there is always an element of uncertainty as to whether more money will have to be paid out and some new grafter have to be "fixed." People complain about the dishonest representations made by second hand dealers, but if they were obliged to conduct their business along the same lines and subject to the same "charges," they would probably make some allowances. The writer fails to see why the second hand business cannot be conducted honestly, without supporting a number of parasites who live on the profits of other people's work.

Like the garage man, the second hand dealer is constantly being approached with schemes for increasing his bank account, either by purchasing mining stock or being party to a certain kind of schemes of which the following is an example: The promoter purchased a bargain lot of dry cells from a defunct battery concern, and also a considerable area of ground about 15 miles from the city where the operations were to be carried on. The dry cells were fitted with new labels, and offers were made to a dealer for desk room in his garage. The cells were sold in sets of eight, in a battery case, for $3, with a guarantee of three months' useful life for the whole eight. If they failed before that time the purchaser would be given a deed to a lot, located in the suburb previously mentioned. The cells usually gave out, so that considerable worthless ground was disposed of. The profit to the promoter was $1.62 per lot, over and above all expenses. The dealer was promised 10 per cent. of the profits, and agreed to hire out desk room. Both dealer and promoter made money, being simply swamped with orders from hardware houses, country stores, private parties, etc. The temptation to be a party to such schemes is a strong one under existing business conditions.

Of the people one comes in contact with in the second hand business, the writer prefers dealing with doctors and contractors. They know what they want and what it will cost them, and usually a sale to a doctor or contractor leads to a sale to friends or competitors of these parties. Some dealers make a special rate to doctors, dealing directly, however, without the intervention of a third party. Certain types of runabouts are preferred by the medical fraternity, and these cars are always good sellers. Most dealers would rather sell 50 runabouts than 25 touring cars, although the latter bring in more money, by reason of the absence of haggling over prices and the fact that smaller commissions, if any, are paid. The merchant usually goes in for more "show" than the doctor or contractor, but in the majority of cases, does considerable bargaining and tries to induce the dealer to take part of the price out in trade, or to get a discount for cash. The methods adopted by men in purchasing automobiles are pretty good indications of their weaknesses.

Garage Notes.

The Abar Auto Co. will open a garage at Devil's Lake, N. Dak.

A Mr. Kugler will open a garage in Spring City, Pa., next spring.

Fred B. Henderson, of Denver, Col., has purchased a property on Fifteenth street for $60,000, on which he expects to erect a first class garage building.

The agencies of the Buick and Mitchell cars for northern California will be housed in a large new building, to be completed early in 1909, on "Automobile Row," San Francisco.

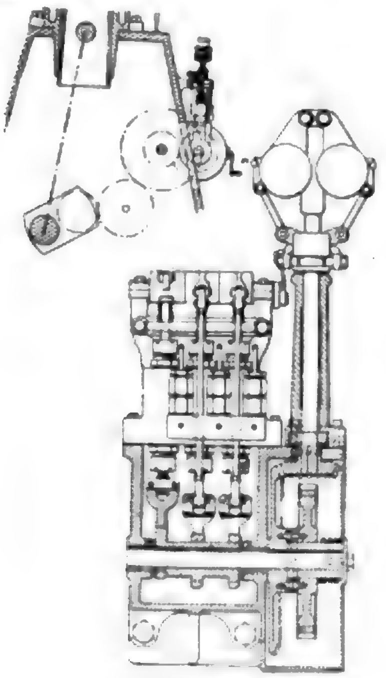
The Murray-Connelly Garage, Newark, Ohio, has been moved from the rear of 140 West Main street to Elmwood court, between Third and Fourth streets and Church and Locust streets.

Robert R. Ashwell, Franklin dealer in Hartford, Conn., has opened his new garage at 341-347 Trumbull street, where he has 3,100 square feet of floor space and room for the storage of 250 cars.

The G. W. Worthing Automobile Co., Fond du Lac, Wis., will be absorbed next spring by a new company, with Mr. Worthing at the head, which will erect a $15,000 garage on East First street.

Dr. C. W. Payne and J. L. Stevens, of Boone, Ia., who recently incorporated the Boone Auto Co., will open an agency for the Buick, Maxwell and Stoddard-Dayton cars in that city on January 1. A general garage and repair business will be conducted in addition to the agency.

The Northwestern Auto Co., of Minneapolis, has leased a building on Fourth street South, now occupied by the Bingham-Jordan Auto Co. and the H. Paulman Co., and will take possession on February 15. The building is 50x165 feet, three stories high, and about $1,500 will be spent in improvements on it.



No. 898,124.

MOTOR VEHICLE PATENTS

898,124. Fuel Pump for Internal Combustion Engines.—James D. MacPherson, of New York, N. Y. September 8, 1908. Filed August 25, 1906.

This refers to a pump or series of pumps for injecting fuel into internal combustion engines of the two cycle or Diesel type. The pump apparatus comprises a solid forging combining a series of pumps bolted to a two-part casing, the whole being attached to some portion of the motor, as the base, and driven positively in phase from the crank shaft by means of spur gearing. The casing is divided into two compartments, in one of which is the spur driving gear and a large bevel, the bevel gear being fastened to a short shaft passing through both compartments, while the spur gear is provided with a tooth clutch which allows of the spur gear overrunning the shaft, but otherwise driving the shaft at the same speed as the gear. The bevel gear is in mesh with a bevel pinion on a vertical shaft fitted at its upper end with a flyball governor. The short horizontal shaft is fitted with three eccentrics which operate the pump plungers by means of yokes. The pump barrels are integral with the forging and are fitted with stuffing boxes both at their lower and upper ends. The upper stuffing boxes are for the inlet valves, which are operated by extension levers pivoted on eccentrics at one end and actuated by push rods attached to the pump eccentric yokes at the other. The shaft upon which the eccentrics for the extension levers are mounted is connected to the flyball governor by a suitable linkage, so that the lift of these extension levers may be varied from zero to the maximum, according as the shaft is rocked by the governor. The outlets are fitted in an L extension at the base of the forging and communicates with the cylinder by leads.

A hand "starter" is fitted, consisting of a small bevel pinion which can be placed in mesh radially with the large bevel gear in the two part casings, and by turning a handle attached to this pinion the pumps may be operated for the initial or starting charge. The tooth clutch before mentioned permits this to be done without opposition by the spur driving gear.

Patents Issued November 10, 1908.

903,714. Pneumatic Tire Casing.—Charles G. Hawley and Erle K. Baker, Chicago, Ill. Filed April 11, 1908.

903,741. Valve Gear for Internal Combustion Engines.—Herbert F. Lloyd, Sutton Coldfield, near Birmingham, England. Filed April 26, 1907.

903,746. Pawl Transmission Gear for Taximeters.—Charles Mascart, Paris, France. Filed January 15, 1908.

903,748. Valve Mechanism for Explosive Engines.—Lawrence A. Merk, Wilkinsburg, Pa Filed May 31, 1907.

903,753. Double Two Cycle Engine.—William L. Morrow, Stockton, Cal. Filed October 25, 1907.

903,762. Automobile.—Charles J. Paulson, Brooklyn, N. Y. Filed October 19, 1907.

903,774. Internal Combustion Engine.—Wolcott Remington, Stamford, Conn. Filed October 9, 1905. Renewed February 25, 1908.

903,793. Speed Indicator.—Ralph Shipman, Sunbury, Pa. Filed February 12, 1908.

Patents Issued November 17, 1908.

903,884. Motor Vehicle.—Arthur Przygode, Charlottenburg, Germany. Filed October 13, 1905.

903,897. Lubricator.—Harry A. Sedgwick, Madison, Wis. Filed November 23, 1907.

903,902. Combustion Engine.—Oliver G. Simmons, Washington, D. C. Filed December 21, 1907.

903,942. Automobile Draught Attachment.—Charles J. Zillgitt, Fairmount, N. Dak. Filed March 10, 1908.

903,979. Drain Cock for Motor Vehicle Cases.—Russell Huff, Detroit, Mich. Filed April 27, 1907.

904,023. Vehicle Wheel.—Thomas A. Silverwood, London, England. Filed April 22, 1907.

904,028. Self Propelled Vehicle.—Joseph Vollmer, Berlin, Germany. Filed January 16, 1905.

904,115. Storage Battery. Rufus N. Chamberlain, Depew, N. Y. Filed February 6, 1906.

904,132. Motor Oiling System.—Kirk G. Johnston, New York, N. Y. Filed March 5, 1908.

904,137. Steering Mechanism for Automobiles.—John M. Mack, Allentown, Pa. Filed November 27, 1905.

904,143. Wheel for Motor Vehicles.—Alden L. McMurtry, New York, N. Y. Filed December 11, 1906.

904,148. Lever and Ratchet for Vehicle Brakes.—Morgan Potter, Fishkill-on-the-Hudson, N. Y. Filed March 6, 1908.

904,150. Garment, Umbrella and Cane Rack for Automobiles.—Edward T. Robinson, St. Louis, Mo. Filed February 11, 1908.

904,163. Indicator for Radiators.—Harry Vissering, Chicago, Ill. Filed April 29, 1907.

904,196. Electric Igniter for Explosive Engines.—George A. Goodson, Minneapolis, Minn. Filed February 8, 1902.

904,197. Valve Mechanism for Gasoline Engines.—Charles J. Gustafson, Reading, Pa. Filed October 15, 1906.

904,203. Fuel Heater for Explosive Engines.—Harry Hertzberg, New York, and Abbot A. Low, Horseshoe, N. Y. Filed October 10, 1907.

904,225. Steering Mechanism for Motor Vehicles.—George G. Porter, Syracuse, N. Y. Filed December 30, 1905.

904,267. Explosion Petroleum Engine.—Ernst Körting, Linden, near Hanover, and Julius Kritzler, Kiel, Germany. Filed February 15, 1906.

904,272. Internal Variable Speed Friction Transmission Device.—Herbert Lutz, Stony Creek, Ont., Canada. Filed July 13, 1906.

904,296. Steering Knuckle for Vehicles.—John C. Bashford, Yonkers, N. Y. Filed January 17, 1908.

904,352. Pneumatic Spring.—William C. McCullough, Bucyrus, Ohio. Filed November 25, 1907.

904,358. Clutch.—Carl T. Painter, Chattanooga, Tenn. Filed November 16, 1907; renewed September 25, 1908.

904,409. Pneumatic Tire.—John L. Coesir, Joplin, Mo. Filed January 30, 1908.

904,434. Oil Pump.—Russell Huff, Detroit, Mich. Filed March 23, 1907.

904,435. Protector and Non-Skidding Band for Pneumatic Tires or Wheels.—Albert T. Hughes, London, England. Filed October 18, 1907.

R. Frank Bryan, of Bloomington, Ill., has recently patented a pneumatic tire on the interior of the outer casing of which there is a series of pneumatic rubber balls completing the rim of the tire.

MINOR MENTION

An agency for Regal cars has just been established on Woodward avenue, Detroit.

The Gyroscope Motor Car Company will shortly open a salesroom on Woodward avenue Detroit.

The Cadillac Motor Car Company are now occupying their new salesroom on Woodward avenue, Detroit, opposite the factory.

Instead of the usual brass band the coming Grand Central Palace show will have an orchestra of twenty-five men using only stringed instruments.

Among the bets laid in connection with the forthcoming Savannah automobile race is said to be one at $100 even that somebody will be killed in one of the races.

The Fuller Automobile Company, of Angus, Neb., are looking for another location, and have been in communication with the Commercial Club, of Fairbury, Neb.

M. W. Hazelton, who is said to have invented an automobile, is looking for a factory site with the object of forming a $50,000 stock company to manufacture the car.

Edward M. Heylman, of Janesville, Wis., has invented a device for starting an automobile motor from the seat, which is claimed to render back kicks entirely impossible.

The National Sales Corporation, of New York, will act as factory sales manager to the automobile trade for the Bergman line of automobile pliers, which are made in Buffalo.

The Rapid Motor Vehicle Company, of Pontiac, Mich., who until recently confined themselves to the smaller sizes of commercial vehicles, have now brought out a five ton truck equipped with a 60 horse power engine.

The Minneapolis Automobile Dealers' Show Association held a meeting at the Plaza Hotel on November 14 and decided to hold a local show the first week in March. The Armory will probably be selected for holding the show.

The agency for the cars made by the Delaunay-Belleville Company, in St Denis, France, for New York and the entire eastern section of the country, has been placed with the old established carriage firm of Brewster & Co., of this city.

A directors meeting of the Bendix Automobile Company, Chicago, took place on November 14, at which the following officers were chosen: V. L. Bendix, president; C. W. Seybold, vice prseident; F. M. Patterson, secretary and treasurer.

Otto C. Owen, State representative of R. M. Owen & Co., have contracted to handle the Moline line of cars in his branch houses in Illinois, with the exception of a few counties. R. M. Owen & Co. handle the Reo single and double cylinder lines, and by this arrangement their sub-agents will also have a four cylinder car.

The first creditors' meeting in the bankruptcy proceedings against the Edmund E. Hans Motor Company, Minneapolis, Minn., was held on November 11. The liabilities of the company proved to be $39,700, while assets valued at $1,000 were found.

President Benjamin Briscoe, of the Maxwell-Briscoe Motor Company, has issued a statement to the effect that his company is not involved in any merger negotiations, and that they do not know of any such negotiations being carried on elsewhere in the industry.

The Olds Motor Works have established a factory branch in Louisville, Ky., in charge of Frank Glenn, Jr., who has been representing the Olds firm locally for the past year. From this branch the business of Kentucky, Tennessee and Arkansas will be handled.

An increase in the capital stock of the Ford Motor Company from $100,000 to $2,000,000, was recorded at Lansing, Mich., on November 5. It is stated that the formality simply involved a transfer of $1,900,000 from the surplus to the capital stock of the company.

The assets of C. A. Duerr & Co., New York, bankrupt, will be sold at public auction at 2182 Broadway, New York, on Wednesday, November 25, at 10:30 A. M. The assets include five Royal tourist cars, parts, equipment, tools, office furniture, fixtures. etc.

A report has been received by the Bureau of Manufactures from an American consular officer giving the name of a German firm that would consider a proposition to handle American automobiles. Interested parties in writing to Washington for the address should refer to No. 2805.

A hearing of creditors of the defunct Albany Automobile Company, New Albany, Ind., took place on November 12. The claims allowed amount to about $5,500, while the assets of the company have been appraised at $1,800. Negotiations for the sale of the property are in progress.

Count Tsatsuma Ninagawa, who was sent by the Japanese Government to familiarize himself with automobile manufacture in this country, and who spent some time at the plant of the Speedwell Motor Car Company, Dayton, Ohio, left there for Seattle, Wash., from whence he will proceed home.

The Roberts Motor Company, of Clyde, Ohio, have finally decided to remove to Sandusky, where they will occupy the old plant of the National Valve Company, which is now being remodeled for the purpose. It is stated that the company expect to build upward of 1,000 motors next year.

In a recent fuel economy contest held in Denver, Colo., samples of the fuels used by the different cars were taken and sent to State Chemist Edward C. Hill, M. D., for analysis. The latter found some ether in the fuel used on No. 18 (Corbin) car, in consequence of which a protest against the award of the cup to this car was filed by the Colburn Automobile Company, to whom the first prize, the Ralph W. Smith cup, has now been awarded.

Chester I. Campbell, manager of the Boston show, has made a contract with the Motor and Accessories Manufacturers' Association, who have taken 10,000 square feet of balcony space for the exhibits of their members.

The report of Brasier Automobile Company, in Paris, shows total earnings of 400,000 francs during the business year which ended September 30. The company was reorganized in November, 1907, since which time it has a capital stock of $3,500,000 francs.

The Hayes Wheel Company has been organized in Jackson, Mich., to manufacture carriage and automobile artillery wheels. C. B. Hayes is president and general manager, and R. H. Loveland secretary. The company will occupy the plant formerly owned and operated by the National Wheel Company.

The date of the Cleveland automobile show has been set for one week later than originally intended, owing to interference with the date of the Detroit show. The Cleveland show will be held during the week of February 22, instead of February 15. The show committee consists of W. D. Price, H. N. Adams and F. R. Phillips.

The Dorris Motor Car Company, of St. Louis, have purchased from A. Charles Schmid, a member of the company, for $15,000, the factory and site on Sarah street and Forest Park boulevard, where the company is now located. The plot is 180x100 feet, and the building, which was erected only a year ago, 180x90 feet, two stories high.

There have been almost 400 automobiles purchased by Indianapolis residents since January 1, according to the record of Secretary of State Simms. These are placed at a valuation varying from $625,000 to $700,000, the estimate being based on the average price of each of the various makes represented. The business so far this year has been much more than it was in 1907, it is said.

The Defiance Machine Works, of Defiance, Ohio, have taken up the manufacture of a machine for automatically assembling automobile wheels. This machine is the invention of George A. Ensign, of the Defiance Company. The Turnbull Wagon Company, of Defiance, Ohio, which intends to enter extensively into the manufacture of automobile wheels, has ordered a number of the machines.

It is reported that the Fritchie Automobile and Battery Company, now located at Denver, Colo., is seeking a new location in Indianapolis. W. P. Pfaff, of the company, recently spent several days in Indiana looking over the ground. He claims that the company now has a factory with a capacity of about 350 cars a year and employs about

250 men. Chicago and Philadelphia are also being considered as possible locations for the new plant.

The new Pittsburg branch of the B. F. Goodrich Company will be opened at 59 Pennsylvania avenue by A. L. Banker on December 1.

Mr. and Mrs. Herbert A. Hover, members of the Spokane, Wash., M. C., who reached New York in a double cylinder Maxwell car on November 8, are reported to be preparing for a trip around the world, which they hope to complete in three years. They will sail from New York on January 22.

The S. P. O. car which was to take part in the light car race at Savannah met with accident in a practice run on Saturday last, when the mechanic, De Rosa, was killed, and the driver, Jean Juhasz, had his leg and collar bone broken. It was expected to have the car repaired, and have it driven in the race today, Wednesday, by some other driver.

The Chamber of Commerce of Syracuse, N. Y., has inaugurated for its thousand members a series of trips of inspection to the homes of the city's greatest industries, and a start has been made by a visit to the plant of the H. H. Franklin Manufacturing Company. We are informed that this plant gives employment to 1,500 men and that 6,000 cars have been turned out from it.

The Owen-Thomas Motor Car Company, Janesville, Wis., has taken out an injunction against the Northwestern Railroad to prevent it from tearing down the factory building occupied by the company, which stands on the railroad company's right of way. The building was formerly used as a machine shop by the railroad and has been rented for one year by the automobile company.

Official reports give a good idea of the extent to which the rubber planting industry has grown in Federated Malay States during 1907. Not far short of 50,000 acres were planted, an increase of 46 per cent. over the figures of the previous year, and by December, 1907, practically 180,000 acres and 27,500,000 trees had been planted. The output of dry rubber increased by 144 per cent., and totaled 1,017 tons.

George Burnham, general factory manager of Morgan & Wright, was accidentally killed while duck hunting at the St. Claire Flats, Mich., on November 14. Mr. Burnham was trying to place the gun in the boat back of him, and in doing so he accidentally discharged it and the load entered his neck at the base of his skull. He was thirty-four years old, and had been with the Morgan & Wright firm since 1893, with one year's interval.

The exclusive agency for the German Daimler Motor Company in England has been taken by the firm of Milnes-Daimler, Limited, who have until now held the agency for the commercial vehicle branch of the Daimler Company's business, while the sale of the Mercedes cars in England has so far been looked after by the firm of Du Cros-Daimler, Limited. The last named firm, will, however, retain the agency for Mercedes cars in London.

The Lindsley Motor Car Company, of Dowagiac, Mich., who recently decided to move to Seymour, Ind., have let the contracts for the erection of a building at the latter place.

Richard Benz, the last member of the Benz family to retain connection with the firm of Benz & Co., in Mannheim, has now also withdrawn and joined his father, the pioneer automobile builder, Carl Benz, and his brother, Eugene Benz, in their new automobile enterprise at Ladenburg. There will hereafter be two distinct makes of Benz cars on the German market.

It is reported that the Lozier Manufacturing Company, of Plattsburg, N. Y., whose incorporation was noticed in one of our recent issues, is a holding company composed of members of the Plattsburg Chamber of Commerce, and will erect a $50,000 factory building to be leased to the Lozier Motor Company as an addition to their present plant. The machinery and equipment for the plant will be purchased by the Lozier Motor Company.

According to a German consular report, fifteen automobiles were imported into Seville, Spain, in 1907, of which three were of German manufacture. French cars are preferred in that district, on account of their materially lower prices. The roads in the vicinity are bad, in consequence of which there is no chance that the automobile movement will make great progress there in the immediate future. A market could probably be created for light but strongly built cars.

Two attachment suits have been filed against the Nevada Motor Car Company at Omaha, Neb. One of the suits is by A. J. P. Bertschy, president of the company, whose claim of $1,887.85 is for salary due him; the other claim is that of the Fowler Brothers Company for $143. The assets of the company are said to be limited to a motor car known as the Desert Flyer, which the Bertschy Brothers brought to Omaha last summer, and for the manufacture of which the company was organized.

Garage Notes.

Herbert Houghton, Clay Center, Kan., has purchased the automobile business of Longren Brothers.

Will Swayne, Winfield, Kan., has moved his garage from East Ninth to Millington street, south of Eighth.

The Zenith Motor Goods Co., Cleveland, Ohio, have taken the general agency for Ohio for the Kepagoin tire.

Harry Simmons, of Bradshaw, Neb., has opened an automobile repair shop at 527 Colorado avenue, Colorado Springs.

Frederick Allen has purchased the interest of Edwin Astin in the automobile garage on Greenwich avenue, Greenwich, Conn.

D. P. McClure, Oskaloosa, Ia., who has recently been appointed State agent for the Buick Motor Co., has begun work on his new garage.

William Anthony, Greenwich, Conn., has purchased a building site at Greenwich avenue and Elm street, on which he will erect an automobile salesroom for the Mechaly Auto Co., of Stamford, Conn.

A. H. McCutchen, Milford, Ia., is erecting a garage.

Remshardt & Oliva, Red Wing, Minn., will move their garage to Main and Potter streets.

L. E. Gell, an implement dealer of Glenwood, Ia., will handle automobiles next season.

The Auto Supply Agency Co., Cleveland, Ohio, has changed its name to the Motor Supply Agency Co.

J. S. Smalley, Muscatine, Ia., has completed arrangements for the erection of a garage at 313 East Front street.

Monroe Brothers, Joliet, Ill., are constructing a garage at Scott and Clinton streets. The building will be 100x66 feet, one story.

George Tebeau, Kansas City, Mo., will establish an automobile salesroom at 1716 Grand avenue in the near future, having secured the agency for the Stearns car.

A garage is to be established in Salem, Ore., next spring, and will be placed in charge of S. F. Anderson, who has just taken the agency for Reo, Ford, Stoddard-Dayton, Kissel and Mitchell cars.

The Catskill Auto Co., Catskill, N. Y., has been formed with Harvey Still, Harvey Scutt and Lucius H. Doty as members. The company have the agency for the E.-M.-F. Mr. Doty is secretary of the company.

A brick and concrete garage, 50x125 feet, is being erected for Hipkins & O'Connel, St. Paul, Minn., to be ready for occupancy about February 1. An agency will be taken and the place will be known as the Selvy Garage.

Erb & Drury, who operate the Bakersfield Garage, Bakersfield, Cal., have purchased a plot of 24,000 square feet on Nineteenth and Twentieth streets, on which they will build a 60x122 foot garage, at a cost of $50,000.

The name of the Gate City Motor Car Co., Keokuk, Ia., has been changed to Ayre Manufacturing Co., and amendments have been made to the articles of incorporation changing some of the provisions of the original instrument regarding the stock of the company.

W. H. C. Higgins, Jr., has taken over the garage business of the Greene Motor Car Co., 654-658 Bloomfield avenue, Montclair, N. J., which he will conduct as the Montclair Garage and Machine Co. The repair department will be in charge of Mr. Higgins, and the painting department in charge of J. D. Bubenheim.

A company has been formed in Waterbury, Conn., by Charles S. Woodward, Ira F. Bachelder and Henry F. Stackman, to handle the E-M-F and Pope-Hartford cars. The capital stock of the company is $50,000, of which $1,000 is paid in. The company has an office at 21 East Main street, Waterbury, and plans to erect a garage at some future date.

The private garage of S. B. Sheldon, 42 Linwood avenue, Buffalo, N. Y., was destroyed by fire on November 13, together with the two automobiles it contained. The loss is estimated at $6,100, and is covered by insurance. The fire was started by the accidental ignition of gasoline which the chauffeur was pouring from a can into the tank of one of the automobiles.

The new garage building which has been erected for the Stoddard-Dayton Automobile Co. in Minneapolis, at Hennepin and Ninth streets, was occupied on November 14. The building is 80x150 feet, and has floor room sufficient for forty cars. It is steam heated and efficiently lighted through four large skylights. J. B. Burmeister and Arthur Kelly are in charge.

Allfrey's Garage, Johnstown, N. Y., is to be enlarged and Edwin C. Allfrey, the proprietor, has also formed a partnership with George Demarest, of Gloversville, N. Y., with the object of erecting a garage in that city, on Gas street, with entrances from Main, Washington and Forest streets. It is to be known as the Up-to-date Garage, and will be of brick and 50x100 feet. A livery service will be conducted in connection with both garages.

The Horseless Age

First Automobile Journal in the English Language

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Cylinder Pattern Making.

By Morris A. Hall.

Pattern making for automobile engine cylinders is influenced by the size, type and number of cylinders in a unit. By size is meant both the diameter of the pattern and the length, the latter being usually dependent upon and a simple multiple of the former. In four different cylinder patterns examined this ratio was 3, 2½, 3 and 3½, so that one may venture the remark that it varies from 2½ to 3½ and is usually 3.

This length may determine the method of molding and therefore the method of making and splitting the pattern. Similarly, the single cylinder allows of a form of pattern and simple method of molding that would not be advisable with cylinders in pairs, and impossible with cylinders in threes or fours, as in the modern block motors.

Pattern making and molding are also influenced by the type of cylinder. It may be a very simple job, as with the valves in the head, or more complicated with extra core boxes and cores, with the valves in pockets but on opposite sides, called the symmetrical type; or it may be most complicated, in the form with all valves on one side. There is also the matter of the water jacket in conjunction with any of the above types. Thus the individual cylinder may have the valves in the head, all on one side or on opposite sides, all of these without the water jacket, or only partially without it. The first case, individual cylinders with valves in the head and without water jackets, makes the simplest pattern and core box that we know of, the former being simply a long cylinder of varying diameters, and the latter a simple rectangular box for one plain circular core having not over three different diameters.

We may also have cylinders in pairs with valves in the head and no water jackets, which require a comparatively simple pattern and simple core boxes. The writer has never heard of blocks of three or more cylinders cast without water jackets. In all of the above, reference is had to the applied water jacket of sheet iron or copper, the cylinder casting itself being literally without water jackets.

So to do the subject justice it will be necessary to cover the individual cylinder with or without jackets, the twin or two cylinder casting and the block of three or more. Incidentally it will be well to cover also the valves in the head design, valves opposite and valves all on one side.

First we shall take up the individual cylinder with water jackets and with valves on opposite sides, as shown in Fig. 1. This happens also to be the largest sized cylinder of the lot, being 6 inches in diameter when finished. It was for a four cylinder 6x7 inch heavy slow speed engine, which was intended for and mostly used upon heavy gasoline railroad cars.

As will be noticed from the drawing, this casting is absolutely symmetrical about the centre line, so that it was possible to make the pattern in two pieces with the split in a central plane through the cylinder and both valves, a section on this line being shown in the drawing at the lower left hand side.

PATTERN MATERIALS.

The first thing is the matter of materials. These vary between simple patterns and master patterns, the latter always or nearly always being of metal. The former, on the other hand, may be of either wood or metal, and both of these may be again subdivided. Two kinds of wood are in general use for patterns, viz., white pine or pattern maker's lumber and mahogany. The cost is about the same for each, that is, an average of $75 a thousand or 7½ cents per foot, but the expense is seldom considered in this connection. The writer has bought very good mahogany for $70 and has known of white pine costing $80. Contrary to the ordinary idea, the former is not hard to work, but has the advantage over pine of not splitting along the grain. Pine is easy to work, but there is no doubt that mahogany will make a longer-lived pattern, and therefore, at the same first cost, a more economical one.

Metal patterns are in either aluminum, brass, or cast iron. Repetition work usually calls for a metal pattern. If the work is such as to allow of making a master pattern, this is a very excellent method and is much used for pieces like cylinders, crank cases, fan flywheels, clutch spiders, etc. The process is as follows: A wood pattern is made, using double shrinkage. This is the master pattern and is made with more care than usual. When finished one casting is made from it (or at most two), after which the master pattern may be stored away. The castings, on the other hand, are carefully cleaned and filed up, and after the pattern maker

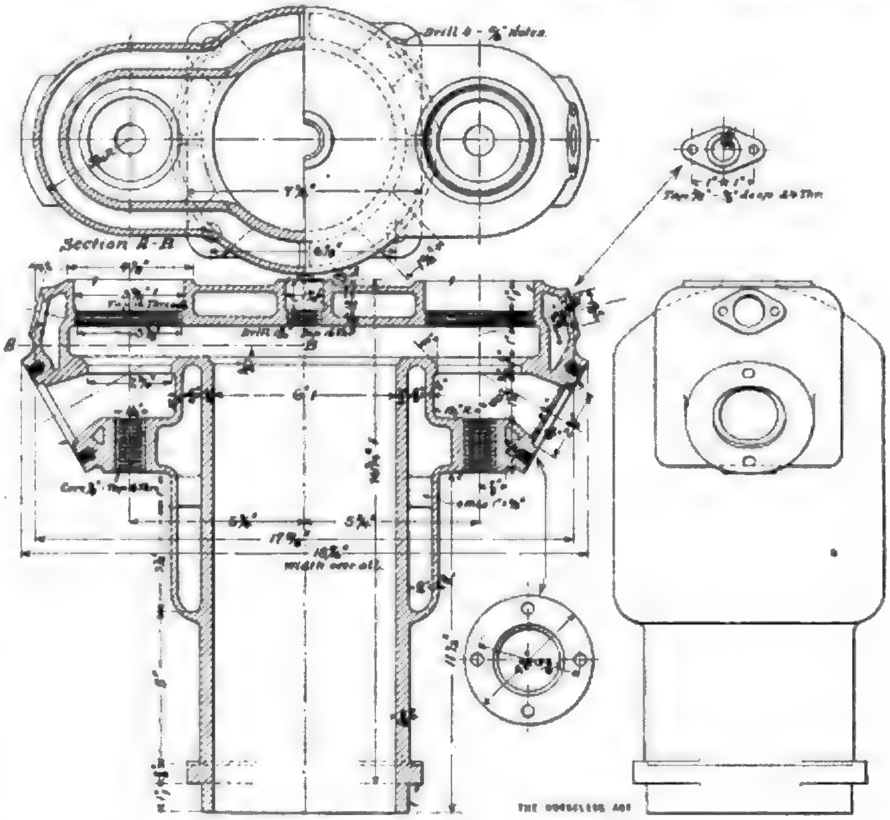

FIG. 1.

has checked them they are used for patterns. One great convenience of this method is that if the pattern gets lost, broken or worn out it is only necessary to get out the master pattern, make a casting from it, and file it up to obtain a new complete and correct pattern.

GLUING UP.

The lumber used for wood patterns introduces another operation known as gluing up. Pine usually comes two inches thick and mahogany one inch thick, so, if the latter be used, more frequent gluing up is necessary than with the former. This operation consists of surfacing the planks down to a true plane surface and gluing two or more of these surfaced planks together, the number depending upon the thickness required; thus in the first pattern to be described two pieces are necessary, each composed of five boards.

In gluing the boards are prepared and the glue is heated very hot and applied very thin. Then the boards are pressed or clamped together with wood screw clamps, being held fast thus for 12 to 15 hours, when the clamps or pressure may be removed and the resultant block worked as one piece.

T TYPE INDIVIDUAL CYLINDERS.

To revert to the pattern under discussion, it was split across the large way of the cylinder head. Being split thus, two pieces were fastened together, placed in the lathe, and the lower end, including the outside of the water jacket, was turned up. This had to be done carefully, because the blocks from which these halves were made were both large and heavy, each being 5x20x22 inches, so the whole block, as placed in the lathe was 10x20x22 inches. This required a large heavy lathe, larger and heavier than the usual automobile pattern shop possesses.

The print for the main cylinder core, the flange, the lower end of the cylinder and the lower part of the water jacket having been turned up, the block was taken from the lathe, split apart and one half clamped in the vise. Then the pattern maker worked off the corners and all excess material, using a very wide flat chisel and logging the wood off rapidly and in large pieces. Next the pattern maker makes templates from small thin strips, the size varying with the size and nature of the work, a favorite size being ¼x2x10 inches. The rest of the wood is worked off more carefully, using smaller and more special chisels, taking smaller chips and using the templates carefully and continually.

When very close to size the template is rubbed with lead, some using red lead in the form of powder and others preferring black lead in stick form. Then the template is set on the pattern, and by moving it slightly backward and forward, up and down, the lead was transferred to the high spots on the pattern. This makes it easy to work down very close. Then, when the pattern has been finished, the core prints are attached. In this case all of these are round, and all are loose, except three. These latter are the lower print of the main core and the exhaust and inlet opening cores. The prints vary in diameter and length, depending upon the shape and size of the core to be supported, the latter influencing the weight. Thus the main cylinder core print was 5¾ inches in diameter by 4 inches long, the exhaust and inlet core prints were each 1½ inches long by 2⅛ inches to 2 inches in diameter.

The small core prints were turned up in the lathe. Most of them were small enough to turn from pieces in stock, but the greater thickness required for the larger diameters necessitated gluing up. In the case of the valve cap opening core print, which was 3⅜ inches in diameter by 2 inches long, it was necessary to have two pieces, each at least 1⅝ inches thick. This means gluing two pieces of stock which will give about 1¾ inches. These pieces of stock are left 6 inches long, to make two prints and allow enough for cutting off and plenty of extra room to work between the lathe centres.

The valve guide prints, being of only seven-eighth inch in diameter by 1½ inches long, can be turned from stock, no gluing being necessary. Similarly with the four water jacket core prints, which are only three-quarter inch in diameter and 1½ inches long. The small print for the main core at the centre of the top of the cylinder requires no gluing, being 1⅛ inches in diameter by 2 inches long. These loose prints are all held in place by nails, two in each half, but if it is desired to have these attached more firmly they may be glued and nailed, as none of them must necessarily be loose.

The bosses for the bolts on the upper side of the flange are loose pieces, this being a necessity in molding. Also, the two core hole bosses on the side of the water jacket are loose, because otherwise the lower part of the cylinder could not be turned in the lathe. All other bosses are worked out on the pattern.

The next work is the making of the main core. This is a four piece core, and requires three separate boxes. The big main core is a simple cylinder, with a round print on the lower end, slightly tapered. The box, then, is simply a pair of hollow troughs, which fit together and are worked out from the solid, one at a time, using a template. This box, as shown in Fig. 2, would be made of pine, two blocks, 3½x7 inches, being required. The length is 19¼ inches for the open box shown, but one with closed ends would be about 21 inches.

The rest of this core consists of the upper part, which is in one piece and carries three prints, and the lower part, in two pieces, each with a print. The box for the former is not so very complicated, yet it is not a cheap box to make. The material for this is 7½x5x17 inches, while the cover, which is simple, is but 1½x7½x17 inches. This core is made with the expanded or increased end of the cylinder bore, a part of it formed in the cover. The same applies to the fillet in the upper corner of the combustion chamber. If now the expanded end of the cylinder bore had been made a part of the cylinder core, this box could have been made in one piece without a cover. Then the radius on the edge would have had to be filed on after baking the core. This is not a good way, as the cores thus vary greatly from one to another. This, in turn, varies the combustion chamber, which it is advisable to have as even and regular as possible. Hence the slightly greater expense in this box. The 1⅛ inch core and print on the vertical centre line is made in a box with a drilled hole, as are also the two 3¼ inch cores, using an expanding bit and making a 3 inch hole. This is tapered up to 3⅛ inches by hand to give a small amount of draft. The total depth of these holes is 4 inches, so a little draft is necessary. Fig. 3 shows this box and cover. This, as will be noticed, is split in a horizontal direction, but an alternate method would be to split this in a vertical direction, as the core is symmetrical about a centre line in that plane.

The lower parts of this core are made in a small box. This is of an irregular shape.

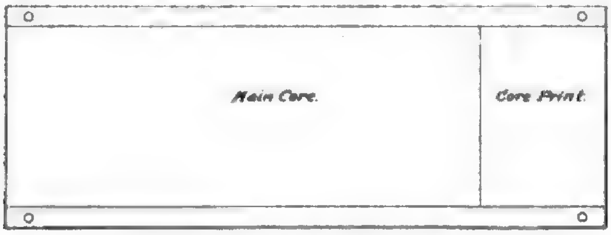

FIG. 2.—SKETCH OF MAIN CORE BOX.

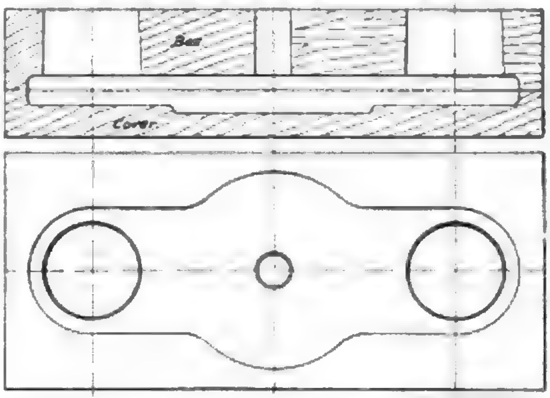

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FIG. 3.—VIEW OF BOX COVER REMOVED.

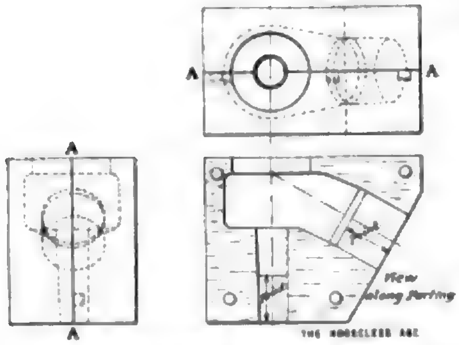

FIG. 4.—EXHAUST AND INLET CORE BOX.

4 inches high by 5½ inches wide by 7 inches greatest length, and is shown in Fig. 4. The split was made in the vertical plane spoken of in connection with the combustion chamber, as this was the only plane about which the core was in the least symmetrical. The box must be entirely worked out by hand, as the shape is complicated, including a full cylinder and a half cylinder in a vertical plane, the latter sloping off in an inclined plane to another smaller cylinder and a conical section, the section between the two being a constantly varying oval. In the figure the split is indicated along the lines AA, and is shown in full view.

It should be explained right here that the main or body core, the combustion chamber core and the exhaust and inlet chamber cores are pasted together to form one large heavy and complicated core, which is, however, well supported by no less than eight prints, the smallest being 1⅛ inch in diameter and the shortest 1½ inch long.

Making the core thus means pasting it in three places. Now, it might have been made in one box, as the whole core is symmetrical about a vertical plane through the centre line, but this would have been a much larger, very heavy, complicated box. The expense would have been tripled to save pasting in three places, as the resultant core would be no better nor more accurate. This was considered as out of proportion, so the method just described was adopted.

It might also be added that several foundries to whom this pattern was sent filled up the small central 1⅛ inch diameter hole in the combustion chamber core box and made another hole through this core, but a trifle smaller, 1 1/16 inch. A new core print was also added to the pattern, of this same diameter and 6 inches long. Then when the big core was made, a 24 inch piece of three-quarter inch iron pipe was bedded in on the centre line, being allowed to project the right distance to pass through the upper core and form a 6 inch print. In pasting the cores the combustion chamber was slipped on over this and then pasted to the cylinder core. It was claimed that this made a much better, stiffer and stronger arrangement, and one that was easier to handle.

The water jacket core box was not as complicated as it would seem to be on glancing at the drawing. This was because, like the cylinder, it was made as a half lying upon one side. This was carried still further, as the halves were wired, rammed, baked and used as halves, the pasting not being done until the last half of the last core to go into the mold was ready to be put in. This pasting was then the last operation before closing the mold. It was impossible to paste these before putting them into the mold, as in that case the other core would not go in. Thus the method was to place the lower half of the water jacket place the pasted main core, then after trying the other half of the jacket in the other half of the mold, paste it to the half which was in place and close.

This cylinder is molded upon the side in a flask about 24x30 inches, being gated, however, to the lower or open end of the cylinder. Then, when the mold has been slicked and blocked, and is complete with all cores in place, it is very carefully closed, fastened and equally carefully set up on end. The cylinder is then poured at the upper or open end. This is done to get the best metal, which is at the bottom, into the valve walls and passages of the head, where it is most necessary. This throws the more porous metal to the lower end of the cylinder, where any slight imperfections do not matter.

T-TYPE CYLINDER PAIRS.

Cylinders in pairs with the valves opposite are poured also with the head end down, all cylinders being poured that way, but the method of molding is different, and consequently the pattern and core box are also different.

Thus the cylinders shown in Fig. 5, while they might appear symmetrical both in the exterior view and in the vertical cross section, really are not. Looking at the upper horizontal sections, it is seen that they are partly symmetrical about a cross centre line passing midway between the valve centres and also between the cylinders. Even if the minor differences were neglected and the pattern split as before, it would be necessary to make several extra cores, including one for the space between the lower part of the cylinders below the water jacket. This would not be so much, but all core prints not on this centre line would have to be carried over to it. This means lots of extra needless work, particularly in the core boxes.

Then, as there was no gain from molding the cylinder on the side, it was made to mold on end, which is the proper way and

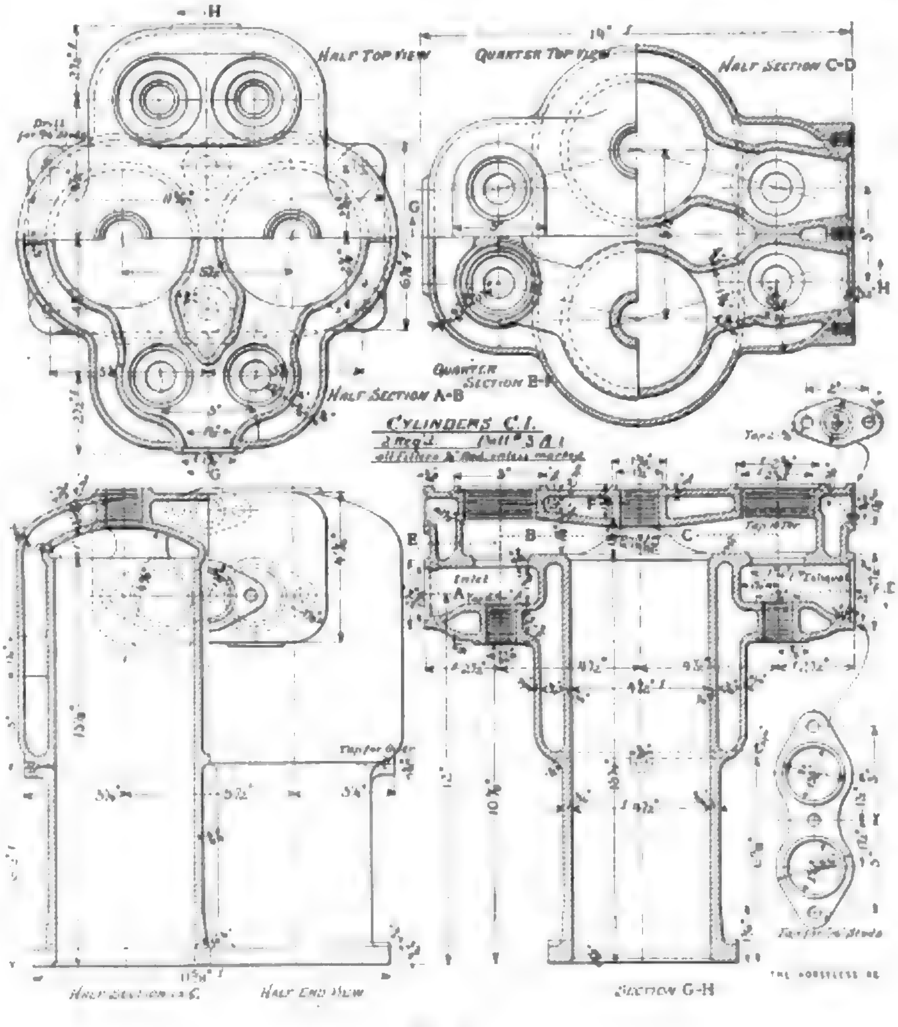

FIG. 5.

the way it must be poured. This molding on end was done by parting the pattern in two places, making it a three piece pattern but requiring a four part flask, as will be explained later.

If the distance from the upper parting line (upper on the cylinder but lower in the mold), which was directly across the pattern on the centre line of the inlet and exhaust passages, to the base, had not been so great—that is, 12⅛ inches—the two part flask could have been used by making the flange in loose pieces and leaving out the taper in the outside of the cylinder walls where they join the flange. But this distance being so large for drawing loose pieces, it was thought best to make another parting in the pattern, which was done 5⅛ inches below the base. This gave a 5⅛ inch draw in one case and a 7 inch draw in the other, but was as even a distribution as was possible.

The fourth part of the flask was necessary for the cylinder core print and could only have been avoided by bedding this or by the use of a special follow board. These two prints were 3½ inches long, which would have meant a deep board, not less than 5 inches. The foundry connections were not such as to allow of any arrangement being made for this. So the print was made as will be described, thus calling for a four part flask.

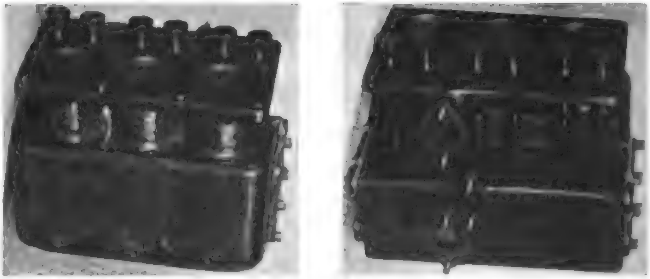

Fig. 7.—Cylinder Block.

The block, as glued up for this cylinder pattern, was 13x4x14½ inches for the upper part, and 13x5½x14½ inches for the central part, while the lower part was not worked out from the solid, but the cylindrical portions were each turned from a solid block which measured 5½ inches square by 12 inches long. Another similar block for the core prints was 5 inches square by 8 inches long.

The upper half is worked out first, all bosses being formed integral, except the water inlet and outlet bosses, which must be loose to draw from the sand and which, moreover, must be drawn at an angle. This would require the core print to be set at an angle, but this latter is undesirable, so two loose pieces were used, the boss forming one and the print the other. It was then possible to set the latter straight and draw it straight in, after the boss had been drawn at an angle.

The middle portion presents no difficulties, everything being of such a shape as to mold easily and draw readily. The inlet and exhaust passage core prints are split on the centre lines, one half being part of the upper portion of the pattern and the other half going with the lower part.

The lower part of the pattern presents no difficulties either, but the method of making it is interesting. The flange is sawed to size and shape from a three-quarter inch board, planed on both sides. Then the cylindrical portions, which have been turned up previously, are glued and screwed to this board. Then the bosses and fillets are worked out in the upper part of this board, and finally the core prints, which also have been turned up previously, are attached (but not permanently) to the lower surface. This completes the lower part of the pattern and takes perhaps one-quarter of the time it would have taken to work it out of a solid block.

The main core is made as before, as to the larger cylindrical part and the upper or combustion chamber part, the latter being slightly more complicated than before. The cylinder cores are both made in the same simple box and pasted as before.

The exhaust and inlet chamber cores are now very different, and, although the core is made in the same manner, must have separate boxes, as a single inlet is used for both cylinders, while the exhausts are made individual. The latter is, however, very simple and the two cores are made right and left from the same box. The inlet has a single more complicated box. This is split on a line at right angles to the face of the boss or through the centre line of the core, then up at an angle to the vertical centre of the pocket, then again in a plane parallel to the first line. The round portions where this core pastes to the combustion chamber core is formed in the upper part of the box.

The water jacket core box is split on the same line as the upper part of the pattern, that portion above the split forming

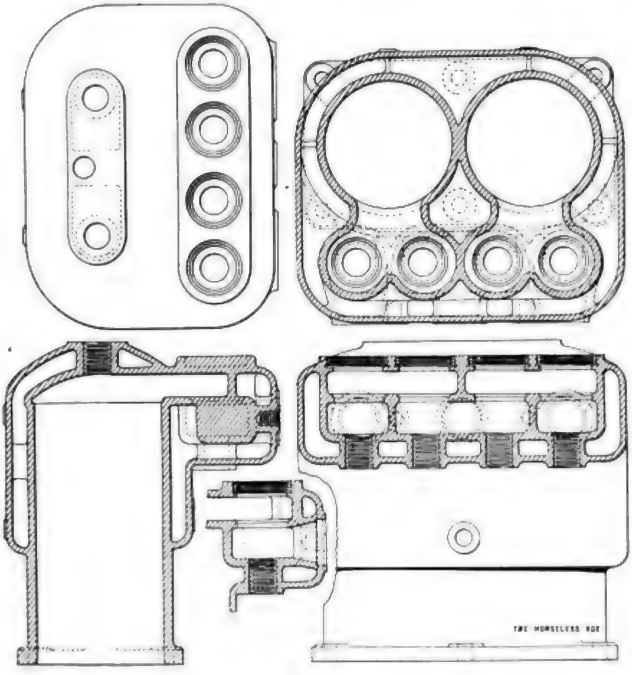

Fig. 6.

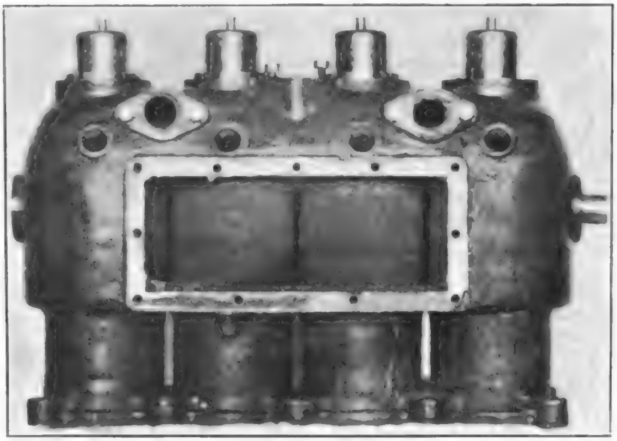

FIG. 10.

one box, and the portion below another. The upper part has three additional core prints, not indicated on the drawing. These are located, one on the centre line of the top of the pattern midway between the cylinders, and two others at the upper curving portion of the cylinder, each 90 degrees away from the water inlet and outlet here shown. These five well located prints hold this light core very firmly, so that the lower part is pasted to it and has no prints. This is done because a print large enough to do any good would complicate the molding as well as pattern and core box.

CYLINDER PAIRS WITH VALVE BOXES ON ONE SIDE.

In next taking up a modification of this type, viz., cylinders in pairs with all valves on one side, we will see that many of the features of the previous construction are retained, but none of those described with the first or individual cylinder.

Referring to Fig. 6, the cylinder diameter is 5½ inches, being midway between the first and second. This was for a 5½x6 inch, four cylinder engine which was used on heavy commercial cars. This pattern is made and molded like the previous one. The upper split is through the centre line of the inlet and outlet. The distance from there to the base, 10⅝ inches, is too great for drawing out loose pieces, so the pattern is split again 4¼ inches below. This makes a split in the core box as well, but was done to gain core prints for the water jacket.

The water outlet on the top makes one; two more are provided on the ends of the cylinders, so as to come at the parting. Then the lower part of this core has two more prints, one the water inlet shown in the front view and another on the back directly opposite. The additional split made more pattern work and more core box work, but this was only done once, while the foundry work which this eliminated was saved hundreds of times. Not only was this extra foundry work saved, but better castings were thus made possible.

The rest of the pattern work and molding was the same as before. The main core, as before, was made in seven pieces, six of them alike in pairs and made from three boxes, two of these being made to make right and left cores, the seventh, or inlet port core, being made in a single box. In this pattern seven parts are also made, six alike, in pairs, made from three boxes, only one of which is made right and left. Similarly the jacket cores differ only in minor matters, one of these being the extra parting. Passing now to the cylinders cast in a unit, we find all forms of construction used and some new ones. Fig. 7 shows a block of three, as recently put on the market in a six cylinder engine. These cylinders are 3⅝ inches in diameter and long, because of the long stroke, 4⅞ inches.

Both views show the core plates covering the ends of the water jacket. These large sized prints for jackets are a feature of all modern motors. The front view clearly shows the upper parting line passing through the centre line of the exhaust opening, the lower one being apparent at the junction of the circular lower portion of the cylinders with the bottom of the water jacket. This is apparent in the back view.

Not having the details of this motor, the writer will have to give a description of the pattern work on another block motor. The latter, however, differ in this respect, that not only are the cylinders cast four in a block, but the upper half of the crank case is cast with them. Fig. 8 shows a typical section through this casting, on which are indicated the three lines upon which the pattern is cut. These are as indicated at AA, which splits the core print and the lower part; BB, where the lower and middle sections part, the former being the crank case and lower half of the cylinder, while the latter is the water jacket, valve guides and part of the valve chambers. The broken line CC indicates the parting between the middle and upper parts, the

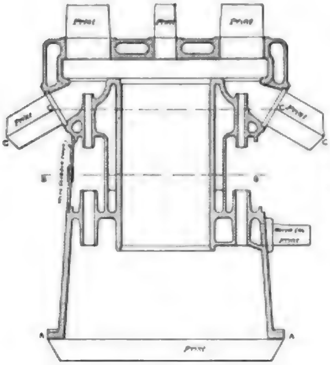

FIG. 8

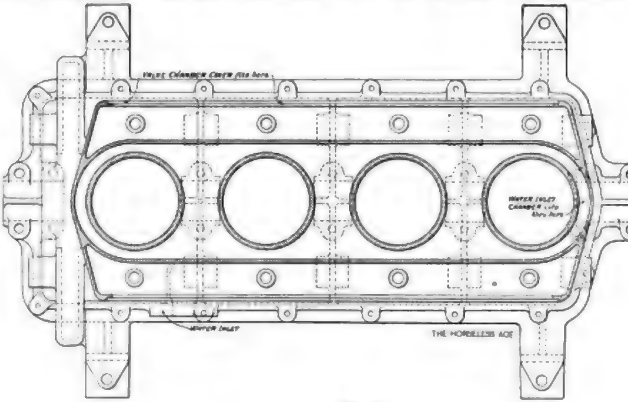
Inlet Chamber Core fits here
Water Inlet Chamber Core fits here
Water Inlet
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FIG. 9.

latter being the rest of the cylinder head and carrying most of the prints.

In making the pattern, which is a small part of the job compared with the core boxes, the gluing up amounted to considerable work. The wood was mahogany, and everything was worked out from the solid, except prints. The glued portions were three in number, one, the upper, and the next or middle were each 3x12x24 inches; finally, the lower was 2½x9½x26 inches. The actual lower portion forming the crank case was built up and was 5½x11x28 inches. The whole pattern with core prints when assembled measured 15½x16x33½ inches, an unusually large pattern for an automobile cylinder.

This engine was of 4 inch bore by 4 inch stroke, but contrary to other block motors, had a bearing on each side of each cylinder, or five bearings in all. These were necessarily rather short, but the total bearing length provided was very large, being 16 per cent in excess of the length given by the Heldt formula for five-bearing crank shafts. This is $l_1 = 9.25\, d_1$, d_1 in this case also being about 15 per cent. larger than the formula calls for. So for a block motor, this one had an unusual bearing area. This was at the expense of other things, as, for instance, the great distance from centre to centre of cylinders made the water space between cylinder walls enormous. This meant lots of water, which is heavy, and a cool motor, which is not efficient. So the large bearing area was not an unmixed blessing.

In this engine not only were the four cylinders and the crank case made in one casting, but the push rod and valve guides were also cast in place. In addition, the water passages were cast in, as well as the exhaust and inlet pipes. The sides of the casting were so shaped that a single plate on each side with two studs and wing nuts for each plate formed a valve chamber enclosing all of the valve mechanism, keeping the noise in and the dirt out.

The top view, partly in section, shown in Fig. 9, illustrates this clearly, as well as showing the inlet water passage. This latter caused the first trouble, which was also the last. The foundry did not understand the location of this core, and had trouble in placing it. As a result, it was placed too low, and the core cut through along the whole length. A slight change in the core box gave a little more metal, and no trouble was experienced thereafter.

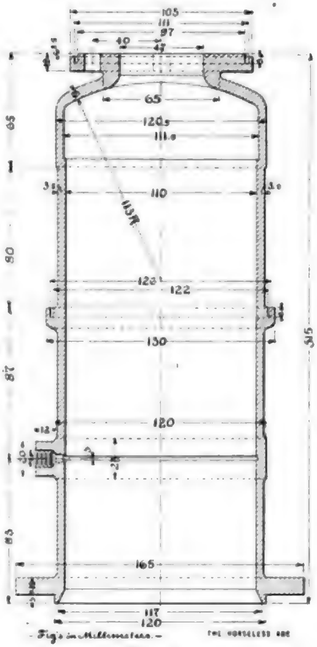


FIG. 11.

The core box was the largest part of the work on this casting, but method of construction is evident from the two views here presented and the description previously given. It was made in two parts, the main core consisting of the case and the four cylinders made in one box, the four combustion chambers made by using one box, and all pasted to the cylinders; the exhaust passages, two in number, made in one box, and the inlet made in another.

The water jacket core was made in one large box consisting of three parts, the top with eight prints, the middle with five prints and the water inlet with one individual print and pasted to the others. This makes a total of fourteen core prints, well distributed, so, despite the complicated nature and size of this core, it was unusually well supported.

Beyond this the writer will not go into the details of this pattern and the core boxes, as most of the work has been covered in previous descriptions. One small matter, however, is that of fillets. On external work they may be cut out of the solid, which makes a fine job. On internal work, however, they must be applied, and these applied fillets may be of two kinds—leather, which is very good, or beeswax, which is a makeshift.

Fig. 10 shows a third block motor which has been recently brought out. The two upper openings are for the inlet, which is cast integral with the water jacket core hole plate which covers the large rectangular opening. The other four openings shown are for the spark plugs.

Among prominent manufacturers of both three and four cylinder block motors may be mentioned Thomas, Ford, Chalmers-Detroit, Hotchkiss, Aster, Argyll, Darracq, Unic and Mors. This list shows that the price has no bearing upon the construction, as it includes many whose price is always high.

CYLINDERS WITHOUT JACKETS.

Everything that has been said thus far has been about cylinders cast with integral water jackets. Now the use of applied water jackets makes a great difference, not only in the pattern and core box but in the foundry work as well. To explain this in a few words, the water jacket core box and cores are entirely dispensed with. If the valves are placed in the head and the latter made removable, the cylinder becomes the simplest possible shape, as is shown in Fig. 11. This is a section through an old Panhard copper water jacketed cylinder. This 24 horse power engine has the valves in the head and water cooled, this latter water jacket being cast integral. Compare this simple casting with some of those we have just described, and figure the work saved in pattern shop and the core room, and on the foundry floor.

Another view, Fig. 12, shows a casting of a cylinder unit in which the cylinders are in pairs but have an applied jacket of copper. This view shows the water jacketed head and the lower portion where the copper jacket is applied. Although we cannot compare fairly without knowing the construction of the interior of the head portion, this view may be used to compare with the examples of cylinders cast in pairs which have been given previously, including Figs. 5 and 6.

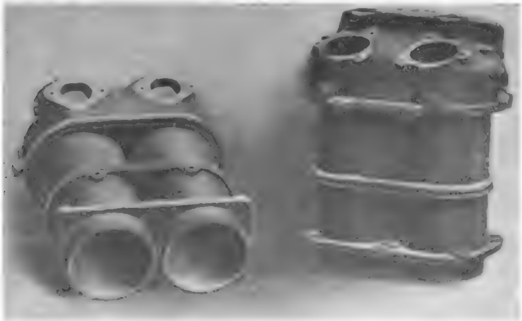


FIG. 12.

Hardening, Tempering and Annealing Steel.

By Herbert C. Barnes.

The hardening and tempering of steel is, in the popular mind, one of the most mystic of the arts, yet, when divested of all the magic which fiction has cast about it, it becomes a subject of great interest to any one who aspires to a knowledge of things mechanical, and absolutely essential for everyone who essays to work in steel.

It is not the intention of the writer to assume the role of originator in the preparation of this article, for the subject of hardening metals is one which has been discussed since the distant time of the lost art of hardening copper, an art fabled since prehistoric ages. He will, however, write of very little which did not come under his own observation in the decade in which he was engaged in the practical working of steel. From time to time treatises by various writers appear which must of necessity cover the same matter.

The smelting of iron ore in blast furnaces is the first step in the production of steel. In the blast furnace the earthen matter and some other impurities are removed. When the iron leaves these furnaces it is known as pig iron or cast iron. Cast iron consists of metallic iron combined with at least 1½ per cent. of carbon and smaller percentages of silicon, sulphur, phosphorus, manganese and other substances which together comprise about 7 per cent. of the whole. The refining processes remove or reduce these ingredients as desired, great care being always taken to eliminate as much sulphur as possible. According to the chemical content of the iron, the steel which is made from it will vary in quality. The quality will also vary according to the method of converting the metal from iron to steel.

This conversion is accomplished in several ways. The more common process is known as the Bessemer which, ordinarily, produces the cheaper grades; the open hearth process, which comprise what is known as the acid and the basic methods, producing a better grade; and the crucible process which produces the highest grade of steel.

It is quite as necessary for the mechanical engineer to know the method by which the steel he uses is produced as it is for the carpenter to know what kind of wood he builds into the structure upon which he is engaged. Perhaps in no other case is this knowledge more essential than in the case of steel which is to be hardened. For when a piece of steel has been machined into a finished product, often at great cost of time, the metal worker must know these conditions and also the chemical content, if he is to harden it in such manner as will secure and preserve its greatest usefulness. While the individual smith may not concern himself with the composition of his steel, yet the system that he employs in hardening is, or should be, governed entirely by the counsel of a chemist, however unconscious he may be of that fact. To be sure, some boastful artisans scorn all "book learning," but as the demands of engineers become more exacting these will disappear in the natural process of selection.

It is generally known that of the chemical elements carbon is the one which gives to steel, when properly treated, the quality of hardness. Sometimes the carbon content of steel is alone relied on to give the required hardness, and sometimes other metallic elements are added. These special alloy steels are usually known as "high speed" or "self-hardening steels."

When the raw material enters the factory from the mill it is usually known as "self-hardening" steel, as just described; "tool" steel, which is graded according to the percentage of carbon which it contains; and "mild" steel, in which the carbon content is very small. There are also many alloy steels which are compounded for special purposes.

Mild steel is used for running parts, such as shafts, spindles and some types of gears, and for screws, tie rods, etc. Tool steel is used for all purposes where edge tools are required. It is graded by the trade as "point carbon" steel, the amount of carbon required in the steel varying according to the demand on the tool. To illustrate the system of grading, "25 point carbon" steel means steel which contains $^{25}/_{100}$ of one per cent. of carbon. When expressed decimally this would read 0.25 per cent. carbon. The term "point" is a translation of the expression "point 25," meaning 25 one-hundredths.

The necessary limitations of this paper preclude any extensive discussion of the various steels, and we will direct our attention to our subject and the intimately related processes of annealing and tempering.

A phenomenon of steel which influences the hardening operations is known as the point of "recalescence," the "critical point," or the point of "transformation." It is observed that when a bar of steel is heated its temperature rises steadily until it reaches a certain degree, which varies in different steels. Then it continues to absorb heat without becoming hotter. This absorption of heat seems to produce chemical changes in the steel and to induce activity among the molecules in the bar. After a time if the supply of heat be continued the steel will begin to increase in temperature once more. This point varies from about 1,300 degrees in some steels to 1,600 and over in others.

A most important factor in the heat treatment of tool steel is the necessity of maintaining a uniform temperature at all times. The steel must not be heated too quickly because of the danger of overheating the exterior before the interior parts are hot enough to produce the results desired. This is especially true when the steel is to be forged. If the outside be much hotter than the inside and the hammer be applied, the outside fibres will be forced or torn apart from the inside fibres, which, because of their harder condition, will not yield. Such pieces, when hardened, will give much dissatisfaction.

PRECAUTIONS IN HEATING.

Another matter of importance is that steel, when hot, should not be exposed to the air more than is necessary. The oxygen in the air decarbonizes the surface of the steel to a marked degree. Since the surface of a piece of steel is always the part which it is desirable to have harder than the interior, it is seen that it is necessary to avoid lessening this surface hardness. It is also necessary to prevent fuel which is in the process of combustion from coming in contact with the steel, since the chemical actions which take place cause injury. When steel is forged this effect is not so noticeable, as the hammering refines it. But in no case should tool steel be exposed to the sulphurous gases of fresh bituminous coal. Charcoal is much safer and better to use when forging it, but when charcoal cannot be obtained the soft coal should be burned to coke and deprived of most of its gases before the steel is heated in it.

It is a good practice to take a piece of pipe, plugged at one end, and build a fire about it, thus making an extemporized oven. In such a device steel may be heated in safety in so far as difficulties from the gas are concerned. But even here it is better to use a regular fireclay oven, since heated steel will decarbonize when left in contact with any other decarbonized iron or steel. Such local decarbonization is very objectionable, as it prevents an even hardness when the steel is finally ready for use. These fireclay ovens are invariably used in the regular furnaces which are offered for sale in the market. In the gas furnaces the burning air and gas are caused to flow about the ovens, thus causing intense heat without coming in contact with the work.

FURNACES.

In large well equipped factories where oil, gas, and electric furnaces are used it is a comparatively easy matter to heat the work as described.

In some oil furnaces the combustion occurs in a separate chamber, after which the heat passes to the work. Another highly useful system for heating small work consists of a lead bath. This is simply a quantity of lead kept in a state of fusion in an iron vessel; or, preferably, an earthen crucible. It is apparent that when an article is immersed in the molten lead it will be uniformly heated to the temperature of the lead, if the lead be kept well stirred. The lead must be pure and entirely free from sulphur, which, as already stated, is destructive to steel. If the part to be heated be irregular in shape the heavier sections should be partly heated before it is immersed in the lead.

Since steel will not sink in molten lead there is a possibility of the part exposed to the air above the lead becoming decarbonized owing to the action of the oxygen, as already mentioned. To prevent this the surface of the lead should be covered to a sufficient depth with powdered charcoal, thus preventing the exposure of the steel to the air. To properly use the lead bath a piece of soft iron wire should be twisted around each piece which is heated, in order to facilitate its removal when hot, and also its subsequent handling. In some commercial furnaces the lead is heated by gas or oil, but it may be used with entire satisfaction in a blacksmith's forge.

ANNEALING.

It is also necessary to know something of the behavior of steel when it is heated. Naturally when it is produced in the mills it is subject to different kinds of strains incident to the various hammering and rolling operations which it undergoes. These strains produce serious results in tool steel, unless they are relieved by the proper process of softening. This process is known as annealing.

It consists in slowly and evenly heating the steel to a degree just above the point of recalescence and then allowing it to cool very slowly. When it is thus heated the molecules in the steel readjust themselves and become relieved of all strain. By slowly cooling they remain in a state of equilibrium. Almost invariably steel will change its shape during the annealing process, although the change may be hardly discernible.

The best way to anneal a large piece of tool steel is to heat it and allow it to cool in the furnace in which it is heated. Furnaces may be bought which will heat the steel to the proper temperature and admit of adjustment in the heat supply so that the steel will be cooled at any desired rate, this rate being determined by automatic devices. Any ordinary heating furnace will cool too quickly to produce good results, unless the steel which is being treated be covered by some non-conductor of heat.

Small parts are usually placed in special iron boxes which are provided with close fitting lids. They are packed in powdered charcoal or charred cracked bone or leather. The lid is put on and sealed up with fireclay, after which the entire box is heated and, after due time, is allowed to cool with its contents. When thus annealing tool steel care must be taken to prevent any of the pieces coming in contact with the box because of the decarbonizing tendency already mentioned. It is better to prevent the pieces touching each other. All steel makers anneal their own steel and will furnish it at a slightly increased cost when ordered.

WHEN ANNEALING IS NECESSARY.

While we have seen that it is necessary to anneal steel when it has been finished at the mill, because of internal strains, it is also necessary to anneal it a second time, before hardening, when it has been subjected to forging or to any considerable amount of machining. These operations set up strains of their own making in the structure of the piece.

Such tools as long taps, drills, reamers and blanking and drawing dies are much benefited by this treatment. The proper course to follow is to do the rough work on such tools and finish them within practical limits before the second annealing. As stated, the tool will change its shape somewhat during the process. If it be found that a long reamer or other tool has changed its shape so much that it cannot be finished without bending or straightening, it should be heated to a forging heat and straightened. It should then be annealed once more. These precautions cost time, but it is certain that if there are strains in the steel before it is heated they will manifest themselves in the distortion of the work when it is hardened. High carbon steel when used for shafts and bearings in special machinery which demands extreme accuracy, or which are to run at high speed, should be treated in the same manner if the parts are to be hardened.

PROTECTION FROM CONTACT WITH AIR.

In every case when partly finished work is to be annealed it should be protected from the oxygen in the air. It may be covered, as before suggested, with charcoal, bone or leather, or when hot it may be "muffled" by placing it in dry sawdust, or on a soft board and covered with ashes or air slacked lime. The wood will smoulder and prolong the time of cooling. These coverings, however, should not be applied in such manner as to "chill" the work. When the work has cooled so that when filed the spot looks purple, the piece may be allowed to cool in the open air.

"WATER ANNEALING."

There is a seemingly paradoxical method of annealing steel when there is need for haste, which, while not recommended for fine work, produces astonishingly satisfactory results. It consists in slowly heating the steel to a dull red and allowing it to cool in the open air until a piece of soft wood will not char when pressed against it. It may then be cooled in greasy or soapy water. This operation is called "water annealing." It is generally used when it is necessary to cut hard steel without delay.

Tool steel drop forgings should be annealed after the forging, as there is great probability of internal strains caused by the forging. Also, when they are of irregular shape they are subject to cooling strains, inasmuch as such forgings are always allowed to cool in the open air.

HARDENING.

Except in the case of the special high speed steels which have been mentioned, the process of hardening consists in heating carbonized steel to the proper temperature and then quickly plunging it into a liquid bath to cool it. This sudden cooling causes the steel to become extremely hard.

As we have already stated, it is necessary for the user to know what the content of the steel which he is working is, if he is to get the best results. Any steel maker will advise the consumer what grade of steel to use for a given class of tools, and also what is the best way to harden the steel, stating the temperature to which it must be heated for hardening, and also the proper temperature for tempering. Common sense dictates that these instructions be closely followed, since no advice could be more sincere, for no one is more anxious than the steel maker that his wares give satisfaction.

HARDNESS TESTS.

It is a wise precaution to test the hardening qualities of a bar of steel before using it for any costly work. This may be done by cutting a small piece from the bar and hardening it according to directions. It should be then tested for hardness and toughness. To test for hardness a sharp file is used. A disc to cut glass should be so hard that the file will not even scratch it, but a cold chisel which is subject to great abuse must be so soft that a file will "bite" quite readily. Between these two extremes range the various degrees of hardness for cutting tools. To test for a toughness the sample should be placed over two blocks on an anvil and struck with a hammer. If it flies apart at the first light blow the steel is too brittle, but if it yields before it breaks the steel possesses the quality of toughness.

If there be some steel at hand whose make is unknown it may be identified with reasonable certainty by the following means: The bar may be brought into contact with the surface of a fast turning emery wheel. If the sparks which are thrown off are of a dull red color the steel is low in carbon, but if the sparks are bright and each individual spark explodes or bursts asunder, the steel is carbon steel. To determine the proper temperature to which the unknown steel must be heated to produce the desired result, a test piece should be taken from the bar, a series of nicks should be filed in the test piece at equal distances from each other. The piece should then be heated so that one end is certain to be destroyed, while the remaining sections are successively cooler than the one nearer the burned end. It is then plunged into the cooling bath. As stated, the end section has been destroyed, but one of the sections will probably be found to have the proper hardness.

The successful use of this system depends on the ability of the workman to observe the appearance of the entire piece before it is cooled, and to heat the piece of the same bar which may be subsequently hardened to the same degree as was the section which proved satisfactory in the test piece. Close attention to the work in hand is imperatively demanded or the least carelessness may result in the loss of a valuable piece of work. A novice should never attempt to harden a valuable piece of steel; he may harden simple pieces, but it is futile for him to attempt to harden special parts. Experience and judgment are essential, for no rules blindly followed, without intelligence, will be certain to produce the best results.

DISTORTION.

The phenomenon of the expansion of metals when they are heated is well known and also the subsequent contraction when cooled. If the metal be in a state of molecular equilibrium and it is evenly and gradually heated to a red heat, and then is gradually cooled, it will expand and then contract to practically the same shape which it presented before the heating. But if it be evenly heated and suddenly cooled by exposing one surface to the bath sooner than any other it is apparent that the surface which is first cooled, even though it be but an infinitely small space of time before the other, will contract first and thus cause a rearrangement of the molecules in the warmer side, this side being softer. This other side becomes in turn almost instantly cooled so that the distorted piece becomes hardened and fixed in its altered shape.

In the heating also, if one section be made hot before the other, it will expand first and in so doing distort the piece. There will be found no tendency inherent in the structure of the metal to restore it to its first shape while the heating gradually becomes uniform. We now see how any distortion which occurs either in the heating or in the cooling will be permanent unless corrected by subsequent treatment.

So varied are the kinds of steel pieces which are hardened that we cannot consider many individual types in this paper.

HANDLING PARTS IN THE BATH.

The furnaces which have already been described for annealing are quite as suitable for use in hardening. The main requirement is that the steel be heated uniformly to a point just above recalescence and then quenched in such manner as will produce the least unevenness in the cooling.

Long, light pieces should be placed in an iron box and packed in powdered charcoal or charred bone, and then slowly heated. When hot they should be removed with care to prevent bending while they are soft, owing to this heated condition, and then plunged straight down into the bath without the least inclination. Any inclination will produce the strain and warping already referred to. Immersing a piece vertically into the bath, and, if necessary, moving it up and down, without too great sidewise motion, is safer than swinging it about under the water. In the latter case the advancing side is always presented to cooler water than the following side, hence the same unequal hardening, accompanied by distorting and cracking. It is generally necessary to move the piece under the water as its great heat causes steam to form all around it. This steam, or vapor, forces the water away from the piece and thus prevents the quick cooling on which the success of the operation depends.

Tools which are formed on one end of a bar or shank, such as lathe tools or cold chisels, are heated and then plunged into the bath as far as they are to be made hard. But they must be moved a certain amount to prevent cracks occurring at the surface of the water because of the unequal cooling of the parts above and below the surface. The heat remaining in the shank after the end is sufficiently cooled is used in "drawing" the hardness to the desired quality. The entire piece is then cooled.

IRREGULAR PARTS.

Pieces of irregular shape, such as blanking dies and punches, or any other tools which have both light and heavy sections, should be heated so that the heavy section becomes hot first. Then, when the lighter parts are hot, the piece should be so plunged into the bath that the heavy part cools first. It is sometimes possible to heat such pieces by holding them for a time by the light section in a pair of heavy tongs, the tongs absorbing heat from the light part while the heavy part becomes heated. The tongs are then removed so that the heat becomes uniform.

The temperature to which steel should be heated varies from around 1,450 degrees to 1,650 degrees, according to the carbon content. A cold chisel would be heated higher than a lathe tool, because the chisel is made of a lower carbon steel than the other tool.

COOLING BATHS.

Pyrometers and electrical devices may be purchased in the market. These will register the temperature of the heating furnace with accuracy.

Ordinarily the cooling bath consists of clear water, brine or oil, but there are many chemical preparations and mixtures of more or less value which are supposed to enhance the qualities of inferior steel. Sometimes the water and brine are heated to prevent a too sudden contraction of the steel, but the warmer water gives less hardness to it than cold water. Often oil is poured on the water to the depth of one inch, the reason being that the oil cools the piece as it is immersed, but with less suddenness than if it were plunged directly into the water.

Rain water and boiled water are preferable to well water. Linseed oil, either raw or boiled, is excellent for hardening, but fish oil is generally used. For some purposes mercury is used as the hardening fluid, while for sharp pointed instruments like scribers or "scratch" awls the piece is heated and thrust into a common potato or into a piece of wax. There are numerous other materials which are also used.

Some tools are quenched and left in the bath until entirely cold, but in most cases it is better to cool them until they can be touched by the fingers without burning them but still cannot be held in the hand. It is good practice to place small or delicate pieces in boiling water immediately after the hardening, and to leave them immersed until every part is heated to the temperature of the water. This temperature, 212 degrees, is too low to affect the hardness in any way.

For some small tools which require extreme toughness and a keen cutting edge, it is customary to use a low carbon steel and to heat the tools in a bath of melted cyanide of potassium, which makes the outside, when quenched, extremely hard. The inside, because of its low carbon, is much softer and, in consequence, much less brittle. This process is really case hardening, which will be treated later.

OVERHEATING DEPRECATED.

Efforts are sometimes made to secure by overheating a greater degree of hardness than the steel will afford when heated in the proper manner. This practice is faulty as the steel is liable to be "burned." The proper course is to use a steel of higher carbon than that of the unsatisfactory piece. When steel is overheated its structure changes. An experienced artisan can tell by looking at a fractured piece of steel whether or not it has been overheated. When properly treated, it presents a beautiful appearance, with a fine close grain not unlike velvet, but when overheated the grain is coarse and crystalline. Some steel workers claim that such steel may be restored without remelting by the use of certain compounds, but ordinarily if steel is overheated the best course is to duplicate it at once and harden it properly.

It is sometimes desirable to harden a piece of steel and have some parts remain soft. This may be accomplished by fastening small strips of iron or steel about the place which is to remain soft. Then when the piece is heated and plunged into the bath the small strips prevent the liquid reaching the protected parts and also permit the vapor already mentioned to form between the two surfaces.

PREVENTING CRACKING OF THIN SECTIONS.

When there is likelihood of a piece cracking during the cooling because of holes which are drilled near on edge of the piece, it is customary to fill the holes with a moist mixture of asbestos and fireclay. This mixture, being a poor conductor of heat, prevents the narrow wall between the holes and the edge of the piece being chilled too quickly.

There are now on the market special machines which will harden great quantities of steel by automatically passing it through a heated chamber and dropping it at a positively regulated temperature into the bath. These machines are of great value where they may be profitably used, because they eliminate all of the uncertainty and variations due to the operator's carelessness or poor judgment.

HARDENING SPIRAL SPRINGS.

Medium and small spiral springs are hardened by passing the steel straight through a small furnace, where it is heated. It emerges through an orifice which is of such shape as will permit it to pass without any extra space. The hot strip is drawn under a stream of oil which hardens it sufficiently. It is then wound on a reel for tempering. Such springs are tested for hardness by bending them over a round plug held at a specified distance from the bend. They are bent so that the two portions are parallel, one above the other. The steel is required to bend without breaking over one plug and to break sharply over another which is just a little smaller. By this test it is possible to secure uniformity of stiffness in a large number of springs.

The preparation and hardening of watch springs are performed under processes of more or less secrecy. The hair springs of a watch represent steel in its most costly condition of refinement.

The customary method of causing any tool steel to act as a spring is to first thoroughly harden it and then to dip it in fish oil. When the piece is dripping with oil it is held over the fire until the oil disappears. This process is repeated until the oil has been burned off three times, when the steel will be in its most elastic condition for use. Special brands known as "spring steel" are sold by steel makers. These should be selected when the springs are required to give a considerable amount of service.

The special high speed steels are heated to a degree just below the melting point for hardening. Some are allowed to cool in the open air, some are cooled in a blast of cool air, and others are cooled in oil. The endurance of the special high speed steel is infinitely greater than that of carbon steel, but its range of usefulness is much more limited. It cannot be profitably used for finishing fine work.

TEMPERING.

In the heat treatment of steel proper tempering is quite as essential as proper hardening. When the steel is thoroughly hard it is usually brittle, and it will crack under the slightest shock. Tempering, technically speaking, always means reducing or moderating the hardness, and is never understood to involve the actual hardening process. It is accomplished by heating the hardened piece to a known temperature which will produce the desired result. In cutting tools this temperature is governed by the material which is to be cut. In parts of machinery it is governed by the kind of work that the piece will be called on to perform. The hammer of a hammering machine would be made softer than the hardened spindle of a high speed grinding machine.

The tempering process, in reducing the hardness of the steel, naturally reduces its weaving qualities. But it is found to prolong the usefulness of nearly every kind of hardened steel except the special alloy and the "high speed" steels. It is more economical to thus "temper" the steel than to hazard the frequent breaking of the more brittle harder steel.

Ordinarily the best way to temper steel pieces is to plunge them into a bath of oil which is heated to the desired temperature. When the cold steel is placed in the oil the oil is somewhat cooled, but it will soon regain its heat if the fuel supply is continued. When this occurs the parts must be removed or they will be of the same temperature as the oil. Thermometers may be obtained which will register the highest temperature used in tempering baths.

When the conveniences of the bath described are not at hand, other expedients will suffice. For flat work a large iron plate may be heated in the fire and the work then placed on it. Of course this will heat the side on the plate more than the other side, but often this result is just what is desired. Sometimes, if the work be of uniform shape with a hole in the centre, like a milling machine mitre, a rod is heated and thrust through the hole in the centre of the piece. The heat will pass from the bar to the outside of the piece which is being treated, leaving the inside of the piece softer than the outside. Again the piece may be tempered by holding it in the flame of a charcoal fire or of a gas burner. The last named process requires care, lest the piece be tempered too much and be made too soft. A conventional expression for this condition is "drawn too low."

The method of heating the work in tempering is really quite unimportant, provided that a uniform amount of heat be delivered, so that no unevenness will occur in the hardness of the work when it is ready for use.

COLOR SCALE.

A phenomenon of the tempering process is the formation of an oxide of iron which appears on the surface of the steel which is under treatment. The color of this oxide changes from a pale straw at 420 degrees to a blackish blue at 640 degrees. Practically all except spring tempering is done at some point between these two extremes. So small a difference as twenty degrees will make an appreciable difference in the hardness of the steel. In order that the oxide of iron may be made to be of reliable service in tempering, the steel should be brightened before it is heated. A given color of the oxide always represents a certain degree of heat. A list of what is known as "standard tempers" is given below. This list is taken from "Chambers' Encyclopædia." Many such lists have been printed:

No.		Degrees.
1.	Pale straw	420
2.	Straw	450
3.	Straw yellow	480
4.	Nut brown	500
5.	Purple	530
6.	Bright blue	560
7.	Deep blue	590
8.	Blackish blue	640

CASE HARDENING.

Thus far we have considered the hardening of steel which contains from 0.25 per cent. to 1.5 per cent. carbon. It is possible to harden non-carbon steel by use of the "case hardening" process already mentioned. This process, as its name suggests, produces a hard shell or case on the entire exterior surface of the piece which is treated, while the central core remains quite soft. This condition is useful in many parts of machines where there are movements which cause excessive wear. Such are cam rollers, the teeth of gears, ratchets, etc., and screws, bolts and nuts, all of which receive sudden strains and shocks. The hard surface prevents their defacement, while the soft interior retains all the qualities the steel possessed previous to the treatment.

The case hardening process consists in placing the parts in an iron box and packing them in either animal or mineral carbon. The box with its contents is then heated for several hours, according to the requirements, after which the work is allowed to cool in the box. The parts are then reheated and treated as if they were made of regular carbon steel.

Case hardening is accomplished in another way by heating cyanide of potassium and barium to the melting point and then holding the parts to be hardened in this bath. When thoroughly hot the piece is cooled as before described. There is also a process of case hardening by which the carbon enters the work during the combustion of certain gases which heat the pieces during the process.

PACKING MATERIALS.

The more common materials used for packing in case hardening are charred bone, powdered charcoal and charred leather. By skillful use of these carbonizing products, beautiful surface colors may be obtained. In order that the pieces be richly colored, it is necessary that they be kept from exposure to the air after they are heated, and also that the heat be evenly applied. As in the case of carbon steel, the parts which are to be case hardened must not come in contact with any other metal, for the same reason, namely, the decarbonizing tendency of the non-carbon steel or iron.

As in the case of tool steel, the parts which are to be hardened are heated to just above the point of recalescence before they are cooled in the bath. The action of the bone and charcoal, etc., is as follows: As the steel parts and the bone in which they are packed become red hot the pores of the steel open while the packing materials give off their carbon content. This carbon is absorbed by the steel. It will penetrate deeper in proportion to the time the heating continues. If one heating does not deliver enough carbon to the work the process should be repeated with fresh packing.

The Design of Planetary Gears.

By James Angelus.

It is interesting to note how, in the progress of any particular branch of human industry, some devices gotten out during the first stages of development are gradually displaced and superseded by others and almost entirely forgotten, to be revived at a later date when they are viewed under a new light and given the benefit of increased knowledge and experience. Sometimes their revival and permanent success are made possible through the development of some minor detail. The planetary gear is just at present going through this process of evolution, especially in the commercial field, and is being considered by several manufacturers. It has several important advantages over other types of speed changing devices, and if well designed and made, with a thorough understanding of its nature, it will again enjoy the popular favor. In view of this renewed interest in the planetary gear, and having lately given it much thought and study, in the course of the design and construction of a gear for a 2 ton truck, which proved very satisfactory, the writer thought it would be interesting to give the result of his observation, especially as very little has been written as regards the design, the articles that have appeared in the trade papers limiting themselves to the determination of the gear ratios.

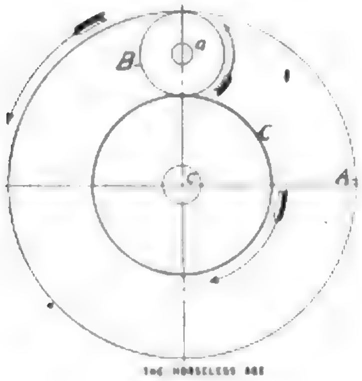


Fig. 1.

One thing that is hardly believable in the light of the wonderful progress of the automobile industry, and which has been mainly responsible for the disfavor of the planetary gear, is that no radical improvement has been made, the planetary gear being still made as it was ten years ago, the only improvement observed by the writer being the adoption of the multiple disc clutch for the direct drive, in place of the single disc or cone clutch.

FAULTS OF THE COMMON TYPE OF PLANETARY GEAR.

1. Non-adjustable and insufficiently large bearings.
2. Faulty design of bearings and pinion shafts.
3. Improper lubrication.
4. Noise.
5. Dragging brakes.
6. Faulty brake anchorage.
7. Too small high speed clutches.
8. Too many gears.
9. Mesh of gears affected by wear of bearings.
10. Inferior materials used in its construction.

Most of these faults may be traced to a common origin, as well be seen later on.

BEARINGS.

As far as the writer knows all of the bearings used in planetary gears have been and are provided with thin bronze bushings, the reason for this apparently being the simplicity and low cost of manufacture of such bearings and the possibility of very compact design with small gears and pinions. In some rare instances some of the bushings have been lubricated through the main shaft, but in most cases the designer has relied on filling the cases with a lubricant, at the same time making no or insufficient provision for its retention and the exclusion of dirt. As most of these bushings have to stand high pressures and rotative speeds, as will be seen below, it is easily explained why they frequently run hot and seize so hard that they have to be removed with a sledge hammer or cut off in a lathe. The wear of the bushings is mainly uneven, and alters the centre to centre distance of the gears, with the result that the pinions are drawn away from the driving gear and crowded against the internal gear, thus lowering the power transmitting efficiency and generating that rumbling noise that is always more or less present in planetary gears. As non-adjustable bearings would thus seem to be out of the question, the use of ball or roller bearings throughout presents the only satisfactory solution of the problem, and was decided on by the writer at the outset of the design above alluded to. While the use of ball bearings will add to the cost of manufacture and somewhat to the size of the gear, this has not been considered a serious objection in the case of sliding gear transmissions, nor, in fact, in any other part of the automobile where they have been adopted, as the advantages they afford in increased reliability and efficiency more than offset the increased cost.

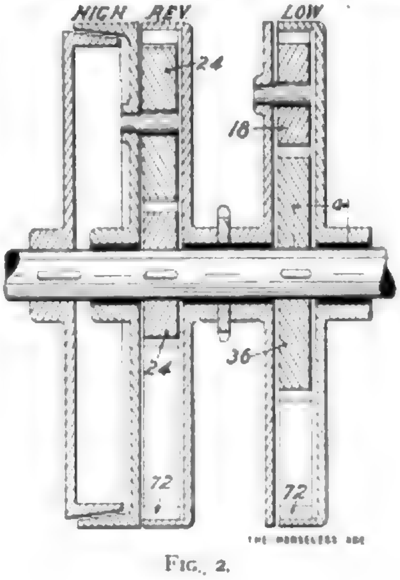


Fig. 2.

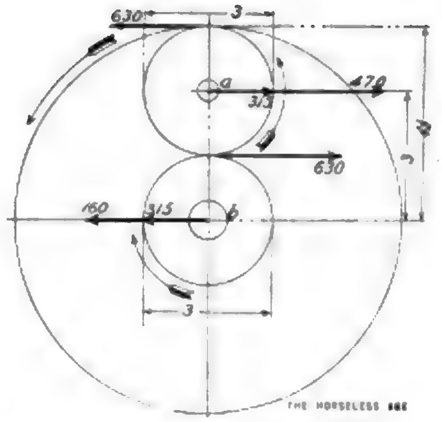


Fig. 3.

THE EFFECT OF WEAR IN PLANETARY GEARS.

Let us consider a planetary gear (Fig. 1) of the internal gear type. C is the driving gear mounted on an extension of the engine shaft, B is a pinion meshing with the driving gear and free to rotate around a pin or short shaft, one or both ends of which are held in a casing, which in its turn is free to rotate around the driving shaft. These mountings and bushings are not shown in Fig. 1, as this type of gear is well understood. It is also well known that either A, which is an internal gear meshing with the pinion and free to rotate around the driving shaft, or the pinion pin may be held stationary by means of a brake, in the former case the low and in the latter the reverse speed being obtained. To make things plainer, let us suppose that the gear is to transmit 15 horse power at 1,000 r. p. m. of the driving shaft. Let us also suppose that A has a pitch diameter of 9 inches, B and C of 3 inches for the reverse motion, and A of 9 inches, B of 4½ inches and C of 2¼ inches for the low speed, thus giving in both cases a ratio of 3 to 1. Let the general construction be as shown in Fig. 2. Referring to Fig. 3, pin *a* being held stationary and the driving gear turning at 1,000 r. p. m., the torque at the pitch circle of the driving gear will be

$$\frac{15 \times 33000 \times 12}{3 \times 33.14 \times 1000} = 630 \text{ pounds.}$$

Both gears being of the same size, the reaction on the pin will then be 315 pounds, and the reaction on the driving shaft bearing will also be 315 pounds. The pinion revolving at the same speed as the driving gear, the torque at its pitch circle will also be 630 pounds, and the reaction caused by the internal gear on the pin will be $\frac{630 + 4\cdot 5}{6} = 470$ pounds, which is in the same direction as that due to the driving gear.

The total pressure on the pinion pin will therefore be 470 + 315 = 785 pounds.

If to determine the necessary bearing surface we take as a basis a pressure of 50 pounds per square inch at 1,000 feet per minute velocity, and decide on a 1¼ inch diameter pin, we have

$$\text{velocity} = \frac{1000 \times 3.14 \times 1.25}{12} = 328 \text{ feet per minute.}$$

At this velocity the allowable pressure

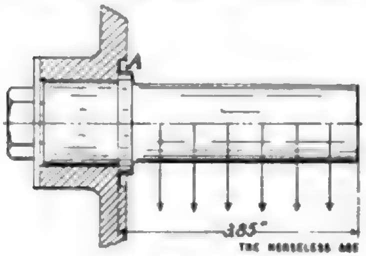


FIG. 4.

per square inch will be

$$\frac{50 \times 1000}{328} = 152 \text{ pounds.}$$

And for a pressure of 735 pounds we would require a bearing area of

$$\frac{725}{152} = 4.83 \text{ square inches,}$$

and for a 1¼ inch shaft a length of $\frac{4.83}{1.25}$ = 3.85 inch.

Besides affording an adequate bearing surface the pin must also be strong enough not to bend under the load imposed upon it. The load being regarded as uniformly distributed, the maximum bending moment will be at A (Fig. 4):

$$M\,b = \frac{735 \times 3.85}{2} = 1420 \text{ pounds-inches.}$$

The maximum shear will also be at A, and equal to 735 pounds. The section modulus being $S = .098 \times 1.25^3 = .20$, the bending stress will be $\frac{1420}{.20} = 7100$ pounds per square inch. The shearing stress will be $\frac{735}{1.76} =$ 600 pounds per square inch, and the total stress 7100 + 600 = 7700 pounds per square inch.

Unmechanically designed pins are also frequently met with, as, for instance, the one illustrated in Fig. 5, in which the section A subjected to the maximum stress is the smallest. The effect of wear of the pinion and casing bushings is shown exaggerated in Fig. 6. The pinion and internal gear will be forced from *a* and *b* to *a'* and *b'*, the pinion being drawn away from the driving gear and crowded against the internal gear with obvious results. The effect of a pinion pin too small to stand the bending stresses is shown in Fig. 7. More trouble occurs in cases where, as in the gear illustrated in Fig. 2, the low speed casing reaction is carried by an offset bushing, as, the wear being then uneven, the casing is thrown out of square with the axis of the shaft, the meshing of the gears being consequently deeper on one side of the face than on the other.

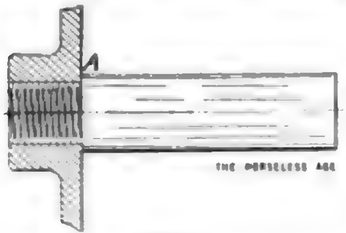


FIG. 5.

LOW SPEED GEAR.

Supposing that a ratio of 3 to 1 is desired on the low speed, the internal gear being held stationary, the pinion will roll inside the internal gear, carrying with itself the pinion mounting. As the pinion pin would make one revolution around the driving gear in the opposite direction, the ratio of the pinion to the driving gear will be 2 to 1, and 4 to 1 to the internal gear. The torque at the centre of the pin will be

$$\frac{15 \times 33000 \times 12}{333 \times 6.75 \times 3.14} = 840 \text{ pounds.}$$

With the assumed gear ratios and speed of the engine the pinion will make 1,000 r. p. m. around its pin, while the pin itself makes 333 r. p. m. in the opposite direction. For a 1¼ inch pin the rubbing velocity will be

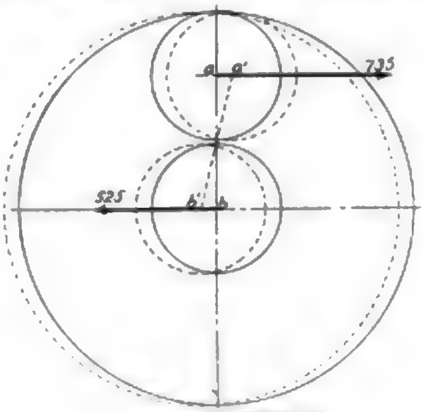


FIG. 6.

$$\frac{1.25 \times 3.14 \times 1333}{12} = 430 \text{ feet per minute,}$$

and the allowable pressure per square inch of bearing surface

$$\frac{50 \times 1000}{430} = 116 \text{ pounds.}$$

The pin length will then be

$$\frac{840}{116} = 7.8 \text{ inch.}$$

A MECHANICAL FALLACY.

It has been common, not to say general, practice to use several pinions or sets of pinions evenly spaced, to the end of distributing the work among them, and thus reducing their size, the size of the pins and bearings, and creating couples which would put no torque reactions on the driving shaft. It must here be remembered that when such arrangements are used the number of teeth in all gears must be divisible by the number of pinions used. The writer knows of a case where such a precaution was disregarded with the unexpected result that it was not possible to assemble the gear. There are serious objections which make the attainment of the results expected from the use of several pinions practically unattainable. To evenly distribute the work among several pinions, these must be very accurately located and, what is perhaps more important, they must remain so.

Granting as possible that the pinions may be exactly spaced, and that the gears mesh to perfection, it is not possible to avoid wear of the bushings, which brings about the effects above shown. As soon as wear takes place in the pinion bushings and pins, and in the carrier bushings, the even distribution of work and pressures expected becomes very uncertain, and all the work may and is, in fact, thrown on one particular pinion, which will, of course, be too small to withstand it. This assertion is confirmed by the fact that the bushings in planetary gears wear out very quickly. In nearly all of the planetary gears that came under the writer's observation the different sets of pinions showed unequal wear. If the attainment of the results sought for through the use of multiple pinions is uncertain, it would seem better to rely on one pinion or set of pinions only, making adequate provisions in order that it may stand the work imposed upon it. The writer is not the only one that entertains such an opinion, as he has discussed the question with people who have had a long experience with planetary gears; besides, there is at present on the market a planetary gear of the all spur type where a single set of pinions is used, a counterbalance weight being cast opposite on the pin carrier. That all that has been said above applies to gears of the all spur type also will be shown later on. On the assumption that there are no reactions on the driving shaft and mountings, their bushings are also made insufficiently large.

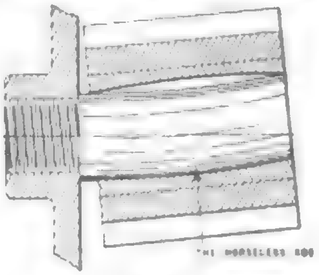


FIG. 7.

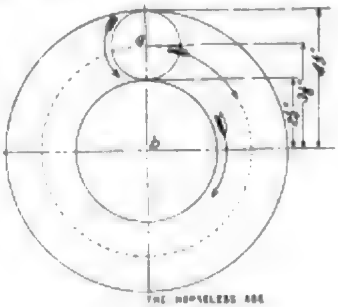


FIG. 8.

Going back to the calculation of the low

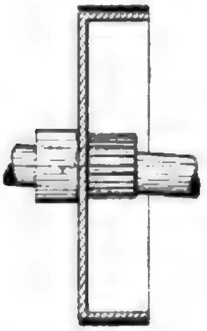


FIG. 9.

speed pinion pin size, it may here be observed that a pin of that length will not be stiff enough to carry the load without bending, unless supported at both ends. If this is not possible, the gears will have to be enlarged, as it would not be possible to use a large enough pin with the size of pinion used.

ECCENTRIC LOAD ON CARRIER BUSHINGS.

When in the gear illustrated in Fig. 2 the low speed band is tightened, and the drum carrying the pinion pin is held stationary, the driving shaft revolves inside of the drum bushing, and the pressure is applied on the pin at a distance *a* from the centre of the drum bushing. The load on the bushing being overhanging, the wear will be uneven, and the pinion and pin will tend to assume the position shown exaggerated in Fig. 9. The same may be said of the centre mounting carrying the internal gear at the left and the low speed pinion at the right.

THE "ALL SPUR" TYPE.

This type is preferred by some makers on account of its lower cost of manufacture, but is not so strong or durable as the internal gear type. On the low speed the former is not so noisy, but the reverse is usually more noisy than that of the internal gear type. Considering Fig. 10, it will be seen that the set of pinions, usually made in one block, allows a long bearing on a pin supported at both ends, while the casing has a bearing on each side. This gear is also more compact than the internal gear type. The low speed being obtained by holding the drum carrying the pinion pin stationary, the torque reactions and bearing pressures will be as follows, for a gear transmitting 15 horse power at 1,000 r. p. m. and for the sizes marked in Fig. 10, giving a ratio of 3 to 1.

Torque at pitch line of driving gear A:

$$F = \frac{15 \times 33000 \times 12}{2.5 \times 3.14 \times 1000} = 760 \text{ pounds.}$$

Reaction on driving shaft:

$$R = \frac{750 \times 1.562}{2.8125} = 415 \text{ pounds.}$$

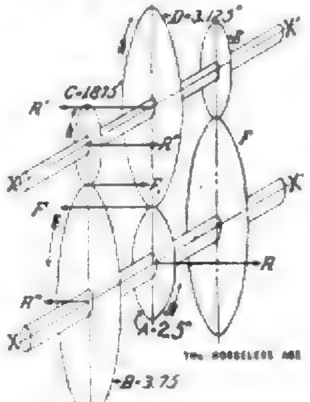


FIG. 11.

Reaction on pin:

$$R' = \frac{750 \times 1.25}{2.8125} = 345 \text{ pounds.}$$

Torque at pitch circle of C:

$$F' = \frac{750 \times 3.125}{1.875} = 1250 \text{ pounds.}$$

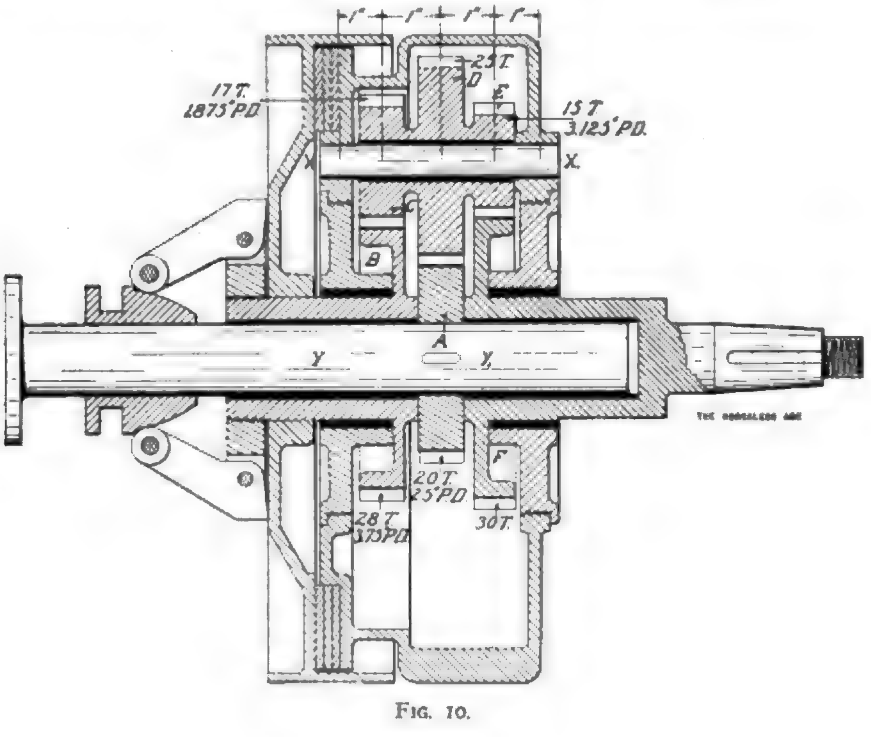


FIG. 10.

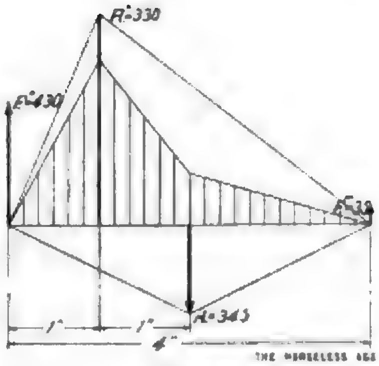


FIG. 12.

Reaction on pin:

$$R'' = \frac{1250 \times 1.875}{2.8125} = 830 \text{ pounds.}$$

Reaction on driving shaft:

$$R''' = \frac{1250 \times .937}{2.8125} = 420 \text{ pounds.}$$

We will then have at X:

$$F'' = \frac{830 \times 3 - 345 \times 2}{4} = 450 \text{ pounds}$$

and at X':

$$F''' = \frac{345 \times 2 - 830 \times 1}{4} = 35 \text{ pounds.}$$

The distribution of the load on the pinion pin will be represented by the shaded polygon, Fig. 12. The wear on the pin will obviously be uneven. If the same calculations were made for the drum bushings, and again for the reverse speed, we would reach similar results. In all cases we would find that the pinions are thrown out of line with the gears, with lower power transmitting efficiency and noisy operation as a direct result.

BRAKE REACTIONS.

Friction brakes are generally resorted to for holding the pinion mountings or drums stationary, in order to obtain the low speed and the reverse. It is a common complaint against the planetary gear that the brake bands do not completely release the drums, causing heating and loss of power. It would seem an easy matter to avoid this trouble by proper design. In the case of planetary gears running in a case filled with a lubricant, the clearance should be such as to avoid a film of lubricant between the bands and the drums. More serious troubles, however, are directly traceable to faulty anchorage and brake reactions. Brake bands are generally anchored at one point close to the drum, thus creating a reaction that will add to the load on the drum bushings and tend to throw the gears out of line. Therefore, the pinions during one revolution will alternately travel away from and toward the gears, creating that well known rumbling noise with varying pitch. In the case of the internal gear planetary transmission above considered, the diameter of the brake drums will be approximately 10 inches, and the anchorage will be at about 6 inches from the centre. For the reverse gear, the pressure on the internal teeth being 630 pounds at 4.5 inches from the centre, the frictional resistance at the circumference of the brake drum will be

$$\frac{630 \times 4.5}{6} = 470 \text{ pounds,}$$

and the reaction on the shaft will be $\frac{470}{3} =$ 156 pounds, which is borne by the drum bushing. In the case of the low gear for the same size drum, the pressure on the pin being 840 pounds at 3.375 inches from the centre, the necessary frictional resistance at the brake drum circumference will be

$$\frac{840 \times 1.25}{5.63} = 156 \text{ pounds,}$$

which is, in this case, eccentrically applied on the bearing. That the brake reactions, or, rather, the internal gear reactions, should be alike in both cases is obvious from the fact that the ratios are alike. These reactions could be avoided by so designing the brakes that there be two points of anchorage diametrically opposite, and such that each one will automatically take one-half of the frictional force of the brake. This is an entirely different proposition from that of using two or more sets of pinions in a planetary gear, the problem being far simpler and easily solved.

There is little to be said about the direct drive on high speed, except that the multiple disc clutch is to be used in preference to other types, especially for high powers.

In closing this article the writer would say that much study is required in order to bring the planetary gear to the state of perfection of other parts of the modern automobile, and that the adoption of ball or roller bearings and the abandonment of multiple pinions will do much toward this end.

Aluminum for the Automobile.

By E. Blough.

The automobile of former years was an experimental machine. Each succeeding year some new development has brought it nearer the standard model of to-day—the car of long life at less cost.

The life of the early automobile was limited generally to one season. But at that time this was no great disadvantage, for the cost of the car, frequently $8,000 or $10,000, made it impossible for the man of limited income to buy such a luxury. Those who did purchase were quite able to replace the machine which lasted only one season, or to indulge in the latest improvement of the new model. Within the past year conditions have changed. Now the manufacturer who wishes to find a market for his output must make a car to sell to the great middle class—the class of moderate means. The man of moderate wealth cannot afford to buy a new car each season, nor can he bear the expense of costly tires and frequent repairs. The car that will appeal to him must be manufactured at as low a cost and of such materials as will produce the most durable car.

The life of a car and the expense of maintenance depend a great deal upon the weight of the car itself. A heavy, cumbersome design means an increase in the dead load. Heavy materials where lighter ones can be substituted mean added expense not only to the manufacturer but also to the purchaser.

Aluminum, the lightest of the commercial metals, is the only metal which enables the manufacturer to produce a car of minimum weight, low cost and long life. In castings for engine beds, crank cases, gear cases, rear axle housing, running boards, etc., it is cheaper and lighter than bronze. Aluminum is less brittle and about two and one-half times lighter than cast iron in a similar position.

Fig. 1 shows a four cylinder engine bed weighing 45 pounds, made from aluminum. As formerly made from cast iron it weighed about 115 pounds.

For body work and panels aluminum is far more durable than wood, which is being rapidly abandoned by the foremost builders of automobiles. It takes and retains paint as well as does wood. In this respect aluminum far excels sheet steel, which retains a coat of paint with difficulty. Aluminum can be put on body forms with less work, thus reducing the shop cost of the body and at the same time giving a more satisfactory finished product. Fig 2 shows a limousine body constructed almost wholly from aluminum.

That the construction of an automobile body from aluminum results in a material saving in weight is well illustrated by the following table:

Table 1.

	Aluminum. Pounds.	Sheet Steel. Pounds.
Body (all metal)	300	600
Hood	25	55
Fenders	30	60
Totals	355	715
		355
Difference		360

That the use of aluminum castings in preference to cast iron results in an equivalent saving is shown in Table 2.

Table 2.

	Aluminum. Pounds.	Sheet Steel. Pounds.
Engine bed (four cylinder)	45	115
Crank case cover	16	40
Gear case	25	65
Totals	86	220
Saved by use of aluminum castings		134
Saved by body		360
Total saved by use of aluminum		494

By the use of aluminum for the fan, rear axle housing, hub nuts, etc., the above figure can easily be increased to at least 500 pounds, or 15 per cent. of a 3,300 pound car.

That this saving in weight is important to everyone concerned, the automobile manufacturer, the tire manufacturer, and the purchaser. M. A. Michelin, the noted French tire expert, in a paper before the French Society of Civil Engineers, said: "If the weight of an automobile is increased 5 per cent. it increases the wear and tear on tires 15 per cent." It is apparent that an increase of 15 per cent. in the weight of the car must not only greatly increase the tire expense but all other repair items, as well as fuel.

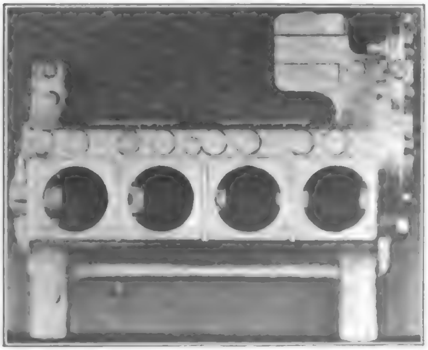


Fig. 1.

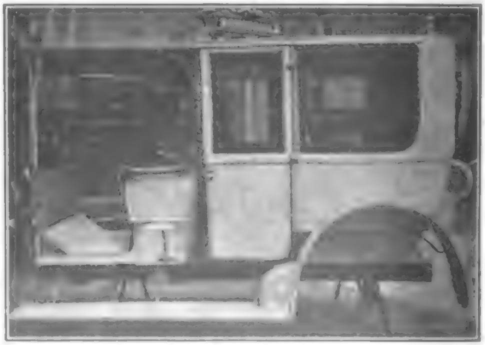


Fig. 2.

Google

Draughting Room Suggestions.

By Charles G. Mahana.

While practically every phase of the automobile business has been discussed in the columns of this paper as the business has developed, there is one important part which has hardly been touched upon, viz., the manner in which the drawings are, or should be, made. If the matter is given consideration it will readily be seen that the subject is well worth studying not only by draughtsmen for the acquirement of greater proficiency in their work, but by employers and shop managers as well, with a view to economy. In fact, the purpose of this article is to show that more proficiency and care in little things, on the part of the draughtsmen, mean a great deal toward economy in the shop.

While we well know that the ability of a draughtsman to originate successful designs, to make the necessary computations for strength of parts, efficiency, etc., and his knowledge of the proper use of the various materials and the proper methods of manufacture determine the size of his salary, rather than his ability to make pretty drawings; and while we know that the less time he can spend in the execution of a drawing and yet fully convey his ideas to the shop, the more his services are appreciated; still there is no excuse for the lack of neatness and the slighting of many little details which we so often see. In fact, the slighting of what sometimes seems to be a minor detail is often the means of the designer's ideas not being fully conveyed to the workmen, with the result that either time is lost in puzzling them out and asking questions or a quantity of work is spoiled.

It will be the especial object of this article, therefore, to call attention to a number of details often overlooked by draughtsmen, which take very little, if any, more time to make them right than to make them wrong, but which convey the desired meaning better, and look much better when made right.

Of course, the article is as applicable to draughting in other lines of work as it is in the automobile line, and, in fact, some of the points mentioned, such as the notes regarding steel shapes, cold rolled and machinery steel, will be found of more value in lines where those materials are more extensively used.

The majority of cases where thoughtlessness is shown are in connection with the dimensioning. If a drawing is neatly dimensioned, its appearance will be improved, but it does not take many poorly executed dimension lines and figures to spoil the appearance of the most carefully constructed drawing. Nor is appearance the prime reason for careful dimensioning. The dimensions and notes are the most important part of the drawing, and the prevention of misunderstandings and questions should be uppermost in mind when the drawing has been completed to the point of dimensioning.

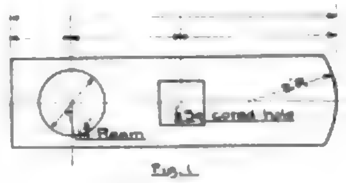


Fig. 1

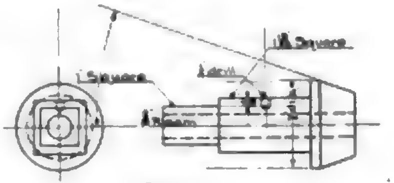


Fig. 2

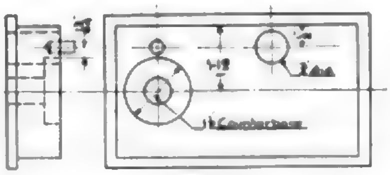


Fig. 3

Perhaps one of the most common errors in this regard is a letter or figure placed on a construction or dimension line, as shown in Figs. 1 and 2. Not only does it detract very greatly from the neat appearance of the drawing, but it often makes the letter or figure difficult or impossible to read. It is one of the things to which the writer has paid particular attention in dimensioning and criticizing drawings, and the necessity of placing a letter or figure on any kind of a line has never yet been found. A dimension line may be broken to avoid passing through a letter or figure, but a construction line of the drawing should be avoided entirely, it not even being allowable to let a line divide letters or figures which belong together, as shown in Fig. 2.

Care should be exercised when putting in dimension and limit lines not to extend them too far, as is done in Figs. 1, 2 and 3. A number of cases have come to the writer's attention where serious errors have been made from that cause, and it is very evident that it does not improve the appearance of a drawing.

In Fig. 2 the depth of the one-quarter inch drilled hole is five-sixteenths inch, but the limit line extends too far to the left, and a workman might take the five-sixteenths inch dimension to mean the distance from the top line of the small end of the piece to the top line of the next size to the right.

In Fig. 3 the pin is located $^{13}/_{64}$ inch from the edge of the 1½ inch counterbore, or $^{21}/_{64}$ inch from the edge of the piece. A careless workman, however, might assume the pin and the three-quarter inch hole to be on the same line, one-half inch from the edge of the piece.

These figures, of course, are very simple drawings, with only a few lines and dimensions given, and on such drawings the probability of the mistakes mentioned actually occurring would be remote. They illustrate, however, how similar mistakes may be, and frequently are, made when the drawings are all complicated, even though the workman might not be termed careless. It is true that the greater part of the blame could be laid to the shop, but not all of it, nor would that fact pay the bill for the time and material wasted.

Use considerable care in dimensioning to give all the dimensions required, arranged in the most convenient manner for the workmen, and not having a number of dimension lines passing through others. Figs. 4 and 5 show a shaft two feet long, turned two inches at each end, the remainder being left rough, and the diameter at the centre reduced by forging. Fig. 4 is properly di-

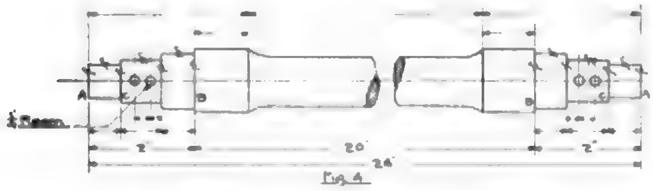


Fig. 4

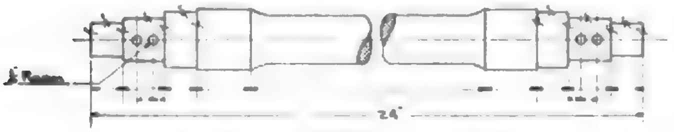


Fig. 5

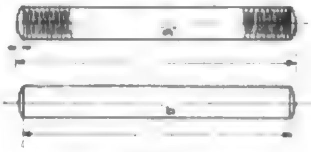


Fig. 6

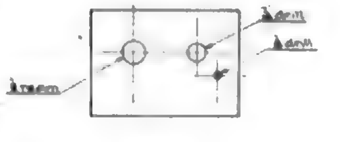


Fig. 7

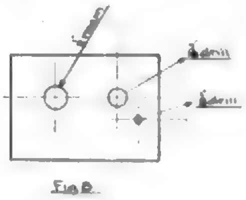


Fig. 8

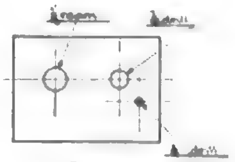


Fig. 9

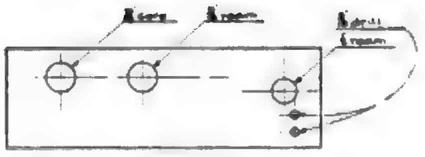


Fig. 10.

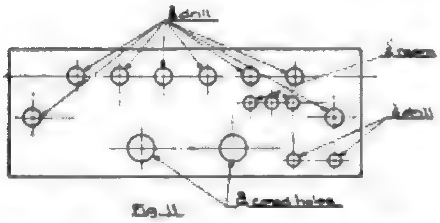


Fig. 11.

mensioned and Fig. 5 is not, but Fig. 5 shows what we more often find on drawings than does Fig. 4. In Fig. 4 the dimensions above the piece give in a convenient form the measurements required in the forge shop, and the dimensions below the line give the measurements required in the machine shop. Dimensions for diameters are not given in these sketches, as the dimensions for length are sufficient to illustrate the point.

The first dimension the machinist will want is the overall length, and next the length of the turned part at each end, and the distance between, as his first cut will be from A to B, not from A to C. If the drawing is dimensioned as shown in Fig. 5 both the forge hand and the machinist will have to add or subtract figures to get the ones they require.

In giving the length of a bolt, rod end, shaft, or similar piece, always give the overall length, including the rounded ends if there are any, as at *a* Fig. 6, instead of as at *b*, same figure.

Sometimes it is necessary to draw dimension lines through others, but to avoid possible confusion when it is done, at least one of the lines should be broken at the point of intersection. A comparison of Figs. 4 and 5 and also 7 and 8 will show what is meant. Figs. 4 and 7 show the lines properly broken. Figs. 5 and 8 do not.

When instructions are to be given regarding some particular part of a piece by a note, as in Figs. 7 and 8, always put the note on a horizontal line if at all convenient, and otherwise on a vertical line. Never put a note on a diagonal line as in Fig. 8, unless the diagonal line is a dimension for the radius or diameter of a circle, as in Fig. 13. As far as possible have all lines indicating to what points the various notes apply at the same angle, as shown in Fig. 7, and always have the arrows point toward the indicated points, not toward the notes, as in Fig. 8. Never use the forms shown in Fig. 9 when possible to use the form shown in Fig. 7. There are times, of course, when it is inconvenient to use that form, as, for instance, when there are other notes, dimensions, or construction lines in the way, but on such occasions a light broken curved line drawn with an irregular curve, as shown by Fig. 10, serves the purpose nicely. Always underline any note or title, not allowing the line to touch the bottoms of the letters or figures, however, as some of them are then hard to read.

When there are several holes in a piece, and not all the same size or kind, do not indicate them as shown in Fig. 11, as it badly disfigures a drawing. It is better to follow the course shown in Fig. 12.

Nearly all of the latter points mentioned apply largely to the appearance of the drawing, but they are good rules to follow, and tend to make good looking drawings.

When we have a piece similar to the one shown in Fig. 13, it is better to dimension the holes as there shown, rather than to give the distance between each pair of holes, which in the present instance would be an odd figure. The holes will be laid off with a pair of dividers anyway, and the distance between holes is not required. It is also better to use the form "Seven 9/16 inch reamed holes," instead of "7-9/16 inch reamed holes," as the former avoids the possibility of the 7 and the 9/16 inch being read as one figure. Don't use the terms "9/16 inch ream 7 for 3/8 rivets," "Ream 7-9/16 inch dia." or "Ream seven 9/16 inch dia." In fact, make your notes read as explicitly and as grammatically as possible.

Always put the figure for a dimension between limit lines, when possible without crowding, as at *a*, Fig. 14. When necessary to use either of the forms *b* or *c*, make the arrows of a proper length to look well, and to be easily understood. At *d* they are too long, and at *e* they are too short.

In dimensioning drawings of bevel gears or similar pieces, be careful to give the dimensions of angles required in turning the blank in such a way that the machinist will not have to add or subtract to be able to get a measurement he can use. If necessary put in the angle and its complement or supplement also. While it is customary to give the angle for the bevel of the blank as at *a* or *b*, Fig. 15, neither angle can be easily measured while the blank is on the arbor in the lathe, and therefore the angle should be dimensioned as shown at *c*. Don't forget to give the dimension for the outside, or largest diameter of the gear, and the distance from the largest diameter to some point on the hub or web, as at *c*, Fig. 15. If one end of the hub is finished and the other is not, give the dimension to the finished end. In fact, always give dimensions to finished surfaces when possible. Also always give the distance from the largest diameter to the pitch line, as shown at *c*, Fig. 15.

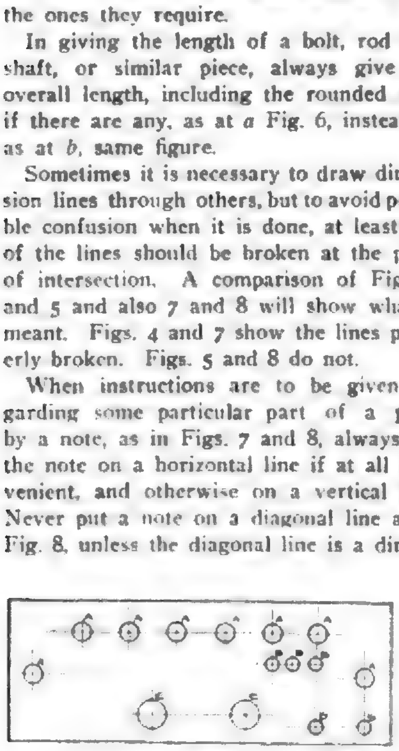


Fig. 12.

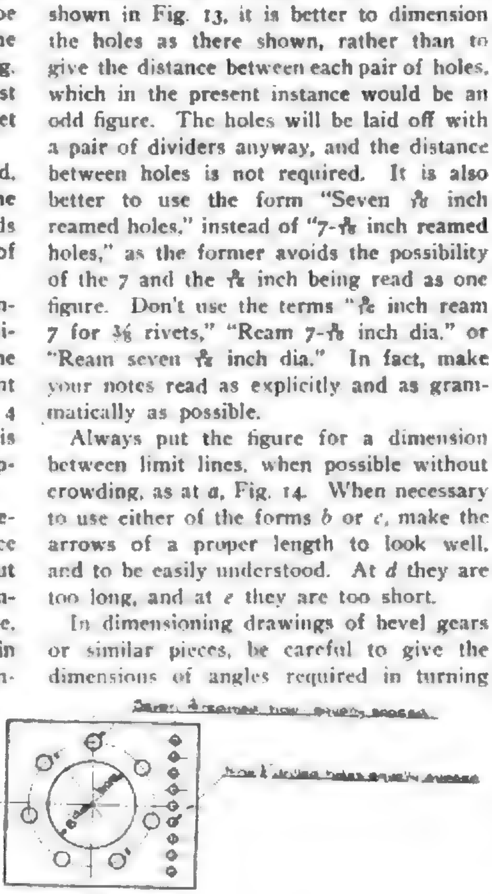


Fig. 13.

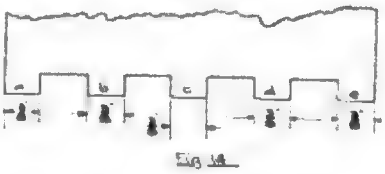


Fig. 14.

Always put the centre line in the centre of the part it is intended it should pass through. Nothing looks more careless than to see centre and dimension lines drawn as in Fig. 16.

In detailing angles, channels, etc., it is a good plan to show the holes laid off on the back side as in Fig. 17. That is the way the workman in the shop will have to lay them off on the piece itself, and it will be much easier for him if the drawing is so drawn, as otherwise all the holes are in a relatively different location. Unless there is some good reason for doing so, give dimensions from centres of holes to the back of the angle, and none to the edge of the leg. This is because it is usually more important that the holes be accurately spaced from the back of the angle and as the actual width of the legs often varies from the nominal dimension.

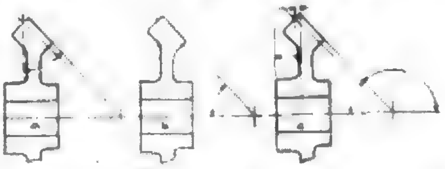


Fig. 15.

The same principle applies to any other piece of work. When it is important that a point be located correctly with respect to only one other point it is better to give a dimension between those two points only.

On details of such pieces as steel shapes, bars, etc., it is well to mark which end is top, front, or right hand in the car, as it aids in assembling the parts and is often a convenience for reference in the drawing room.

When it is necessary to put a dimension across a piece which is drawn in section as at *a*, Fig. 18, do not pass the hatch lines through the figure, but do not stop them off to avoid the dimension line as shown at *b*.

Indicate finish by a small *f*, letting the construction line of the drawing and the two lines of the *f* intersect at one point. If this is always practiced, there is never any

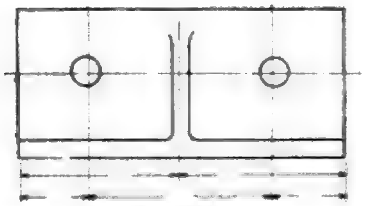


Fig 16

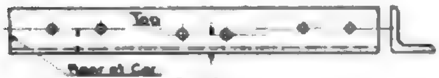


Fig 17

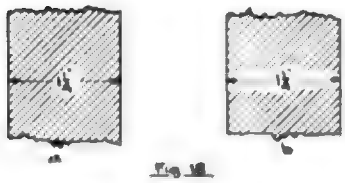


Fig 18

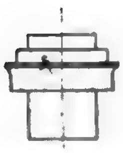


Fig 19

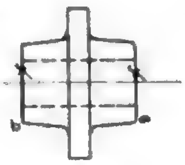


Fig 20

question as to what line the finish mark belongs to, even though the lines are close together. In Fig. 19 it is plain that the finish mark belongs to the third line from the top. If finish is other than ordinary machine finish, make a note stating kind of finish.

Unless there is some particular reason for it, do not show round corners when a face is finished, as at *a*, Fig. 20. The tool will leave the corners sharp as at *b*, so the drawing should be shown that way. A good machinist will know enough to take off the "razor edge," but if the drawing is shown with large round corners, he will probably take the time to finish them so. Always, in fact, endeavor to draw things as nearly correct as possible. Don't show round corners when you know they wont be there, nor square corners when you want them rounded or chamfered.

Don't draw pipe threads with the sides of the hole parallel.

Don't show a piece threaded up to a shoulder as at *a*, Fig. 21, as it cannot be so threaded. If there is to be a piece screwed up against the shoulder it will be necessary to cut a groove equal in depth to the depth of the thread, or very slightly deeper for the thread tool to run out into, as at *b*, Fig. 21, but if there is to be a washer or other spacer of any kind to go against the shoulder as at *c*, same figure, stop off the threads a little way back from the shoulder.

When a drawing made as shown at *a* is sent to the shop the machinist is left in doubt whether to make the piece as at *b* or as shown at *c*. He cannot make it like *a*, so he either takes the time to go back at the drawing room and inquire, or, to make sure of enough thread he makes it like *b*, which in the majority of cases means unnecessary labor and unnecessary weakening of the part.

Don't show drilled or drilled and tapped holes as at *a*, *b* or *d*, Fig. 22, but show them as at *c*. It takes but a moment to show the conical shaped end of the hole as left by the drill, and never raises a doubt in the shop whether a square bottom is required. It takes less time to show that conical shaped end at the correct angle than it does to show it incorrectly, as at *b* or *c*, because, consisting of 30 degree angles, it is conveniently drawn with the 30 degree triangle. The hole cannot be tapped as shown at *c*, making a perfect thread at the bottom, although a good many draughtsmen seem to think so, and in that case it takes at least a couple more dotted lines to show it wrong than to show it right. At *d* the short lines representing the small diameter of the threads are needlessly dotted in. They should always be shown when drawing in full lines, but the work looks better, takes less time, and is as easily understood if they are omitted when it is necessary to dot them. In fact, many drawings would be much clearer if half, or more, of the dotted lines were omitted.

Don't show threads as at *a*, *b* or *c*, Fig. 23, but show them as at *d*. It is evident on examination what the criticisms are.

Don't show left hand threads pitched the same way as right hand threads, and when a tapped hole is sectioned show the threads properly pitched.

Don't use shade lines, except where essential in making the drawing clearer. There are places where a little shading is the only correct way of showing what is intended, and so little of it is then required that it pays to use it. For instance, a draughtsman will often put in a single full line to represent a curved surface as in Fig. 24, and at *a* in Fig. 25, when properly there should be no such line there. A half dozen shade lines, drawn free hand, if short, as at *b*, Fig. 25, convey the meaning much better.

Very often we see drawings of bent bars or straps of steel or bent sheets, made as shown at *a* and *b*, Fig. 26. The sheet metal worker usually knows that it is not intended to have the sheets bent that way, but the forge hand does not know what the requirements are regarding the bars and straps, as it sometimes necessary for him to make forgings with such bends. Of course to get them it is necessary for him to upset the metal and hammer it down to shape, and this is much more expensive than to make them as at *c*, same figure. When, therefore, it is necessary to make sharp bends at all, unless such a bend as shown at *a* or *b* are really necessary, the drawing should be made as at *c*.

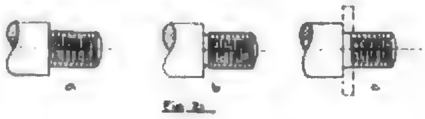


Fig 21

Another thing which often results in a loss of time and material, and which is no saving of time whatever in the draughting room, is illustrated at *a*, Fig. 27. On account of lack of room, or to save time in making the drawing, only half a gear, plate or similar piece is sometimes drawn.

Instead of using a jagged line representing a break, as at *b*, Fig. 27, many draughtsmen make their drawings as shown at *a* and occasionally half a pattern and half a casting are the result.

As on detail drawings the material is always specified, there is no reason for using conventional cross-sectioning for details. The conventional cross-section for

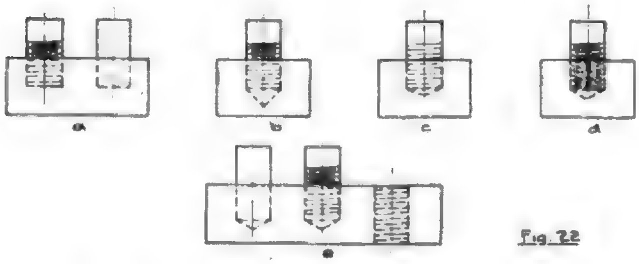


Fig 22

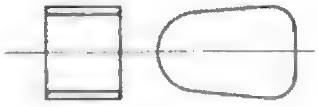


Fig 24

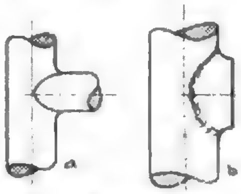


Fig 25

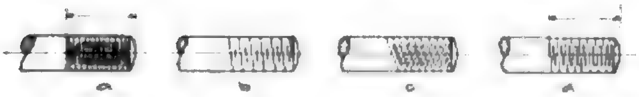


Fig 23

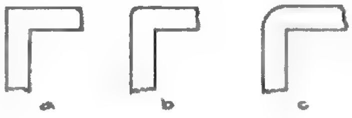


Fig 26

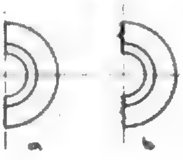


Fig 27

cast iron is the most rapidly made of any, and may as well be used for all such metals as the various kinds of steel and iron. Bronze, copper and similar metals may be sectioned the same as brass. On assembly drawings, however, it is generally better to use conventional cross-sections throughout.

Tracers should make it a rule never to put a line in on a tracing until it is thoroughly understood what it represents, and until satisfied that it is correctly drawn.

In making tracings, such parts of the drawing as are not to scale should be traced to scale.

On every detail drawing there should be a note specifying the number of the parts required for one finished article, the symbol or part number, if any, the material, and any notations regarding special finish or treatment, such as hardening, etc. The note should as far as possible be placed in the same relative location on the drawing, so that it may be found at a glance. In specifying the number of pieces required, "3 per car" or "4 per engine," etc., is better than "3 wanted," "3 required," "make 3," etc., as it is more definite. Often a piece has to be made right hand and left hand. Then the note should read "2 right hand and 2 left hand per car. Right hand shown" (or "Left hand shown" as the case may be).

Don't specify "Machinery Steel" when you mean "Cold Rolled Steel," nor "Cold Rolled Steel" when the piece is to be finished all over. In specifying gauge number of wire or sheet metal, always state what gauge.

Abbreviations are a bad thing on a drawing, and should be avoided as far as possible. Much more time is lost (to say nothing of resulting errors) through the use of abbreviations on drawings than the trivial amount saved would ever total. When abbreviations are used, however, at least take time to put on the period. Also don't forget decimal points and inch marks.

In fact, in making drawings and tracings, don't try to see how little information you can give, how much you can abbreviate either words or sentences, or how inconvenient you can arrange dimensions and notes for yourself and others to find. A drawing is usually made but once, while it is referred to in the office and the shop time after time. It should, therefore, be as clear and concise as possible, containing all the information required, yet not having on it a lot of superfluous matter which will needlessly take the time and attention of whoever uses it. It should be free from poorly executed lettering and dimensioning, abbreviations, etc., which will continually take someone's time to decipher or explain. It should be neatly but not extravagantly made, but first and last of all it should be correct.

The latest accessory to come into demand is said to be a bouquet holder for closed cars.

A Year's Experience With Demountable Rims.

By H. H. Brown.

Demountable rims first came into considerable use abroad in the summer of 1906. At that time the idea appealed to me, and I determined to have rims of this type fitted to my car the following year if possible. At that time the so called quick detachable tire and rim was being introduced into this country, but there was only one make of demountable rim on the market, and that was a rim of American design and make.

OBJECTIONS URGED.

When I came to talk over the subject of demountable rims with both the tire makers and the makers of machines, I was met with a host of objections, most of which I have now forgotten, as they were very trivial. The ones which seemed to be reasonable were the following: Deterioration of the spares which were kept inflated. Difficulty of tire manipulation on the detached rim. Liability of the rim to rust onto the wheel, rendering renewal difficult. The additional weight of the rims attached to the wheels, and also of the spares. One tire maker actually went so far as to say that this would be about 200 pounds.

WEIGHT.

The facts as regards the weight of demountable rims are as follows: The demountable rim proper weighs substantially the same as the ordinary clincher rim, which is permanently attached to the wheel, the additional weight involved being simply that of the inner rim attached to the wheel and that of the clamps and bolts. This amounts to about 9 to 12 pounds per wheel, according to size, making a total of, let us say, 45 pounds for the four wheels. The spare demountable rims weigh on an average 15 pounds, and as two of these are generally carried, the total added weight is increased by 30 pounds, making a total of 70 pounds for the complete additional equipment. The weight of the spare shoes and tubes has not been included, as these are now carried in almost every case. It hardly seems as if a matter of 75 pounds is of much moment on a car weighing from 2,000 to 3,000 pounds, especially as more than half of this goes toward strengthening the wheels and puts no additional weight on frame or axles. The other objections seemed about as trivial to me, and only strengthened my determination; accordingly my car was delivered to me the latter part of June equipped with this type of rim.

MUST BE KEPT INFLATED.

My first puncture did not occur till about the first of August, about a month and a half later, and after 2,000 miles of riding. I experienced no difficulty in the removal of the old rim and the replacement of the new, but when I came to let the jack down I found that the spare was only about half inflated. As the day was warm, the road smooth and a garage with a power air pump only a couple of miles distant, I ran carefully to this garage and fully inflated the tire. This experience taught me my first practical lesson in the use of the demountable rim, which may be stated as follows: In order to be sure of having the spares ready for immediate use they should be examined about once a week to see that they are properly inflated. In case a power air pump and tank are at hand, in which latter a known constant pressure is maintained, it would only be necessary to connect the spares to this from time to time. However, as there may be slow leaks, valve troubles, etc., and as one may not have a power pump available at all times, it is best to have a tire pressure gauge with which the pressure in the spares may be measured from time to time. This gives one a line on the tightness of the valve, etc.

TROUBLE WITH LUGS.

When I came to replace the punctured tube with a sound one I experienced no especial difficulty. However, I found that I was fortunate in having provided myself with a large supply of spare lugs. The lugs provided at that time by the makers of the rim were of the foreign cloth covered variety. The stem was somewhat larger in diameter than those generally employed, and had a hole drilled and tapped in its centre, to attach the manipulating stems or keys. The stems had been left long enough originally so as to fit different thicknesses of tires, and were supposed to be cut off after the inflation of the tires and the tightening of the lug nuts. This had been done, but when I came to again fit the manipulation stems I found that the hole had not been tapped deep enough, so I was forced to use my spare lugs. This defect has since been remedied by the makers. I found, however, that it was possible to use any standard lug by having nuts made to fit the stem and seeing that the stems were threaded clean up to the shoulder. Of course socket manipulating stems should be made for use with these lugs. In making the nuts, care should be taken to see that they are of the same outward dimensions as those supplied by the rim makers, and they should be made of composition to prevent rusting to the lug stem. The lugs supplied by the rim makers had iron nuts and stems, which were nickel plated, and which fitted together somewhat loosely. These precautions seemed to prevent rusting, as I never experienced any trouble from this cause with their lugs, although I had considerable trouble this way with standard lugs which I had provided with iron nuts.

My second puncture did not occur till the following December. This time it was in a front tire which went down over night. This was the only time that I was obliged to change a rim in the garage.

TIME OF MAKING CHANGE.

On February 22, in following up an endurance run of which I was an official, a puncture occurred about seven miles from the finish. While I did not take the time of the change, I believe that it was under 15 minutes from the time of stopping to the time of starting. It is probable that if my car had been equipped with ordinary clincher or q. d. tires I would have taken a chance riding in on the rim, and probably would have ruined a shoe. I therefore consider that I saved in this one case almost half the cost of the equipment.

I have never experienced any trouble in replacing or removing rims owing to "rusting on," in fact, about the quickest time that I have any record of was a change of a front tire in about eight minutes from the time of starting to get out the tools till all were stowed away again. This was with the help of two friends. This was a front tire which had never been removed from the wheel since the car was delivered to me, and which had run about 6,500 miles. The only difficulty which I have experienced in the removal or replacement of rims has been due to the use of too large nuts on the lug stems. This was my own fault. However, the change is not made quite as easily as on the show demonstration stand, and I generally take a hammer out of my kit, although I have many times found it entirely unnecessary, a few light blows being sufficient in any event.

As regards the time required to make a change, I always count it from the time of starting to take the tools from the tool box until everything is again stowed away in proper order to proceed. In one case, when I was entirely alone, I discovered a puncture on a long hill. It did not seem best to wait till the top was reached, so I looked for a rock, jacked up the wheels and made the change. The day was extremely hot and although I took things easy, the total time, including the jacking up of the wheels, was only 20 minutes. Another time when I was accompanied by a friend, I was able to make the entire change in between eight and a half and nine minutes.

TWO HANDY TOOLS.

Placing of a tire on the detached rim is easier than placing one on a wheel, if it is gone about in the right way. I have found two simple tools of great assistance in this. The first is some form of plug to place through the valve hole in the rim and the valve notch in the shoe. A tapered wooden plug will serve for this purpose, or even a discarded valve stem. The other is known as a "lug hook." It consists of a piece of three-eighths inch round iron, bent at its centre to an angle of about 30 degrees, the ends of these arms being turned up at an acute angle in a plane perpendicular to that of the main angle. The arms are about 6 inches long and the turned up ends about 1 inch long. This is used in conjunction with some form of lever about five-eighths inch in diameter and eighteen inches long. This tool forms part of two standard tire kits, but may be easily made by any blacksmith.

METHOD OF REPLACING.

The rim is first laid on the ground, the shoe laid over it, the lower part of the bead at the valve hole being put in its place on the rim and the "plug" inserted in the valve notch and hole. The remainder of the lower bead may now be put into position.

Now stand the rim upright, the detached edge of the tire away from the body, and the lug hole next the valve hole uppermost. Catch the edge of the tire on either side of the lug hole with the lug hook, pass the round lever through the angle of the hook, and, with the near edge of the rim as a fulcrum, bend back the tire. By slightly canting the rim away from the body it will be found that the end of the lever can be caught in the crook of the knee, and then both hands can be used to place the lug in position. The use of this device not only enables one to pull back the cover from over the lug hole, but actually pulls the bead of the tire into position in the clinch of the rim. It is best to work round progressively in placing the lugs, as in case of the use of a "protector strip" this will then not be moved out of position. When all the lugs are in position the valve stem of the tube may be put into position by means of the lug hook, the "plug" being first removed. The rim is now laid on the ground and the remainder of the tube placed in position in the shoe. It is now as well to slightly inflate the tube, seeing to it that it is not twisted and that the lugs do not nip it. The other edge of the tire may now be placed in position and the lugs tested by the stems to see that they are all right. After this is done the tire may be fully inflated. During the inflation the lug stems may be removed and the nuts screwed in place. If the lugs are new ones the ends of the stems should be filed or sawed off flush with the nuts. This may, however, be done before they are placed on the rim, if an old lug is available as a guide.

By following this method I have been able, single handed, to repeatedly place a new tire complete on a rim in between 14 and 17 minutes, this including inflation by power pump. In case of a simple puncture the rim is placed on the ground, the nuts are removed from the lugs, and the edge of the tire is removed from the rim. The stems are then attached to the lugs without the aid of the lug hook, while the rim is on the ground. The lug hook is only used to remove and replace the valve stem of the old and new tubes.

MILEAGE OF TIRES.

My car is a well known make, actually weighing about 3,300 pounds. It is equipped with 34x4 front and 34x4½ rear tires. Have thus far used up three front tires and four rears. The mileages of these have been as follows: Fronts, 6,600, 1,938 and 7,810; rears, 4,027, 5,030, 5,555 and 4,145. There is still in use a front tire which has seen about 5,800 miles of service and a rear which has been in use for about 5,000 miles. I have every reason to believe that those tires whose mileages ran much below the average were ruined by bad cuts and punctures. However, the average mileage compares favorably with that of either q. d. or ordinary clincher tires.

I have only once had to replace a tube while on the road, and that was a tube with a bad leak which had been placed in a spare. My experience has taught me that where trouble occurs twice during a trip of moderate length, it is generally found on the same wheel, and if investigated will be found to be some form of tube pinching.

TIRE CASES DISCARDED.

At first I used tire covers on the spares, but as they did not serve any useful purpose, as in the case of a spare shoe, I discarded them, but have taken the precaution to place the valve stems uppermost. A 34x4 inch tire and rim requires a 36x4½ inch cover. It would appear that the use of the same size tire all around, while desirable even on the ordinary type of rim, is even more so in the case of demountable rims. For carrying the rims some form of carrier requiring less straps and buckles than the ordinary form of tire bracket would be a great convenience, and would probably greatly shorten the total time of making the change.

As a matter of fact none of the arguments used against the demountable rim have proven valid, with the possible exception of that to the effect that a second puncture takes more time. This total extra time would not amount to more than five minutes over that required to replace a tube in the ordinary clincher rim, as the only additional work would be the unscrewing and replacement of the clamps and the changing of the rims. The wheel would have to be jacked up and the inner tubes removed and replaced in both cases. On the other hand, apart from the time saved by shortening roadside delays, it is probable that the money saved by preventing pinching of inner tubes and ruining of shoes by being run deflated has gone far toward defraying the cost of the outfit.

New Taxicab Signal.

A taxicab operating company in Liverpool, England, has a very simple contrivance in use for the indication at night time of a cab's freedom for hire or the reverse. When the cab is "For Hire," a blue light is shown immediately above the flag of the motor, up the stem of which the wiring is run; when the vehicle is engaged no light is visible. It is claimed that this innovation has helped in no small degree to make the cabs popular, and to obtain the maximum number of fares for them, apart from the excellence of the vehicles as a whole.

Optical Indicators.*

By L. E. French, S. B., Mech. E.

Several years ago I became interested in high speed indicators for use on automobile engines. This subject I chose for thesis work while at college, and during the limited time at my disposal succeeded in obtaining results which were interesting enough to lead me to return and complete the work later. In description of the instrument a few passages of the original thesis are quoted.

"The introduction of the gasoline engine for automobile use has demanded less weight for a given power, which has led to higher piston speeds. In short stroke motors this means a large number of revolutions per minute, and the ordinary indicator, with its inertia and friction effects, has been entirely unable to cope with the new conditions. Until recently the internal action of engines at high speeds has been more or less a matter of theory.

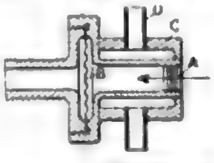


Fig. 1.

"Some time ago Mr. Davis and the writer designed an indicator to overcome some of these difficulties. This instrument was intended to operate by a step process, taking a large number of engine strokes to produce one indicator card. Soon the foreign 'manograph' began to attract attention and we at once realized the advantages of using a beam of light, reflected from a small concave mirror, since the motion of the latter can be made as small as necessary to eliminate the inertia."

* * * * * *

The foreign "manograph" has been designed, in my opinion, rather with a view to convenient commercial application than to accuracy. A flexible shaft has been used to connect the rotating parts of the instrument with those of the engine, and although a thumb screw has been provided for relative adjustment, it would seem almost inevitable under these conditions that there should be a difference of phase between the reciprocating parts of the instrument and those of the engine. (In this connection see Card A.) To be accurate, the position of the miniature piston in the indicator should exactly correspond with the engine piston at every part of the stroke. This can be accomplished only by using a positive drive between the instrument and the engine and by making the proportions between the connecting rods and strokes in both cases identical.

No attempt has been made, as far as can be learned from a study of the literature which has appeared on the subject up to the time of writing, to provide variable proportions in the instrument between the lengths of connecting rod and stroke, which would be necessary to the proper application of the "manograph" to motors of different kinds.

To produce a correct record of the pressures in the cylinder, two conditions are necessary.

First.—The size and motion of the diaphragm should be so proportioned to the size of pipes communicating the pressure from the cylinder that there will be the least friction and inertia effects in the pipes. At the same time the size of these passages must not be such that the compression space will be greatly increased. Small copper tubing of considerable length is used in the foreign instrument, which, although more convenient to connect to the engine, must certainly affect the accuracy of the results.

Second.—The deflection of the diaphragm should be exactly proportional to the pressure. The proper fulfillment of this condition seems to the writer to be the only one which presents any serious difficulties to the development of a very accurate instrument. Given the proper diaphragm and the rest is merely a question of design and accurate workmanship.

To gain some knowledge of the deflection of flat, circular, steel plates under pressure a test diaphragm was constructed, the portion of the plate exposed to the pressure being 2 inches in diameter. To measure the deflections, a spherometer was mounted so that its movable point could be brought into contact with the centre of the plate. At the instant of contact an electric connection was formed, through a voltmeter, which made the setting very delicate. The deflection could be measured to within three-thousandths of a millimeter. The pressures were supplied by a Crosby gauge tester.

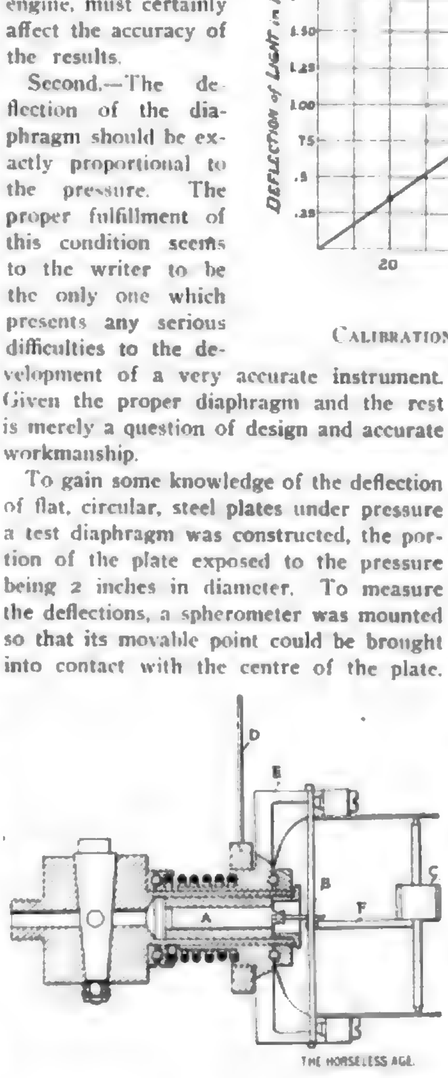
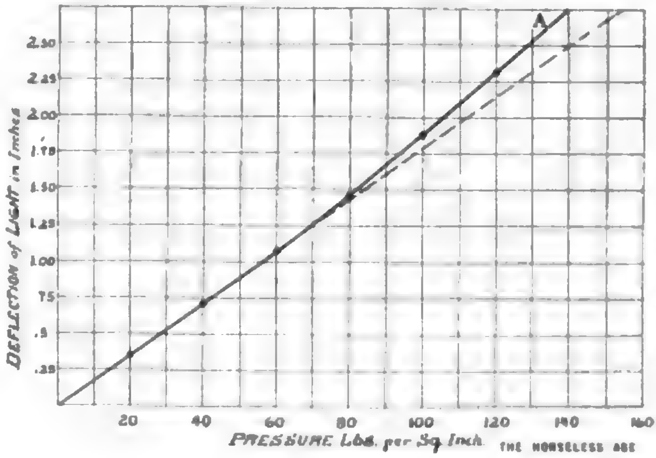


Fig. 2.

The diaphragm, as at first designed, was 2 inches in diameter to permit of some motion at the centre of the plate without bending it too much. It was intended to fill with oil the pipe connecting the diaphragm and the cylinder, to avoid heating the plate and also to avoid increasing the compression space. The motion of this oil in a one-eighth inch tube and a 2 inch diaphragm, would be about 2½ inches, which, at extreme engine speed, would, require about 700 pounds per square inch to overcome the inertia.

The diaphragm, as constructed for the instrument, was 1 inch in diameter with a deflection at the centre of less than $^3/_{100}$ inch, giving a 3 inch deflection of the light on the glass. The pipe leading to the diaphragm was of one-quarter inch internal diameter and about 4 inches long.



Calibration Curve of Indicator Diaphragm.

In connection with the experiments on the deflection of steel plates, the results were compared by plotting the deflections against the pressures, the departure from a straight line indicating the extent of the inaccuracy of the diaphragm. With a flat, mild steel plate the line was straight for a certain distance, after which an increasing negative departure occurred. A flat, tempered steel plate gave a uniform curve. We finally adopted a tempered, corrugated steel plate, originally constructed for use on a diaphragm pressure gauge. This plate was calibrated hot by applying measured steam pressures from an indicator tester. The actual deflection of the spot of light in the indicator was measured, in order to include all errors. Referring to Curve 1, it will be noted that this plate gives a positive departure (between 0 and 150 pounds), while a flat plate gives a negative departure. It might thus be possible to combine a corrugated with a flat steel plate in such a way that the two opposite departures would

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* The author spent several months at the Harvard Engineering Laboratory in developing and completing an optical indicator of his own design and construction. He was the first, we believe, to make an exclusively American instrument.

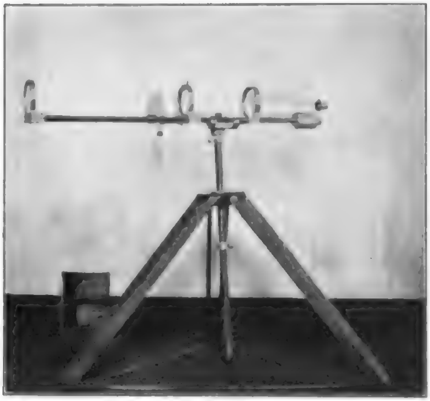


FIG 3.

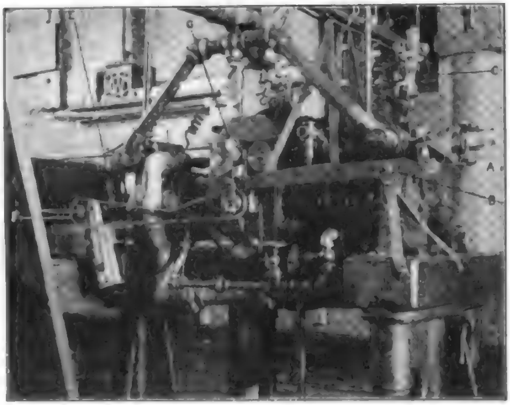
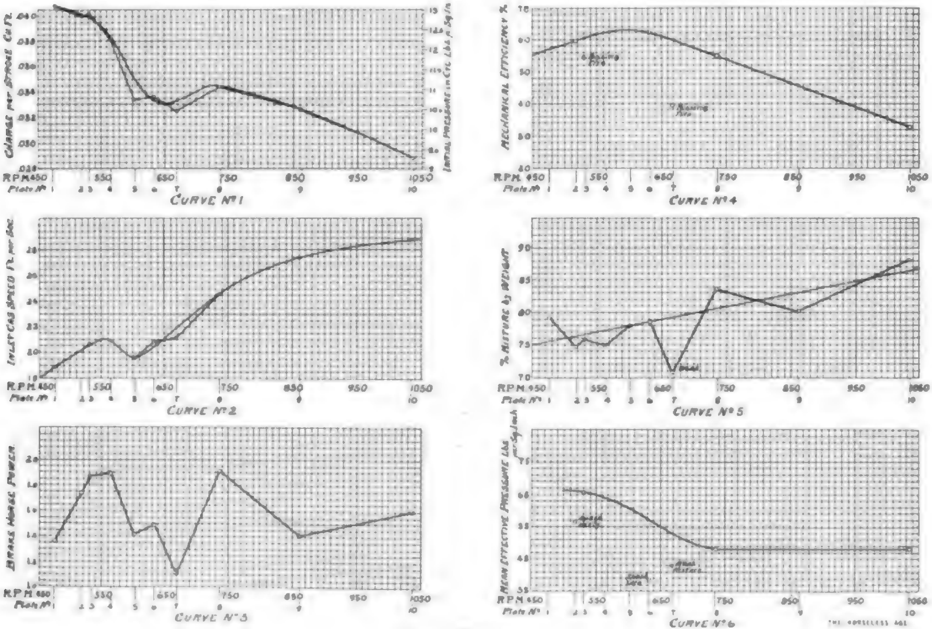


FIG. 4.

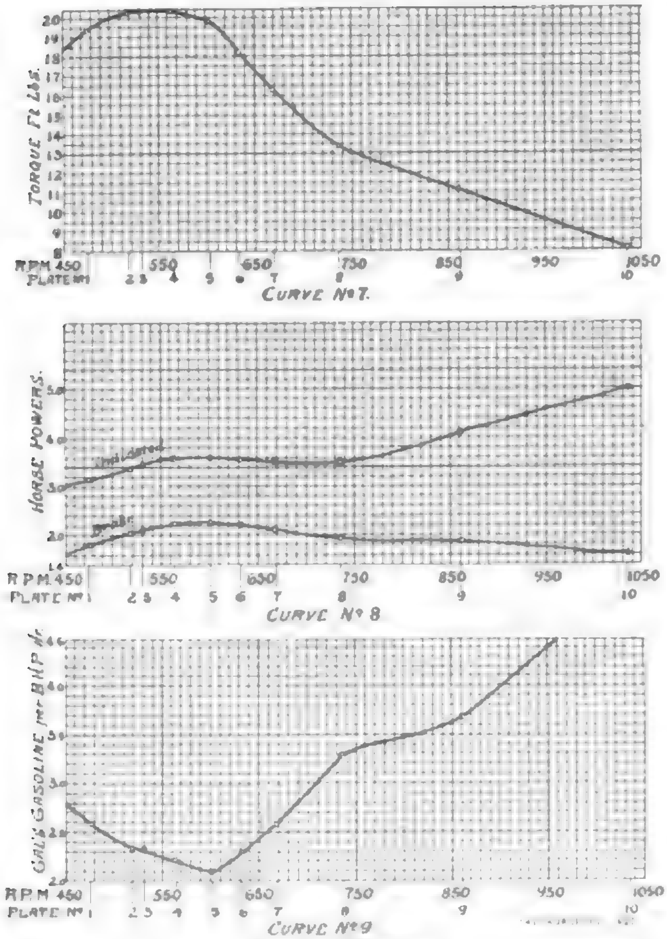
neutralize each other in such a way as to result in a straight line. I calibrated a corrugated steel plate with cold oil pressure up to 250 pounds. At higher pressures the positive departure decreases, and, crossing the straight line, becomes negative. Calibrating the diaphragm, however, even if the latter be imperfect, makes it possible to get fairly accurate results by using the calibration scale to measure mean effective pressures.

A cross section of the diaphragm and holder is shown in Fig. 1. B is the corrugated plate and A the pressure inlet. The first test of the instrument was made on a Thor motorcycle engine with a maximum speed of 4,000 revolutions per minute. The pressure pipe between the diaphragm and cylinder became red hot, and it was necessary to jacket both the pipe and the diaphragm holder. The jacket is shown at C, the water inlet pipe at D. A shut-off cock was provided between the cylinder and diaphragm, and the pressure was only admitted at times of taking cards.

The instrument was designed for the use of two diaphragms simultaneously, either for comparison of the action of two cylinders or for the use of a low pressure plate with a stop, giving a large scale for studying valve action. A small crank and connecting rod, positively driven from the engine shaft, actuated a reducing lever which acted upon the two mirrors. The length of the connecting rod was adjusted by means of a thumb screw, while another adjustment was provided for again centering the shaft after changing the length of the rod; in fact, everything necessary was made adjustable, to enable the operator to shift the diagram to any part of the ground glass screen.



ACTUAL RESULTS..



CORRECTED RESULTS.

The obtaining of a source of light which would give photographic results required considerable experimenting. Acetylene was first used, then a Nernst lamp and finally an arc. The Nernst lamp, while giving a powerful light, was too easily affected by vibration, the filaments breaking very frequently. The arc was hand regulated and it was necessary to centre the spot of light each time on the mirror before taking a card, but although this was inconvenient, the arc was nevertheless the most satisfactory light.

Three different indicators were used, the second being an instrument of English make, a cross section of which is shown in Fig. 2. This is an optical, piston indicator, the motion of the mirror being small enough to reduce the motion of the piston to a point where the inertia and friction effects are limited. The piston is shown at A. It acts on a steel spring B, which is supported at both ends, the motion of the spring being communicated to the motion of the mirror by the small strip F. The motion of the engine piston is duplicated by a movement of the frame E, which holds the mirror, the frame being carried on two ball thrust bearings as shown. The light is produced by a minute incandescent bulb placed back of a pin hole, but as the mirror is flat, the indicator card can only be seen by looking through the open telescope shown in Fig. 3. The adjustment of this telescope requires some pains, and the least touch throws the image off the screen. Photographic results can be obtained only by the use of an elaborate camera, which we did not have.

The third indicator was of the ordinary drum type, but one-quarter size, being especially adapted for high speeds. This instrument, an English affair, was a beautiful example of superb workmanship and flashy finish. At speeds of six or seven hundred, the cord kept breaking, and as the scale of the cards was very small the results were not very satisfactory.

In connection with the indicators described, a test was made on a double opposed automobile engine ($4\frac{1}{4} \times 4\frac{7}{8}$ inch) having automatic inlet valves. A side view of this engine is shown in Fig. 4. A is the English optical indicator and B the mechanism for driving it. C is the drum indicator and D its driving lever. The American indicator is shown at E, while the small chain and sprockets for driving this appear at F. A Veeder revolution counter attached to the half speed shaft is shown at G. Fig. 5 shows the arc lantern A used for supplying light to the indicator; B is the ground glass screen on which the indicator card appears; C is the carburetor, D the spring balance and E the brake drum. Both the gasoline and air were accurately measured, Fig. 6 showing the apparatus for measuring the former. The graduated glass measure was filled from the tank A, the engine running meanwhile from gasoline supplied by tank B. When it was desired to take a reading the supply from B was cut off and the cock C opened, when the gasoline was drawn through the small siphon, causing the level in the graduated vessel to drop. The consumption of a definite volume was accurately timed with a stop watch. Fig. 6 also shows the spark coil D and the jacket water outlet E. The inlet air was measured in the gas tank shown in Fig. 7. The gauge C registered the pressure in the tank. The top or movable portion of the tank was so counterbalanced by the weights B, Fig. 8, that atmospheric pressure was maintained in the tank. The marker A, Fig. 7, resting on a sliding scale, registered the cubic feet of air passing out, and by timing this with a stop watch the rate was obtained. The gate B was opened in admitting a fresh charge to the tank. The large hose for conducting the air from the tank to the carburetor is shown in Fig. 8; also switch C and cheostat D for controlling the lantern. The test was made by Messrs. H. S. McDewell, S. Withington, H. P. Forte, R. Pleasonton and myself. Readings and indicator cards were taken simultaneously at given signals.

Before examining the results it should be understood that this test was not intended as a measure of the maximum possible output of the motor, but as a study of the conditions under which the motor was operating. The action of this engine was rather peculiar. When running with perfect regularity it was liable at any time to begin to misfire, but this irregularity was just as likely to disappear as suddenly as it came. As the exhaust was conducted to another part of the building it was impossible, without opening the relief cocks, to tell just when this missing occurred. The ignition outfit consisted of two multiple cell storage batteries, giving a total of 10 volts, a double Splitdorf coil and new mica plugs. The missing was undoubtedly caused by the commutator, which was inside the crank case and hence saturated with oil, the loose sleeves of this device doubtless making irregular electric contacts. The results show not only the irregularities but their causes.

Table 1 contains the results of the test which are graphically shown by the curves. Only one cylinder was operated, as only one could be properly indicated, the results from the other indicators not being available for measurement. It will be noted (Curve 3) that the brake horse power at points 5, 6 and 7 was considerably lower than it should have been. Looking for the cause we find first (Curve 1), that the charge per stroke at these points shows a decided drop. Curve 5 shows that at point 7 the mixture was too weak. This curve is also interesting as a study in carburetor action, and it will be noted that the percentage by weight of gasoline in the air varied between 71 per cent. and 88 per cent. The carburetor had been adjusted before the test in the ordinary way until the power developed by the engine seemed to the operator to be a maximum. The M. E. P is shown in curve 6 with points 2, 6 and 7 at fault. Consulting indicator cards 2 and 6 it will be seen that the spark was early at 2 and late at 6. Curve 4 shows the mechanical efficiency, with two points, 3 and 7, below the average. This is clearly accounted for by misfiring.

In order to correct the results, values were taken from the curves 4 and 6 (see Table 2) and embodied in curves 7, 8 and 9. The maximum torque occurs at 550 revolutions per minute, the maximum power at 600 revolutions per minute, and the best fuel efficiency at the same speed. With both

TABLE I.—ACTUAL RESULTS.

Number.	R. P. M.	Air to Cylinder Cubic Feet Per Minute.	Air to Cylinder. Cubic Feet Per Stroke.	Air to Cylinder. Grams Per Stroke	Speed Inlet Gas. Feet Per Second.	C. C. Gasoline Used Per Minute.	Gallons Gasoline Per Hour.	Gallons Gasoline Used Per B. H. P. Hour.	Grams Gasoline Per Stroke.	Mixture. Ratio by Weight in Per Cent.	Corrected Brake Load. Pounds.	Torque. Foot-Pounds.	Brake Horse Power.	Indicated Horse Power.	Apparent Mechanical Efficiency.	Mean Effective Pressure. Pounds Per Square Inch	Cubic Feet Gas Per Stroke.	Cubic Feet Mixture Per Stroke.	Initial Pressure in Cylinder. Pounds Square Inch.	Compression Pressure.	Inlet Friction. Loss Pounds Square Inch.
1	476	7.46	.0313	1.082	18.85	29.2	.463	.3405	.859	79.3	23	15.08	1.36	....	....	....	.00942	.0407	13.12	46	.3
2	517	8.07	.0312	1.079	20.15	29.7	.471	.272	.805	74.7	27	17.7	1.73	2.9	59.7	56.6	.00892	.0400	12.92	44	.5
3	530	8.26	.0312	1.079	20.7	31	.492	.263	.819	75.9	28.5	18.7	1.87	3.46	54.1	65.7	.00898	.0402	12.96	44	.4
4	564	8.375	.0297	1.028	20.9	31	.492	.260	.77	75	27	17.7	1.89	....	....	....	.00844	.0381	12.3	42	1.1
5	602	7.77	.0258	.893	19.6	30	.476	.335	.697	78	19	12.46	1.42	....	....	....	.00763	.0334	10.79	34	2.6
6	633	8.23	.026	.900	20.8	32.15	.51	.342	.707	78.6	19	12.46	1.49	2.4	62	38.2	.00775	.0337	10.80	34	2.5
7	668	8.55	.0256	.886	21.2	30	.476	.426	.628	70.9	13.5	8.86	1.118	2.85	39.2	42.9	.00698	.0325	10.50	33	2.2
8	735	9.58	.02615	.905	24.6	39.72	.629	.329	.737	83.7	21	13.78	1.912	3.49	54.8	48	.00830	.0344	11.11	36	2.3
9	861	10.80	.0251	.869	27.4	42.8	.679	.472	.697	80.2	13.5	8.86	1.44	....	....	....	.00763	.0327	10.57	33	2.8
10	1035	11.20	.02165	.748	28.8	48.7	.772	.48	.659	88.2	12.5	8.12	1.60	4.93	32.5	48	.00723	.0289	9.35	28	4.0

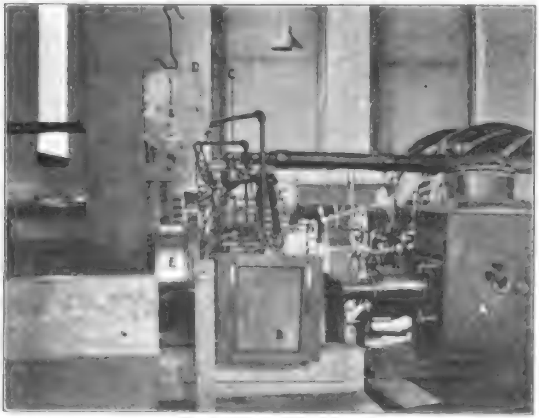


FIG. 5.

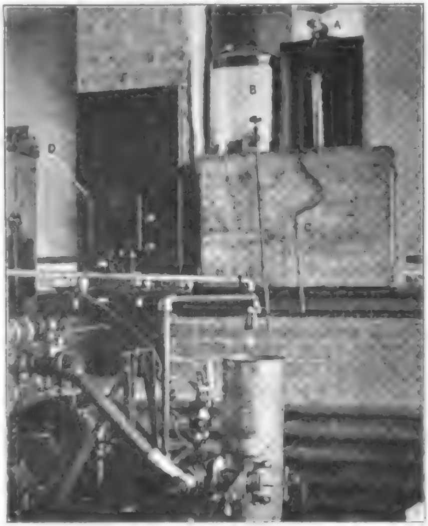


FIG. 6.

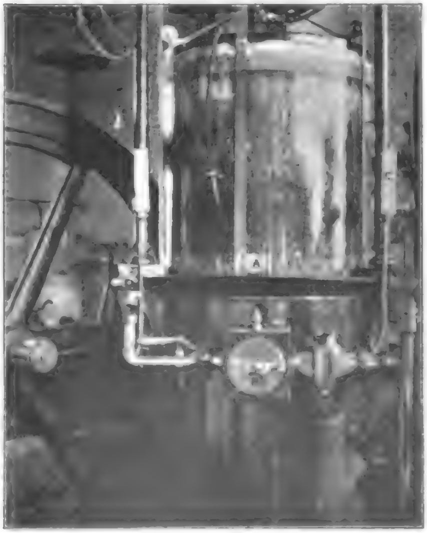


FIG. 7.

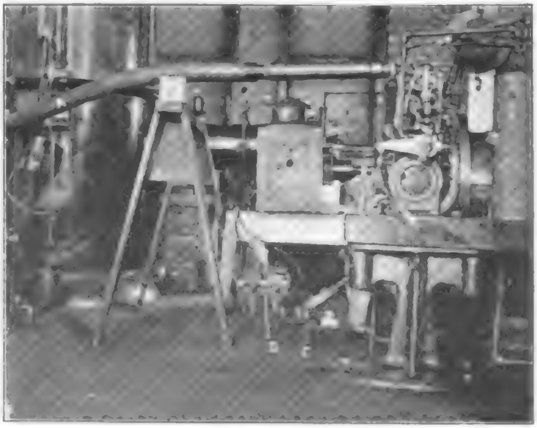
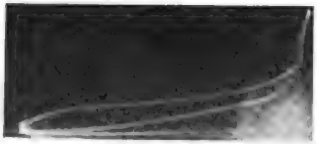
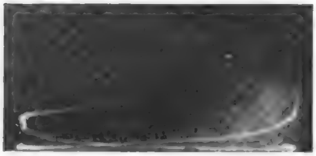


FIG. 8.

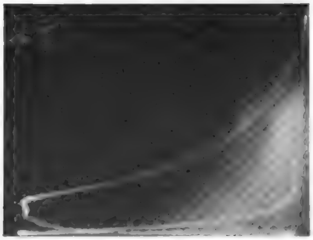


Card 1.

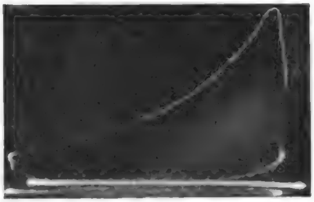
Card 6.



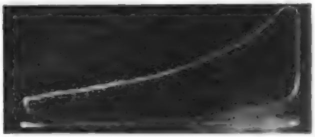
Card 8.



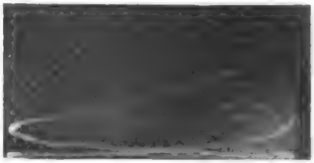
Card 2.



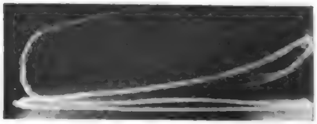
Card 3.



Card 7.



Card 9.



Card 10.

Table II.—Corrected Results.

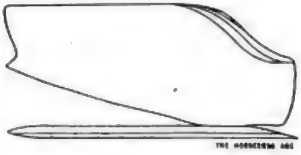
No.	R. P. M.	Mean Effective Pressure, Lbs. Per Sq. In.	Mechanical Efficiency, Per Cent.	Indicated Horse Power.	Brake Horse Power.	Torque. Ft. Lbs.	Gal. Gasoline Per B. H. P. Hr.
1	476	66.5	57.2	3.14	1.79	19.72	.250
2	517	66	59.7	3.38	2.02	20.51	.233
3	530	65.7	60.5	3.48	2.1	20.8	.234
4	564	64	62	3.56	2.22	20.68	.221
5	602	60.5	62.7	3.62	2.26	19.7	.21
6	633	57	62	3.58	2.22	18.4	.23
7	668	53	59.6	3.52	2.1	16.5	.257
8	735	48	54.8	3.51	1.92	13.7	.328
9	861	48	45.2	4.1	1.85	11.3	.367
10	1035	48	32.5	4.93	1.6	8.12	.482

cylinders running the mechanical efficiency would have been increased and the results correspondingly changed. In a test to determine the best possibilities of an engine it is necessary to indicate all the cylinders.

Card 10 was taken with very late spark and shows how this increases the pressure at the time the exhaust valve opens, which has a tendency to overheat the valve. The card also shows quite a loss of compression, represented by the loop. Table 1 gives the compression values, calculated from the initial pressures in the cylinder and a 47.5 per cent. clearance. It will be noted that the compression ranged from 46 to 28 pounds per square inch. The indicator cards show a compression of about 32 pounds per square inch.

Indicator cards 3 and 7 have been touched up. The entire diagram was visible on the negative but too faint to come out well on the print without being emphasized. It was necessary to use the very highest speed plates obtainable for this work.

Card 11 was taken on the small drum indicator with light spring and stop, at a speed of 500 revolutions per minute.



Card 11.

Some Notes on Engine Design.

By John Coapman.

When designing a new motor or improving upon an old design, one of the things to be considered is the method of driving the various accessories located on the engine. These accessories include the oil pump, water pump and magneto. The timer or distributor is usually driven direct without any coupling, but the magneto and water and oil pumps are usually driven by some sort of a coupling interposed between the driving shaft and the driven.

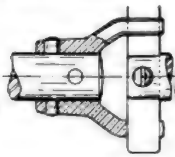


Fig. 1.

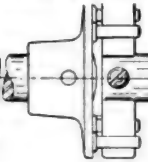


Fig. 2.

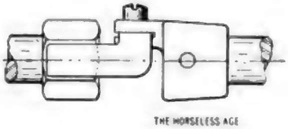


Fig. 3.

The magneto is positively driven in all cases, as it is essential that the correct relation be maintained between the positions of the pistons and the circuit breaker on the magneto. The oil pump is quite often positively driven, but it is better design to have a flexible coupling used here, so in case any solid matter gets into the oil pump the latter will not be damaged thereby. The same holds true in the case of the water pump.

In Fig. 1 is shown a coupling designed to drive either an oil or a water pump. This is a very simple affair, consisting of but one casting, made of bronze, either two, three or four flexible spring leaves made from spring steel, and two taper pins and filister head machine screw to secure the spring leaves in the end of the slotted shaft.

Fig. 2 is essentially the same, but was used before Fig. 1. A comparison of the two will show Fig. 1 to not only be simpler but also cheaper, as the four driving pins in Fig. 2 are obviated in Fig. 1.

Fig. 3 is a coupling that has been used on one of the large cars built in America, and will probably be readily recognized. It consists of a hexagonal driver, secured to the driving shaft by a suitable method, and this does the driving by means of the spring which fits on both sides and is held in place on the driven shaft by the slot in the dog and secured in place by the filister head screw. This will not recommend itself to very many, on account of its cost.

Fig. 4 shows one method of coupling two shafts where it is desired to transmit small power by means of a flexible coupling. This is probably one of its cheapest forms, not only in first cost but also in design. The high grade motor is made up of highly developed small details which enter into its construction. A little thing like this would spoil the appearance of a motor correct in every other detail.

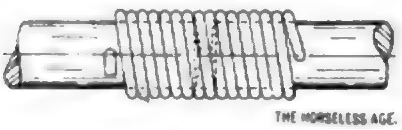


Fig. 4.

The above mentioned couplings are suitable for driving a pump, but another form is necessary to drive the magneto, and some designers prefer to use a positive form for pump drives.

Fig. 5 shows a form of the Oldham coupling which is used in a great many cases, owing to its simplicity and low cost. It is so familiar that it is not necessary to enter into detail regarding it.

In Fig. 6 is shown another form of the Oldham coupling, which differs from the first in that it has a spring between the driver and the bearing boss, to keep the driver always in contact with the driven dog.

Fig. 7 shows a more elaborate and possibly more mechanical method of accomplishing the same result. This consists of a driving member mounted on the driving shaft and secured in place by two taper pins. This drives a dog on the magneto shaft and secured by the nut, key and taper of same. This method makes a cheap, well appearing coupling, probably as cheap, if not cheaper, than the first two shown, viz., Figs. 5 and 6.

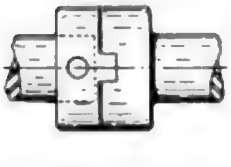


Fig. 5.

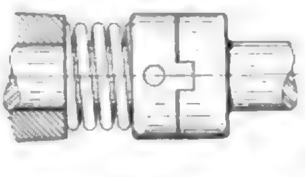


Fig. 6.

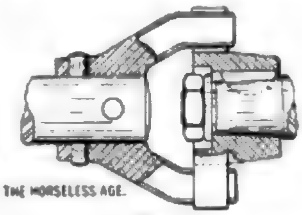


Fig. 7.

Fig. 8 shows a universal coupling which has been used on one high priced American car to my knowledge, but it seems to me that this is carrying the refining to too fine a business. It consists of an annular gear which drives another gear of the spur type, but having the teeth cut with a radius on the face. This makes a very expensive form but allows the magneto to be adjusted by shifting the position of the spur gear in relation to the crank shaft.

Fig. 9 shows a form of box coupling which is more often used between engine and transmission, though it could be used for the magneto drive, but a coupling of this style approaches too near to the design of universal joints, which is beyond the scope of this article.

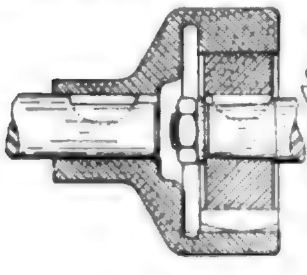


Fig. 8.

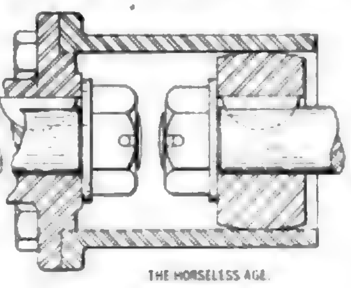


Fig. 9.

Probable Factory Changes in Automobile Production.

By F. M. Blair.

In comparing results and methods in an automobile factory with those in almost any other line, one cannot help but notice the large number of rejected parts; in fact, some shops have the appearance of making scrap for an output and automobiles as a by-product. In a large measure, this condition of affairs is a result of methods adopted in the days when we all knew a great deal less about automobiles than we do now, and, the proportion of wasters could be cut away down at the present time. It has continued because profits were large and sales easy.

However, we are past the experimental stage, and from now on the selling of cars will probably be a much more difficult task. As a result, radical changes in shop methods may be looked for.

Almost any of the large companies could save a good deal of money by seeing to it not only that the number of pieces actually spoiled is cut down, but also that many parts now thrown away are used. Of course, no one would advocate in an automobile anything that might by any possibility be unsafe, but a surface defect of a slight nature in a part that is not exposed is passed in any other line—engines, dynamos, machine tools, etc.—why not in an automobile? Again, a part can often be permanently mended in a workmanlike manner for a fraction of its original cost, but the average automobile inspector throws is out. No one can blame the inspector, as he is usually under pretty rigid instructions, but it would pay any company to add a re-operation department in charge of a really competent man and see how much of this material would pass even their present inspection system.

Also, if these defective parts were properly and fairly charged to the department at fault, it would work wonders in cutting down their number. Another man who could be profitably added would be a master mechanic to look after speeds and ways of doing work. This latter, to be of any use, should be a man of good judgment and wide experience, who would know when to cut down speed as well as when to increase it. It must be remembered that a good many of our standards are set by what a machine tool can do in the stationary or marine gas engine lines. The writer has often seen work spoiled in quantities by trying to equal this in automobile production.

The difference between a 5 inch piston 3/16 inch thick in its thinnest part and one only 3/32 inch is very evident, and yet some shops try to make as many of the thin ones as other shops not working to nearly as close limits do of the heavy ones. Results: Cracked pistons, too much out of true for economical grinding, not close enough to pass inspection, and trouble in general. The obvious remedy is to reduce the speed.

This could also be applied in other places to good advantage. For instance, the draughting room should be given time enough to turn out drawings that you can swear by, instead of the kind you swear at. This alone would save many pieces that now find their way to the scrap pile.

In the matter of important jig and tool equipment and machine tools, the average automobile shop is in good shape, but it is usually deficient in small things, little inexpensive ways of saving time have been overlooked all along the line. These little things come mostly from the men doing the work, and the piece work system or premium plan will do more to bring them up to the standard than any other possible thing, as it puts it up to the men to think of little ways of saving time. Far from causing bad work, it will turn out directly opposite if the inspection system is right, as no man is fond of doing work that he is not going to get paid for.

The piece work system also has the advantage of providing a very accurate cost system with the minimum of clerical labor.

The foregoing does not cover all the points that need attention, but is intended only to draw attention to the worst features prevailing to-day. If these points were straightened out, almost any car could be made at a considerable reduction from the present cost.

Recent Developments in Rear Axle Construction.

By F. E. Watts.

It is not the purpose of the present article to cover the entire field of rear axle construction, but rather to call attention to a few of the features of recent gear driven axles. Particular attention will be paid to those parts of the axles which support the weight and house the revolving parts. The interior construction will only be referred to incidentally.

Probably no unit which goes into the make up of the modern automobile has been responsible for more trouble during the past few years than bevel driven rear axles. Besides such troubles as the breaking of spring seats, disarrangement of differentials, shearing of the rivets which fasten the bevel gear ring to the differential housing, and leakage of oil, there have been a certain number of failures due to weakness in the load carrying member. Not that many axles have actually broken, but quite a number have sagged, throwing the parts out of line.

Apparently a good deal of study has recently been given to the cause of these defects, particularly to that of the last mentioned, and this has resulted in quite a number of novel designs which are just being put on the market. These designs seem to aim at several objects, viz., stronger construction, smaller weight and neater appearance, and in some cases the provision of means for mounting the change gear with the driving bevels. Many of them have only been rendered practical by the advent of quantity production which permits the use of pressed steel. The development of autogenous and other methods of welding allows of pressed steel being worked into forms which were prohibitively expensive a short time ago. It is these conditions which have made it possible to produce the casing and supporting member in one piece.

Up to the present it is the customary practice to build up the load carrying member from three or four pieces. Thus the casing for the bevel gears is cast from steel, aluminum or malleable iron. This is sometimes split vertically and bolted together on the vertical plane; in other cases the housing is in one piece and the gears are put in through a large opening at the top or rear. To the opposite sides of this casing are secured the tubes which house the axle shafts. They are usually brazed or riveted in place; occasionally they are screwed in or made a drive or shrink fit. It is in the method of attaching these tubes to the gear housing that many rear axle troubles have originated. In brazing the tubes are often overheated and lose their stiffness. When held in by rivets put in cold they are very likely to come loose. Screwing and riveting makes a good job if properly carried out, but has seldom been used. The shrink fit and the force fit are perhaps the best methods known, but they require more skillful workmen than are usually employed on stock axles.

The foregoing must not be taken as condemning any of these methods of fastening; all of them will do the work if they are properly designed and executed. There are so many thousands of axles made in all of these ways which are giving good satisfaction that it would be idle to say that these constructions are bad. But they have this undeniable fault, that through poor workmanship, or a sudden excessive overload, or if the construction is normally loaded too near its limit, the casing may take on a permanent set and throw the parts out of line. Some companies practically never have axle trouble, while others have had enough to eat large holes in the year's profits.

It is probably to the troubles experienced by the latter class that we are quite largely indebted for the production of the axles described, the object sought being to get a construction capable of taking all sudden stresses without injury.

To guard against failure of supporting members of the old style, it has been customary to use one or more truss rods. These in many cases have proved a fruitful source of the troubles they were supposed to remedy. Relying on the promise of strength they afforded, designers have reduced the sections of the other parts to cut down weight. Instead of building an axle strong enough for all ordinary conditions and then adding a truss rod for emergencies, they have relied upon the truss rod all the time. While this practice might possibly have been a success if the rods were always at the proper tension, it has proved a miserable failure in practice.

Many owners seem to consider the truss rod a convenient place to put the jack against; scarcely anyone ever thinks of tightening one; so out of a great many such truss rods I have examined a considerable number were loose or bent. Sometimes they were even tied together with piano wire. These facts force the conclusion that an axle which does not require a truss is best, for you can never count on the truss being tight in an emergency.

Realizing these objections to the usual three piece trussed construction, some makers have produced axles in which the entire casing is cast. Usually such axles are made in two parts, bolted together along the vertical central plane of the gear housing. Cast steel, malleable steel or bronze are the metals usually employed. Some few of these axles appear to be very successful, and are still in use, but it was usually found that the construction was too expensive, largely owing to the difficulty of getting sound thin castings. This is particularly the case with steel and semi-steel. Bronze is out of the question, owing to weight, lack of stiffness and high cost per pound.

While pressed steel has been used for axles in Europe for some time, it is only within the past few months that it has come into use in this country to any extent. While quite a number of styles have been brought out in that time, there is none of them which are broadly new or which have not been preceded by similar constructions in other metals.

The axles we will consider may be roughly divided into two classes:

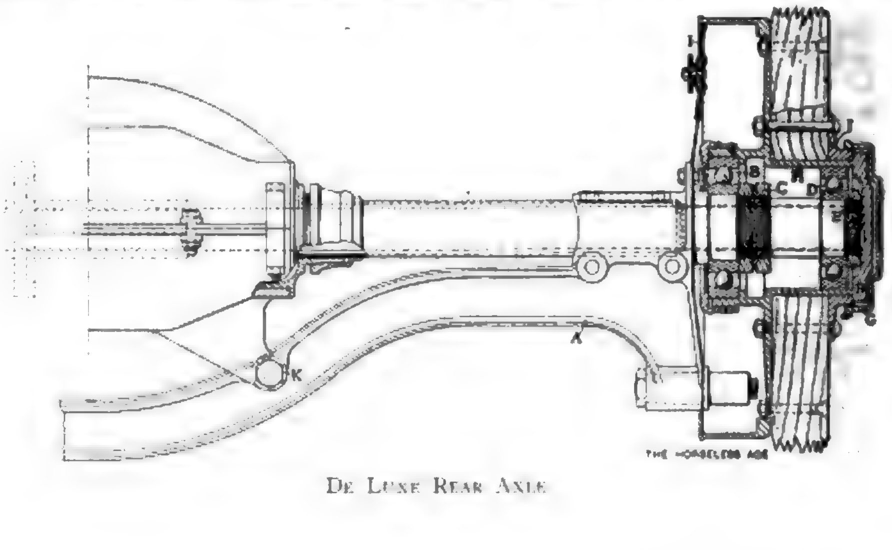
A.—Those which employ a continuous forged or pressed steel member for carrying the load, and house the gears in a case which is either wholly or partly separate from this load carrying member.

B.—Those which combine the load carrying and gear housing functions.

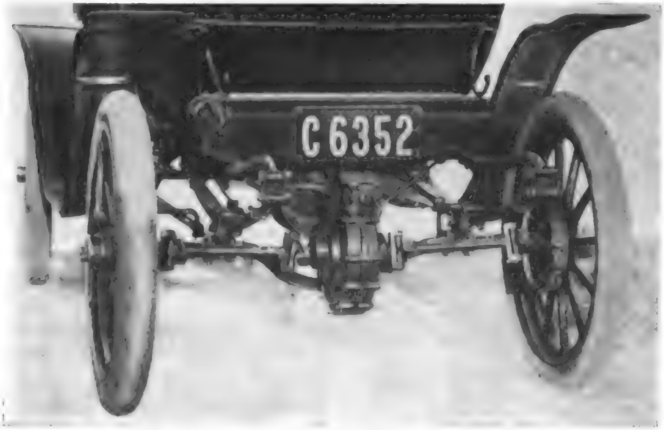
Let us consider some examples of these two classes.

CLASS A.

The first axle of this type to be brought prominently before the American public was the De Luxe. The load carrying member of this axle is an I section forging of chrome nickel steel. The wheels are mounted upon annular ball bearings which are fast upon the tubular ends of this forging. The gear and axle shaft housing is made up in the usual manner from steel tubes and aluminum castings, but is, of course, lighter than



De Luxe Rear Axle

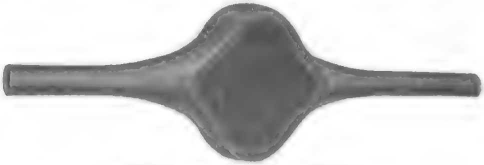


Maxim-Goodridge Rear Axle.

it could be made if it carried the spring load.

While this axle construction is amply strong for all conditions, it is heavier than the more usual types. It is also unduly expensive, both in cost of material and labor.

In the Stearns axle the forged piece which carries the load has a tubular form where it houses the axle shafts. The central part is made in the form of a loop, surrounding the cast aluminum case which contains the bevel gears. This loop is placed nearly in the vertical plane. Each member of the loop is of I section. Being in the form of a heavy truss, and stiffened by the case which fills the loop, this type of axle is stronger than the foregoing for equal weights. It would seem, however, that it would be rather expensive to machine.



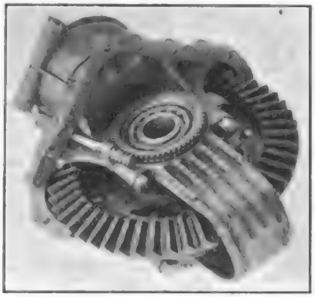
Timken Pressed Axle Housing.

The Maxin-Goodridge electric vehicle has lately called attention to a type of axle which was first used in this country, I believe, upon the De Dion cars. In this axle the load carrying member is a forging, something like that in the De Luxe, but the gear housing is carried on the body, connection from the gears to the wheels being made through two shafts. Each shaft is provided with two universal joints to compensate for the spring action. While this construction permits a light axle, since the springs carry the central load, it would seem to introduce other possible chances for trouble in the multiplicity of universal and sliding joints. It is said to have been very successful for small cars, however.

GAL 3—Revent Development in Rear Axles

In the Timken axle the load carrying member forms nearly the whole of the gear and shaft housing. It is formed from pressed steel. Each half is pressed from a flat sheet, the large diameter being drawn first, then the tubular portion. The finished halves are autogenously welded together in the fore and aft vertical plane of the gear housing. This leaves a complete one piece housing with a large opening toward the front. The bevel gears are introduced through this opening. They are mounted upon a casting, together with their bearings and adjustments. The bridge between the bearings shown in the figure is no longer used. It was put in as a precaution to ensure stiffness, but was found to be unnecessary. Mounting the gears in this manner allows of their being carefully meshed on the bench. It should be noticed that all of the gear strains are taken in the casting, and that a slight deflection of the axle would not throw the gears out of alignment. The large flange of the pressed steel housing to which the gear carrier bolts, is reinforced with a cast rim on the inside, the studs which screw into this reinforcing rim are shouldered, being larger outside than where they pass through the housing, so when they are screwed home the reinforcing rim practically becomes a part of the housing.

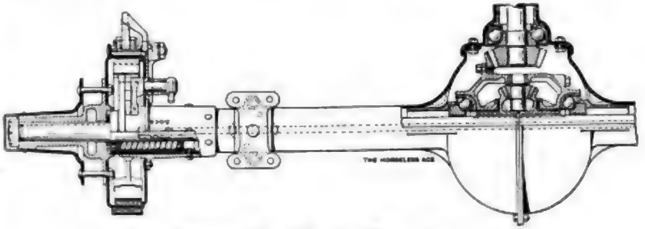
Similar in general principle to the Timken axle is that used upon the Marmon car. But while the pressed steel housing performs the same functions, it is produced in a different manner. It is made in two halves, each of which runs the entire length of the axle, and these halves are welded together in the vertical crosswise central plane. This construction allows the formation of long ribs at top and bottom, the welds coming at the outside of these ribs, so the casing can be made very light and still be stiff enough. Each wheel is carried



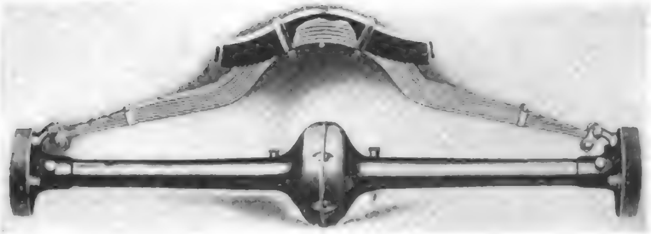
Timken Gear Carrier.

upon a single annular ball bearing placed directly under the spokes. The axle shaft has an integral flange at its outer end which is bolted securely to the wheel. The inner ends of the shafts are supported in the differential gears in the usual manner. This novel method of wheel mounting reduces the tendency to localize stresses.

The housing has a large hole in the front and a large one at the back. The casting which carries the gears (in much the same manner as in the Timken axle) is bolted to the front flange, and the part which encases the change gears protrudes through



American Ball Bearing Rear Axle.



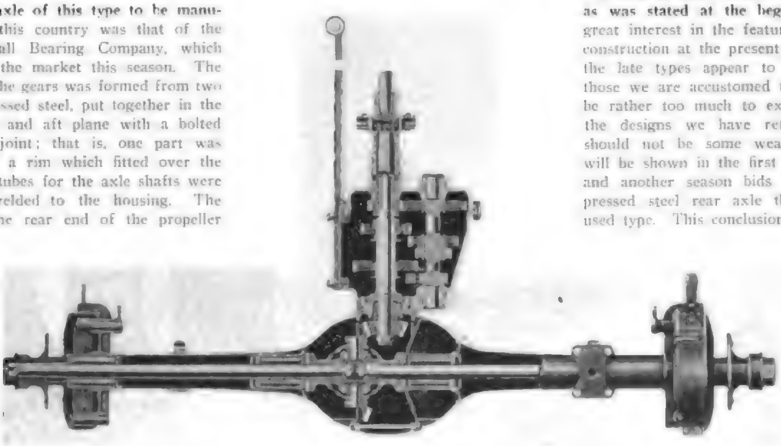
FORD REAR AXLE.

the forward opening. The entire gear assemblage may be withdrawn through the opening at the rear while the axle is in place on the car. This opening is, of course, ordinarily closed by a cast cover.

CLASS B.

The first axle of this type to be manufactured in this country was that of the American Ball Bearing Company, which was put on the market this season. The housing for the gears was formed from two pieces of pressed steel, put together in the vertical fore and aft plane with a bolted overlapping joint; that is, one part was pressed with a rim which fitted over the other. The tubes for the axle shafts were electrically welded to the housing. The flange for the rear end of the propeller shaft housing was welded to the rear end of the tube. It also was provided with a pressed rim which fitted over the end of the housing and held it central. Ball bearings were used at the inner ends of the shafts, and Hyatt rollers at the outer ends.

The E-M-F axle also deserves mention in this class. The bevel pinion and change gears are carried in an aluminum case, the cylindrical rear portion of which forms a spacer between two pressed steel pieces which extend out to the wheels. The three parts are secured together by bolts. They are held in alignment by the steel fitting into a turned recess in the aluminum. The bolt heads and nuts lie in pockets pressed in the steel. Hyatt roller bearings are used all around on the axle shafts. The inner bearings are held in pressed steel brackets autogenously welded in place.

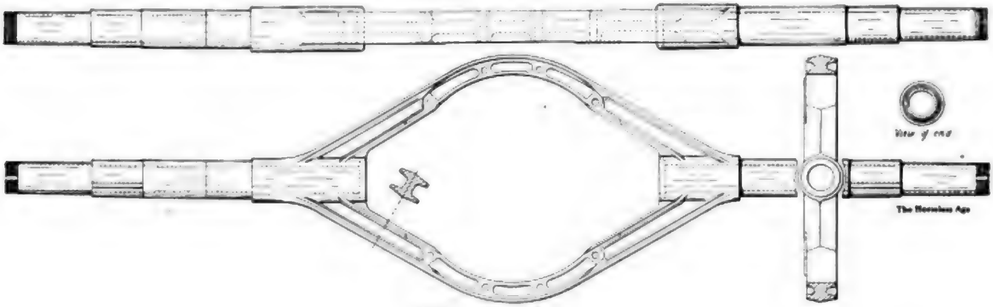


E-M-F REAR AXLE.

The Ford axle carries the use of pressed steel to its extreme limit. Indeed, every part where this material could be used is made from it. It would seem that some of these parts could be made more cheaply from castings. The entire casing is made in two parts bolted together in the middle. The inner bearings are plain and the outer are Hyatt rollers. Pressed steel pieces, welded in place, carry the plain bearings.

The brackets which support the brakes and the flange at the rear end of the propeller shaft tube are made from pressed steel. The former carry the shackles for the cross spring. It will be seen that since the weight is carried very near the wheels, the central portion of the axle may be made unusually light. This appears to be one of the best possible constructions for small cars.

It will be seen from the foregoing that, as was stated at the beginning, there is great interest in the features of rear axle construction at the present time. Some of the late types appear to be superior to those we are accustomed to, but it would be rather too much to expect that in all the designs we have referred to there should not be some weaknesses. These will be shown in the first year of service, and another season bids fair to see the pressed steel rear axle the most widely used type. This conclusion is also pointed to by the fact that many companies other than those mentioned are working on axles of this type, but alongside it will be found axles of differing construction doing similar work. The result will probably be to add another to the already long list of subjects for controversy which the automobile affords.



STEARNS REAR AXLE.

Motorcycle Design.

By L. E. French, S. B., Mech. E.

The motorcycle as a self propelled vehicle has certain decided advantages. It is cheap, both in first cost and in operation. Moreover, it is simple, light and compact. It requires small storage space and little room on the road, yet it is as speedy both on the level and on hills as the most powerful car. On the other hand, it has certain inherent disadvantages. The rider is wholly unprotected from weather conditions; he cannot nestle behind a glass front and side curtains, but has to take the downpour, wind or sun as the case may be. He is also unprotected from dust and dirt. While it is perfectly possible to operate a motorcycle under all weather conditions, there are few who care to do so for pleasure, so that its use is more or less restricted to mild weather.

Motorcycle design, in its present state of development, is about where automobile design was four years ago. This simply means that progress has been slower, and for good reasons. The advent of the automobile has unquestionably retarded the development of the motorcycle. If the latter had come five years before the automobile there is every reason to believe that it would have enjoyed a boom like that of the bicycle business, but the motorcycle was eclipsed by the blaze and dash of the motor car, which had a twofold effect upon the motorcycle industry. First, the automobile distracted the attention of the public, making people save their money for something more ambitious, and, second, it claimed the immediate attention of manufacturers and capital. Large bicycle factories were turned, not, as might have been supposed, into motorcycle factories, but into automobile factories.

To represent an equal investment of capital there would have to be seven times as many motorcycles in use as automobiles, if the average price of the automobile is called roughly $1,400 and that of the motorcycle $200. It is evident, even to a casual observer, that motorcycles are comparatively scarce when compared with cars, so that only a relatively small amount of capital has been invested in the former. As the money expended in the development of a product is necessarily limited to a comparatively small percentage of the receipts, it is evident that only a relatively small amount has been expended in the development of the motorcycle. On the other hand, the actual development by the automobile industry of the gasoline engine has helped the motorcycle designer to a certain extent, although the motorcycle problem is a distinct, even if a simpler one.

The early stages of automobile history were marked by a wide diversity of design. Every maker was working out his own individual and distinct ideas and the result was a heterogeneous collection of what would now be classed as "freak machines." The first idea was that of a horseless carriage, and it took the makers a long time to realize that the motor car was not a carriage, but a distinct proposition to be considered on its own merits. The perfection of the automobile was accompanied by a drawing together of diversified ideas; an approach toward standardization in the modern four cylinder with shaft drive.

Motorcycle development is now passing through a similar process. The first idea was only that of a power bicycle, despite the fact that the motorcycle is a distinct proposition. There is still a wide diversity in design and construction, the motors being largely single cylinders placed in various positions, and the transmissions being of varying and distinct types.

COMPETITION.

One of the most powerful factors in the development of a product is competition. In a new industry competition is small at first, and markets are relatively large. The manufacturer goes on enjoying large profits, blissfully oblivious to the kicks of users, just as long as the lack of competition will permit him to do so. When Smith across the street comes out with something better, Jones wakes up, cuts his profits a little and improves his design. Competition in the motorcycle business has not been strong enough, before the present time, to force makers to adopt certain changes even when they knew that these would be decided improvements. The change would mean an extra expense; the shop was busy without it, and the change was therefore not required. This fact has been brought home to me so many times that it makes me weary to think about it. Only last year the president of a motorcycle company remarked to me: "We can't build the kind of machines you and I would prefer to use, but we have to build what the people want." That last word in the sentence makes it sound very fine at first, but another way to say the same thing would be: "As long as the public will put up with the thing we are building it won't pay us to do our best." Competition has now begun to be felt in the motorcycle business, however, and we can therefore soon expect to see decided improvements in design. Complaints from dissatisfied users are no longer entirely ignored.

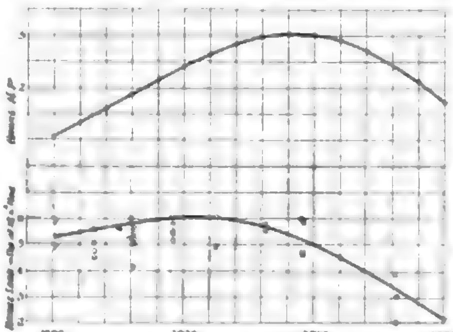


Fig. 1.—Brake Test of Thor Motorcycle.

Rated power = 1¾ horse power ; bore = 2 19-32 in. ; stroke = 3 in.

INFLUENCE OF SALES METHODS.

The relation between user and manufacturer has an important influence on design. This relation is more direct in the motorcycle than in the automobile business, since there are very few motorcycle salesrooms, almost all the agents being riders and users. The sales department therefore deals more directly with the users, and it might thus be supposed that a more beneficial effect would be produced by having the complaints registered directly at headquarters, but there is another influence that tends to counteract this result. The prime object of the sales department is not to influence the designer but to get rid of the product. In dealing directly with the purchasers, this department is constantly hammering home the merits of the machine, which has a reactionary effect, and soon they idealize their product and are unable to see its faults. The position of the designer meanwhile is like that of the horse thief whose case was being argued by an expert attorney. The argument was so convincing that he was acquitted. Later the lawyer happened to meet him on the street and asked confidentially, "Say, now honest, Bill, didn't you steal that horse?" to which he replied, "Wal, when I come to court, I did have a sneekin' suspishun that I once got next to that er hoss; but gol blink it, ever since I heared that argement o' yourn, I'll be blamed if I know whether I did or not."

SPECIAL MACHINES IN CONTESTS.

Now the motorcycle designer may be quite an expert in his line, but he is almost always handicapped in one respect, and that is, he does not often realize all the requirements of the problem before him. He sits before his draughting board and works it all out on paper, possibly taking a little spin in front of the shop on a new machine before it is shipped. When competing in contests the result is not much better, for I can certify to the fact that pure and simple stock machines are practically never used by him for such a purpose. I remember once creating quite a little amusement in trade circles by drawing a so called "Snap shot in Hades." The illustration represented a motorcycle designer, who, after arriving in the lower regions, was about to be forced to ride his own machine over a mile and a half of cobble stones. Only the users of a machine who are constantly subjecting it to all kinds of practical tests under varying conditions fully realize all the defects of the product.

Let us examine, then, the defects of the present motorcycle from the standpoint of the superficial observer and of the user. Ask any ten athletically inclined but impartial men who have never ridden a motorcycle what they think of it, and they will reply, "They are noisy things that shake the life out of you." In other words, vibration and noise are the two things about a motorcycle that first attract the attention of the prospective public. Give these same men a ride on the machine and they return enthusiastic. The vibration and noise are just as bad as before, but they overlook these faults in their excitement over the swift, birdlike flight. Noise and vibration, however, are not inherent faults, and they have to go. Spring forks have been common for some time, but although most of these devices are as yet scarcely more than a name, their use is a step in the right direction. As in the automobile, the motor lies at the heart of the problem, and the single cylinder, with its inherent defects, is bound to give place to a better balanced machine.

WEIGHT AND HANDLE BAR LENGTH.

The motorcycle designer's problem is and always will be distinct from the automobile. It is not sufficient to merely adapt an automobile engine so that it can be fitted into a bicycle, but a motorcycle engine should be designed as such from the ground up. The motorcycle is not a self balanced vehicle, and this fact unavoidably imposes certain limitations which seem to have been in part unrecognized or else entirely ignored by many designers. The two features referred to are weight and handle bar length. With a self balanced vehicle the weight is only limited by the power, but with a motorcycle this condition applies only on good roads. On bad roads the weight of the machine is limited by the weight and strength of the rider, and it has been my experience in sand, and especially on sandy hills, that a machine of over 140 pounds is very difficult to handle and in some cases entirely unmanageable. I have ridden various machines over the sandy hills of western Massachusetts, one such adventure being described several years ago in **The Horseless Age** as "Crossing Turkey Pass in the Dark," and I have found that a machine with short handle bars, weighing under 120 pounds, could be handled with comparative ease in places where a heavy machine could not live. Where the power is sufficient to force a motorcycle rapidly through the sand, the rider's sensation is that of being mounted on a bucking bronco. I have had a machine twist under me so suddenly as to strike the tank violently against my knee. In the New York to Boston endurance run there competed 48 machines, varying in weight from 100 to 200 pounds. The lightest machines had 1½ horse power, and the heaviest 6 horse power. This latter ran 60 miles per hour on good roads, but in one sandy stretch its rider had to get off and push his machine for five miles, being utterly unable to keep his seat. This competitor lost the run, while the lighter machines with short handle bars had little or no difficulty in covering the same spot at a fair speed.

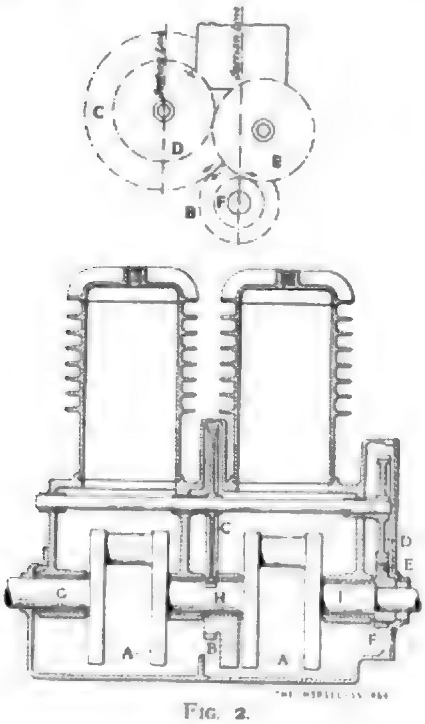


Fig. 2.

Long bars may be tolerated on good roads, but for all round use I consider them a very bad design, since with long bars the rider never has the same control over his machine that he does with short ones. It must not be thought from this that I advocate the use of a short wheel base. A long wheel base gives a very much better action, and it is perfectly possible to combine this with the fairly short bar, by keeping saddle and foot rests forward.

The power of a motorcycle should be as great as possible within the weight limit. This is the reason why a light weight, high speed motor is needed in a motorcycle as much as in an air ship. The writer made a brake test on one of the most successful single cylinder motorcycle engines produced in this country, the results being shown by the accompanying curves, Fig. 1. The maximum horse power (3.1) from this motor was attained at 2,800 revolutions per minute, but I have obtained excellent results on the road at speeds as high as 3,400 revolutions per minute. A double cylinder machine of 6.2 horse power can be built to weigh less than 120 pounds and such a machine is easily handled and has ample power for all purposes.

VIBRATION.

The vibration attending the higher speeds of the motor mentioned above was very great. At about 2,000 revolutions per minute the tools walked off a nearby table; the table itself walked across the room, and the chandelier on the ceiling below came near falling. The apparatus was removed to the basement and bolted to a solid concrete floor, but even here the heavy frame vibrated so that it was necessary to run long staybolts from the motor to the floor.

Proper balance in a motor is worth all the cost and exertion necessary to obtain it. The six cylinder engine for automobile use, which is certainly a step away from simplicity, represents an attempt to overcome two evils, namely, vibration and uneven turning moment. Of these two features, the latter has been considered the most important, since the four cylinder with its comparatively even torque has a decided advantage over the double opposed, which latter can be made to have a really better mechanical balance than a four cylinder of the same power. The question of torque, aside from vibration, is simply and purely a question of flywheel design, since the speed fluctuation may be limited by the flywheel to anything desired; the more uneven the torque, however, the heavier the flywheel must be. For this reason a four cylinder is lighter than a two cylinder of the same power, if the speed fluctuation in each is the same per stroke at equal speeds. With a motorcycle engine the speed is great, hence the flywheel can be correspondingly smaller without increasing the fluctuation at the normal speed, and for this reason it is doubtful, to my mind, whether the four cylinder engine will ever become popular for motorcycle use. Everyone agrees that the simpler the apparatus for accomplishing a definite purpose the better. Now a double cylinder engine can be balanced as well, sometimes better than a four; hence if the stroke of the former is half that of the latter the revolutions per minute can be doubled for the same piston speed, which cuts the flywheel weight in half for the same speed fluctuation and gives equally good results in each. The objection to the four cylinder engine for a motorcycle, besides its extra complication and expense, is that it necessitates the lengthening of the frame between saddle and fork, thus resulting in long handle bars.

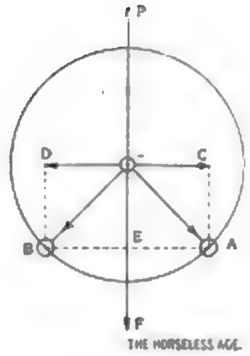


Fig. 3.

DOUBLE CYLINDER TYPES.

There are two types of double cylinder engines which seem to me to be especially applicable to motorcycle use. The first is the 90 degrees V type, which is capable of a very fine mechanical balance. The only objections to this motor are its unequally timed impulses and the fact that it is not so easily adapted for use with a shaft drive. The other type is the double cylinder vertical, with cranks together, an outline of which is shown in Fig. 2. The several disadvantages of the other types mentioned above are entirely overcome in this form of motor and it simply remains to balance it properly. This can be accomplished by the use of counterweights, revolving in opposite directions. Each crank is counterbalanced at A. A weighted collar B is driven by the cam shaft through gearing C, D, E, F, at crankshaft speed, but in the opposite direction. The principle of operation in this form of balance is shown in Fig. 3, the two counterweights each exerting a force in the direction of the arrows. The force OA may be resolved into the two forces OC and OE; the force OB into the two forces OD and OE. OC neutralizes OD and 2OE = OF, which balances the piston inertia forces OP. The extent to which the force F balances the force P may be seen in Fig. 4, the shaded portion showing the unbalanced forces.

The advantages of a motor such as described above are: Equally spaced power impulses, good balance, short length, comparative simplicity with correspondingly decreased cost, adaptability for use with shaft drive and magneto, and light weight for ample power.

TRANSMISSIONS.

There is one point which seems to have been a stumbling block to nearly every American motorcycle designer, and that is the transmission. I have been asked many times which I considered the best form of transmission, the chain or the belt, to which I have always replied that the situation reminded me of the two hotels at A——, Mich. It makes no difference which one you take, for in either case you wish you had taken the other. The trouble with each of the above transmissions is found in the conditions under which they have to operate. Take the chain, for instance; like any other piece of machinery, it must be lubricated and running very close to the wheel; it is soon covered with sand and grit, which works in and cuts like emery. I once rode a machine which I considered very fine, with the exception of the drive, which was simply rank. With the utmost care a chain only lasted 500 miles, so that the cost of renewal was actually equal to that of the gasoline. Wherever a motorcycle chain runs at a high speed over a small sprocket, it wears excessively.

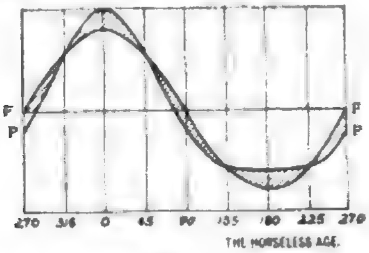


Fig. 4.

Besides all this the chain is a greasy thing at best. It throws grease over the machine and over one's clothes, and cannot be touched without saturating the hands. The designer is responsible for the fact that most motorcyclists go around looking like coal drivers, which accounts for the disrepute into which the motorcycle has fallen among a certain class. The belt drive, while it is at least cleanly and noiseless, is still far from perfect, with its slipping and stretching. To my mind, there is only one good form of transmission for a motorcycle and that is the shaft drive. This can be protected from road conditions and hence can be properly lubricated, and, moreover, it is cleanly and positive in action. The fact that this kind of drive has not been adopted before is only another illustration of what was said at the beginning of this article.

The subject of motorcycle design is too broad to be covered in the space allowable here but before concluding it would be well to say a word in regard to price. It is perfectly possible to build a motorcycle of the kind outlined in this article to list at $250. A machine selling for more than this, say $350, will always have a limited field, but in the motorcycle class it corresponds exactly to the $6,000 to $10,000 automobile in its class. If an American machine costs as much as an imported foreign duplicate, it means that the cost of manufacture in this country is 40 per cent more here than abroad, which seems to me incredible, even if foreign labor is cheaper.

The Permanent Magnets of Ignition Magnetos.

By Albert B. Clough.

In order that an ignition magneto may be satisfactory it must be capable of delivering an effective current at low speeds. It must deteriorate in this respect as slightly as possible with age and use, and it must be reasonably compact and light. Assuming that the armature is properly designed and constructed, and that the contact system is well carried out, the realization of the above requirements will depend upon the character of the field magnets. These permanent magnets must furnish as strong a field as possible, initially, and must decrease in strength as slightly and as slowly as may be, and they should, at the same time, be as small and light as practicable. By field strength is meant the number of magnetic lines which are caused to pass through the armature so as to be cut by the wire conductors thereof when the machine is in action. The voltage generated by the armature will be proportional to the product of the total flux of magnetic lines through the armature, the number of armature conductors and the speed of rotation. In order to secure the voltage required to give a spark at a low speed of cranking, the product of the total flux and the number of armature conductors must be kept as small as possible. Increasing the number of conductors unduly seriously augments the internal resistance of the armature and raises other electrical objections, so that in order to keep the product of turns and flux as high as possible an increase of the latter becomes the chief desideratum. As undue bulk and weight is also an objection, the chief thing to be desired is high flux density in the field magnets—that is, the number of lines of magnetic force per square inch of cross section of the field magnets must be kept high.

A high initial flux density in the field magnets is, however, of no avail unless it can persist at very near its original value for a satisfactory length of time, for it would be very disappointing to possess a magneto which, while it would afford easy starting at first, might later make recourse necessary to a battery for starting and indeed for slow running.

The two requirements of high flux density and permanence or retentivity, both of them of extreme importance, are unfortunately to a large degree incompatible. A magnetic material which has high permeability and will carry a high flux density has a low degree of retentivity, while a material of high retentivity usually possesses a low permeability. If the attempt is made to secure too high flux density, the magnetism will not prove permanent, while, if extreme permanency is secured it is at a flux density of a comparatively low order. A compromise is therefore effected and a reasonably satisfactory degree of permanence is aimed at, with a flux density as high as can be attained in conjunction therewith.

The full skill of the magnet maker is concentrated upon attaining the above result, and, as the detailed methods used in the process have been experimentally evolved by individual concerns, at considerable outlay, they are very closely guarded as business secrets and cannot be learned except in a very general way. Some facts are, however, available, but an outsider is very likely to fail to unearth some of the most important "wrinkles" practiced by the most successful manufacturers, which spell the difference between high and low quality in their product.

Among the considerations which enter in the making of magnets, fulfilling the above requirements, are the following:

(1) The design of the magnets themselves and of the magnetic circuit as a whole.

(2) The character of the steel employed.

(3) The methods employed in forming the rough steel into the desired form.

(4) The nature of the hardening process.

(5) The method of magnetization and the treatment accorded the steel during the process.

(6) The aging process.

SHAPE OF MAGNETS.

(1) A magnet with its poles brought rather closely together is an obvious requirement in this work, and this may take either the conventional horseshoe form or that of an interrupted circle. Long magnets are known to be more permanent than short ones, the ratio of length to cross section being quite a factor in the resulting retentivity. It is not practical, however, from considerations of cost, weight and bulk to use a magnet of as great length as would secure the greatest degree of permanence.

Compound magnets, built up of a number of similar laminæ, are known to be stronger than solid magnets of the same weight, and this is fortunate, as the mechanical difficulties involved in producing a single piece magnet blank of the desired size would prove serious.

Practically all magneto fields are compound and some steel makers do not recommend the use of their product in a flat section of more than about one-half inch thickness. It is quite possible that some of the magneto manufacturers are not laminating their magnets sufficiently to obtain the best results. There is no doubt that the form and size of the soft iron pole pieces and their method of attachment is a matter of the greatest importance, as affecting field permanence. Some authorities state that the pole pieces should encircle the armature through a large arc, as such practice reduces the demagnetizing effect of armature reaction. Magnetic leakage from pole to pole, outside the armature core, is of course to be considered. It is admitted that the pole pieces should be very securely attached to the polar ends of the magnets and that the abutting surfaces should be very closely fitted. Whether clamping on of the pole pieces is much superior to bolting on is not a settled point. The closer the magnetic circuit is kept closed the more permanent the magnetism and the larger the value of the flux. As small an air gap as mechanically possible should be used between pole pieces and armature core, and the core should be of the most permeable material—silicon or silico-vanadium steel stampings being preferable.

COMPOSITION OF THE STEEL.

(2) So far as the ability to be highly magnetized only is concerned a high carbon steel containing .60 per cent. or .70 per cent. of carbon seems to answer all requirements, as it will harden to an extreme degree.

In order to secure permanency, however, and for that purpose alone, tungsten must be added. Tungsten is not appreciably magnetic, but acts in a specific manner.

A prominent electrical engineer has said that tungsten is the best solder for sticking steel molecules together, so that they cannot turn around. This is no doubt a recognition of the hypothesis of Weber that a magnet is a collection of innumerable molecular magnets and that the maximum magnetic condition is reached when all these molecules have been turned by the magnetizing force so as to point along the lines of force. The tungsten seems to keep these molecules into place when they are once there.

A tungsten content of from 5 to 6 per cent. is understood to give the best results as to permanency. It has apparently no effect upon other magnetic properties.

The following are analyses of two samples of tungsten magnet steel:

Carbon	.71	Carbon	.56
Silicon	.15	Silicon	.17
Manganese	.57	Manganese	.28
Tungsten	4.00	Tungsten	6.23

The manganese content is probably of no special significance in this instance. Any large admixture of manganese has the curious property of rendering steel almost perfectly non-magnetic. However, a .60-.70 carbon steel containing from .75 to 1.00 per cent. of manganese has been used for a cheap grade of magnets employed in telephone work.

Tungsten steel such as the above sells at from 14 cents to 15 cents, with extra charges for special sizes, while the cheaper grades of ordinary magnet steel may be bought for 3½ cents per pound.

Certain grades of chrome steel make very retentive magnets, but seem to be no cheaper than good tungsten steel, while being much more delicate to work as regards the heat treatment.

There are special carbon magnet steels made which, it is claimed, equal tungsten steel for practical purposes, but the general opinion seems to be that the high tungsten steel is the proper material, all things considered. A great deal of secrecy surrounds the composition of most special magnet steels, the manner in which the components are introduced and the handling of the metal.

WORKING THE STEEL.

(3) It is generally held that the less the steel has to be heated during the forming process the better the final results will be. It should be worked at the lowest practicable temperature and protected as far as possible from oxidation. Whatever scale is formed should be removed and the magnet should be put into a smooth condition before magnetization as well as be examined for cracks.

It is common practice to heat the steel in the bar in a gas furnace to the lowest temperature required for safe bending and to use a die press or "bulldozer" to give the requisite form. If the steel could be sheared and formed cold it would probably be an advantage from the magnetic standpoint, as annealing is detrimental, but it is very difficult to secure a steel which will not fracture in the shears, break while being bent into form or spring out of shape after forming, unless these operations are performed under heat. Tungsten steels can be drilled cold, but it seems difficult to retain the desired form unless the strains due to the bending are released by annealing. Some makers recommend that the bending be accomplished in several low heats not exceeding 1,400° Fahr., and that all heat should be applied rather slowly.

HARDENING PROCESS.

(4) The hardening process should leave the steel "dead hard" throughout, as only when in that condition will it possess the maximum retentivity. Every grade of steel requires its own treatment, and almost every concern producing magnets has developed its own procedure.

A certain maker of a high tungsten steel states that it should be heated to about 1,500° Fahr., not too rapidly, and quenched in cold flowing water. All scale should be removed before quenching, as otherwise the hardening may not reach the centre of the metal. This should give the metal a smooth, silky fracture of a gray cast, overheating being indicated by a white, open grained fracture.

Other manufacturers of high tungsten steel recommend a hardening temperature of 1,600° to 1,700° Fahr. and quenching either in cold salt water or in clear running water. Still other steel makers mention slightly different temperature ranges around 1,550° or 1,600° Fahr., but all agree that cold running water or brine is the best quenching medium.

MAGNETIZATION.

(5) Magnetization seems either to be effected by slipping the two poles of the magnet into magnetizing coils, through which a powerful direct current is passed, or by placing the poles of the magnet blank in contact with the two poles of a powerful electro-magnet. It is understood that the best results are obtained by magnetizing with the pole pieces attached. When magnetizing with the coils, the magnetic circuit should be closed by a keeper. In the second method of magnetization the magnet blank acts to close the magnetic circuit. The flux passed through the magnet during magnetization should be high and considerably in excess of what it is expected to retain, but the best density to be used is arrived at only by experiment. It is generally believed that the magnetizing force should not be withdrawn suddenly, when the magnetizing process is complete, but should be gradually reduced to zero. Mechanical vibration of the magnet blank during magnetization has been claimed to assist the process, by favoring the adjustment of the molecules into the correct magnetic positions. Tapping of the metal by a mechanical device, during the charging process has been recommended.

AGEING PROCESS.

(6) Every magnet tends to lose its strength, under changes of temperature, and when subjected to shocks, especially those of a sharp character. The reaction produced by the current flowing in a magneto armature tends to produce the same result. Just after magnetization a magnet's strength is greater than it ever will be later, as almost everything which happens to it will cause weakening. The deterioration is comparatively rapid at first, but becomes progressively slower with time, until a strength is reached which is fairly constant under any but extraordinary conditions. The lapse of time and the shocks and temperature changes of practice will finally bring about a fairly stable condition, but it is sometimes more desirable to artificially "age" a magnet, so that the stable value of its magnetization may be at once known before it is put into service, and so that there will be but a slight deterioration after it reaches the user.

Some magneto manufacturers age their magnets, rejecting those which show inferiority after the process has been applied

Aging may be accomplished by artificial temperature changes, by vibration or by other means. The magnets may be alternately plunged into boiling water and exposed to the air a considerable number of times, or they may be tapped by a mechanical vibrator for a certain period. After being aged in one or the other of these ways they may be again magnetized and finally aged. Exposure to an atmosphere of live steam for a number of hours, remagnetization and a second steaming is sometimes resorted to and the spinning of a copper disc between the poles, in which eddy currents of a demagnetizing tendency are produced, has been used as a method of ageing.

The figures obtainable as to the final strength of magneto magnets when in a finished condition vary rather widely. A flux of about 65,000 lines per square inch in the magnet probably represents good practice, although some makers claim flux densities of 75,000 to 90,000 lines per square inch. These latter figures seem rather high. With pole pieces of the average form and size and air gaps of customary width it may be presumed that the flux density in the gap may be 15,000 to 20,000 lines per square inch.

Imported magnet steels seem to be held in very high esteem in this country, but American steel makers are producing grades which are believed to be excellent in every respect. Some magneto builders import the finished magnets instead of going into the difficult technique required for their production.

There seems to be a general belief that but very few concerns can produce magnets thoroughly successful in service in automobile magnetos, the impression being current that the magnets of the average magneto require too frequent remagnetization. That remagnetization is required in many cases after long use is very often the case, and there is no doubt that the production of magnets that will withstand automobile service is a matter of great delicacy. Improvements are being made along this line, however.

The suggestion is here made that the permanence of magneto fields, in service, might be increased by providing the machine with a resilient mounting, such as a rubber cushion, so designed as not to interfere with the drive. It would seem that vibration might thus be somewhat reduced in this manner and its demagnetizing effect sensibly diminished.

A return from the push pedal to the "piano" or press pedal is noticeable in several makes of light cars seen at the Paris Salon and at the Olympia Show in London. One of the reasons given for this reversion is that in these cars the leg room between the seat and the dash is insufficient to comfortably operate push pedals. The piano pedal can be operated in a comparatively restricted space, hence its adoption.

The Tire Problem.

By E. Favary.

While automobile design and construction have undergone great changes for the better during the last ten years, the tire problem has been at a standstill; in fact, in some respect tires are worse to-day than they were formerly, viz., in the matter of resiliency. In order to minimize punctures and blowouts, resiliency had to be sacrificed, and this reduced resiliency—due to an increase in the thickness of rubber and canvas and the use of steel studded leather tire protectors, etc.—is the cause of many breakdowns arising from continuous vibrations.

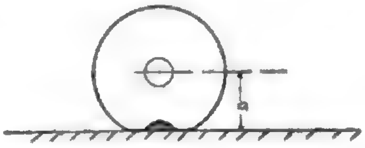


Fig. 1.

Excessive vibrations cause a disintegration of the machinery and an untimely fatigue of the metal employed in the construction of the entire automobile, and, no doubt, many serious accidents, arising from the breaking of steering knuckles, axles, etc., can be directly traced to it. Yet, measures had to be adopted to reduce tire troubles, which probably amount to about 90 per cent. of all the breakdowns occurring on the road, and, worst of all, they usually come without warning. There can be no doubt that thousands of people who would like to buy machines refrain from doing so because they cannot cope with the large upkeep expense due to the tires. Many owners delight in taking care of their machines and to drive them, but they have to engage chauffeurs for removing big tires on the road, jacking up the wheels, etc., which means soiling clothes and hands and hard physical labor, and a person not used to it can not do it without ill effects afterward.

ADVANTAGES OF THE PNEUMATIC TIRE.

The chief advantage of the pneumatic tire is its ability to absorb small obstructions on the road without raising the centre of the wheel (see Fig. 1). Tires having non-deformable rims will, when passing over obstructions, raise the entire wheels (see Fig. 2), and therefore the entire weight resting on the wheel. As the car is going at speed the momentum will cause the wheel to shoot over the obstruction after it is raised, and land it on the ground at some distance from the obstacle. All this means a loss of power, for whenever we raise a weight any distance we expend energy which can be computed in foot pounds.

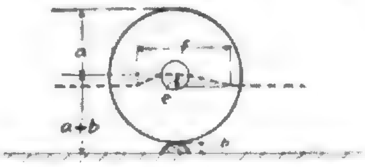


Fig. 2.

If a very elastic or resilient medium, like helical springs (see Fig. 3), is interposed between the outer (non-deformable) rim and the centre of the wheel, there would be a loss of power nevertheless, for in order to compress a spring we have to expend energy, and if such a spring tire passes an obstruction the first sudden impact will be taken up by the spring and the centre of the wheel will remain at approximately the same distance from the ground. In other words, if *a* is the radius of the wheel, and *b* the height of the obstruction, at first the springs in the lower half will be compressed, leaving the distance *a* the same as before, and increasing the length of the upper spring spokes to *axb*. An instant later, however, the impact imparted to the lower end of the spring will be transmitted to the upper end, thus raising the weight resting on the wheel. The dotted lines in Figs. 2 and 3 show the path the centre of the wheel will take in both cases, the obstruction being the same in height, and the wheel traveling at the same speed. The horizontal distance of the dotted line corresponds to the distance traveled. As can be seen, the distance *f* is greater in Fig. 3 than in Fig. 2, but *e* is smaller, showing that the weight is not raised to the same height.

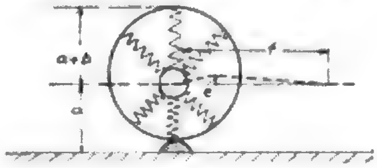


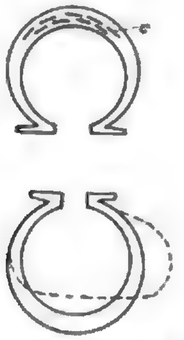
Fig. 3.

DISADVANTAGES OF THE PNEUMATIC TIRE.

The pneumatic tire being the most efficient, and also preventing vibrations to a great extent, it is almost universally used, and many attempts have been made to overcome its bad features, the most common of which are punctures, blowouts, rim cuts, valve leakages, skidding and road destruction. In order to minimize the first three evils the thickness of the rubber and the canvas was increased, but this only partly did away with these troubles, while, on the other hand, it reduced the resiliency. Other attempts were in the direction of placing steel plates, a steel armor, or a fine chain in the inside of the casing, between the rubber and the canvas, or between several layers of canvas. In Fig. 4 *c* represents small plates of steel, so arranged as to be flexible in all directions. While this would prevent punctures, it does not prevent blowouts or rimcuts, and, what is more important, it is impractical, as the steel will wear through the canvas and rubber sooner or later, and all attempts in this direction seem to have failed for this reason.

SKIDDING.

The pneumatic tire is especially liable to skidding, more so than a spring tire. A pneumatic tire being round, it facilitates skidding, whereas a spring tire can be made square, which will tend to minimize skidding, as the edge will grip the surface of the ground. (See Figs. 5 and 6.) Fig 5 shows in dotted lines the shape of the pneumatic tire when there is a tendency to skid. Whenever an automobile deviates from a straight course, or when it turns a corner, there is a greater pressure on the outer wheels, whereby the air in the air tube is compressed to a higher degree, and thus the surface area in contact with the ground is increased. The greater the surface area for a given weight, the smaller the pressure per square inch, and the lower the coefficient of friction. If the surface between the tire and the ground could be the same, the increased pressure on the outer wheels would increase the pressure per square inch and consequently the coefficient of friction, thus reducing skidding. The author recalls an incident where the drivers of the old London Electric Cab Company refused to take out cabs having wider solid tires. The tires of all the cabs were of solid rubber, about 1½ inch in width, and in order to increase their life about one-half dozen cabs were experimentally equipped with 2¼ inch tires. After having used them several times the drivers simply refused to drive the latter, on account of the increased skidding.



FIGS. 4 AND 5.

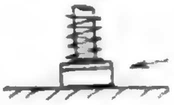


FIG. 6.

In spring tires, whenever there is an increased load on the wheel, the surface in contact with the ground remaining about the same, the pressure per square inch is increased. Furthermore, if there should be a side pressure (when there is a tendency to skid) or when in turning a corner the wheels on the inside tend to rise from the ground, the spring tire will assume a shape as shown exaggerated in Fig. 6, showing that the bearing surface is actually reduced.

DESTROYING ROADS.

Pneumatic tires are more apt to destroy roads than spring tires having a flat or square tread of the same width (see Figs. 7 and 8).

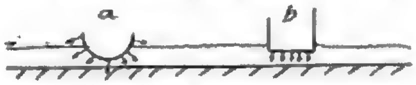


FIG. 7.

Take, for instance, a case like that of Fig. 7, showing a cross section of the road; *m* represents deep mud, sand, dust or a soft road bed. The pneumatic tire being round, it has a tendency, as it comes in contact with the ground, to force the surface material sidewise, as shown by the arrows, drawn at right angles to the tangents. A flat rim, on the other hand, has a tendency to compress the road (see *b*), rather than to squeeze it aside or to make deep ruts. The pneumatic tire is alike destructive to hard road beds, however, as seen from Fig. 8. Take an ordinary country road which is full of small ruts or furrows. The round tire will always tend to slide to the bottom of the grooves, whereas the flat rim of the spring tire will tend to depress the hills and render the road surface more even, or at least it will not damage it as much.

Other attempts to render the pneumatic tire more durable were in the direction of using a number of inner tubes or rubber balls in the interior of the ordinary inner tube (see Fig. 9). These attempts proved impractical, as the larger amount of rubber rendered the tire harder, and if several tubes were punctured, or if a blowout occurred, the tire became entirely useless, as it would be very difficult to execute repairs, except in the tire repair shop. It was also attempted to fill the inner tube with some rubber compounds of small density. In order to have the tire hard enough the compound must be forced into the tube under pressure, and this amounts to the same thing as a solid rubber tire and has the same objections.

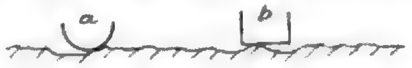


FIG. 8.

SOLID RUBBER TIRES.

Ordinary solid rubber tires are too hard and cause too much damage by reason of the great vibrations. Experiments were made to use a great thickness of rubber so as to render it as soft as, or softer than, the pneumatic tire, and thus to enable small obstacles to embed themselves in it, the same as in the pneumatic. These attempts were bound to fail, on account of the poor elastic efficiency of rubber. A simple experiment to test this efficiency can be made as follows: Take a block of rubber of any convenient size (see Fig. 10), and place a weight of, say, 50 pounds on it. The rubber will be depressed to *a* (not compressed, as rubber will only change its form). Now place another 50 pounds on it and it will be depressed to *b*. If 50 pounds were now removed, the rubber would not return too, but only to *c*. The distance between *a* and *c* shows the loss of energy.

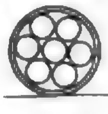


FIG. 9.

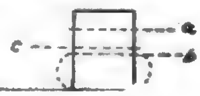
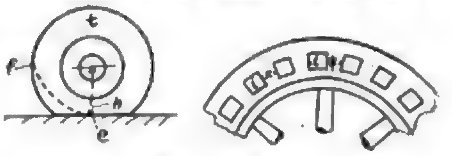


FIG. 10.

In other words, rubber returns only a small amount of the energy imparted to it. If a wheel is provided with a solid rubber tire *t* of a great height (see Fig. 11), it can easily be made as soft as a pneumatic tire, and to absorb small obstructions on the road. If such a wheel were run on the road the rubber in front would be depressed by the rotation. The depression of the rubber would be greatest in a vertical line through the centre of the wheel, indicated by *h*. As soon as the point *e* leaves the ground, the rubber will, theoretically, not resume its original position immediately, but only after a certain interval of time, say until the point *e* reaches *f*, as shown by the dotted line. It can easily be understood, by noticing the shape of the tire when the wheel is rotating, that the continual compression of rubber in front amounts to the same thing as going through deep mud, or climbing a continuous grade. Thus solid rubber tires consume a great deal more energy than pneumatic or spring tires, for a given resiliency.



FIGS. 11 AND 12.

The different cushion tires, like that shown in Fig. 12 (*i* being air spaces), act the same way as solid tires. In order to obtain sufficient strength in the rubber the thickness at *k* must be made sufficient to be able to support the weight to be carried, and the air spaces *i* can hardly be said to increase the elastic efficiency of the rubber.

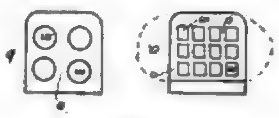


FIG. 13.

Still other attempts to supplant the pneumatic tire led to the constructions shown in Fig. 13, which shows cross sectional views *a* and *b*, of two different constructions. The object in view in these designs is to get the enclosed air spaces *m* to act the same as a pneumatic tire when there is a pressure on the outside of the tire, when the air will be compressed and form a cushion. Unfortunately, the rubber will bulge sidewise, as shown by the dotted lines, and not offer sufficient resistance, unless the rubber at *o* is very thick.

Autogenous Welding by the Oxy-Acetylene Flame.

By Henry Cave, A. M. I., M. E.

EARLY HISTORY.

The discovery of the fact that a very high temperature could be obtained by the combustion of acetylene with oxygen followed very closely upon the commercial development of acetylene, H. Le Chatelier, of Paris, being credited with having first introduced the subject, in a note to the Academy of Sciences, December 30, 1895, in which he showed by calculations that with an equal volume of oxygen acetylene would give a temperature of about 4,000° centigrade, or 6,350° Fahr. His calculations were based on his knowledge of the oxy-hydrogen flame, which had then been in use for some years and which has a temperature of about 4,500° Fahr.

It was, however, not until six years later (1901) that this discovery could be put to any practical use, owing to the difficulty of constructing a torch in which the combustion would not travel back, due to the rapid propagation of the flame; in other words, in which there would be no "back flashing."

This development was largely due to the discovery of the absorbent power of acetone for acetylene, producing what is correctly termed dissolved acetylene, but more commonly "compressed" acetylene. The inventos, Messrs. Fouché and Picard, both engineers of the French "Acetylene Dissous" Company, exhibited this torch to the French Society of Physics in December, 1901. Though the torch they exhibited was handicapped by the necessity of diluting the acetylene with ether to prevent back flashing, it was fairly successful.

In March of the following year they exhibited a torch in which they had eliminated this objectionable feature, using only acetylene and oxygen, but under considerable pressure, which may be best termed the high pressure torch. The high pressure increases the speed of the gases beyond that of the propagation of the flame, and therefore eliminates flashing back. The torch, however, was subject to the objection that it blew a considerable proportion of the fused metal out of the weld, thus retarding the operation of the welding.

Edmond Fouché then became connected with a company making acetylene lighting generators, in which the gas was produced at a pressure of only a few ounces per square inch. He set to work to develop a torch which would work satisfactorily under these conditions, but it was not until the end of 1903 that he was able to do this, the result being what is called the "low pressure torch." In this device there is only sufficient pressure on the acetylene to cause it to flow into the torch, the "injector" action of the oxygen carrying it through from that point.

About this time Camille Rodrigues-Ely and Emile Gauthier, of the firm of A. Boas, Rodrigues & Co., of Paris, brought out a torch which operates at a pressure intermediate between the other two, and which has most of the disadvantages of the other two systems. For the purposes of this article this torch is termed the medium pressure torch, though, owing to the first torch invented not having been introduced into this country, it is known here as the high pressure torch.

THE HIGH PRESSURE TORCH.

The high pressure torch can be used only with acetylene under a high pressure, and it can, therefore, be operated only with dissolved acetylene, as acetylene gas cannot be safely compressed above 30 pounds per square inch. This condition considerably increases the cost of the operation, which is further increased by the fact that some of the molten metal is blown out of the weld, owing to the extreme pressure.

The main advantages of the system are the perfect control and the uniformity of the mixture, which can be regulated by varying the amount of either gas as required. Also, the high pressure, tending to a close molecular contact of the gases, results in the economical use of oxygen and in a maximum strength of the weld. The flame remains constant under all conditions.

THE LOW PRESSURE TORCH.

This torch, because of being based on the principle of the injector, has the disadvantage that it requires constant adjustment to preserve a neutral flame; that is, a flame in which the correct proportions of acetylene and oxygen are brought together, resulting in complete combustion. As is known, the suction of an injector varies as the square of the velocity of the propelling fluid. The amount of acetylene drawn in may vary considerably, owing to variations in the temperature of the nozzle and consequent expansion or contraction of the orifice through which the mixture issues, and also on account of particles of metal partly obstructing the orifice.

The variation in mixture thus produced, if not corrected, will affect the quality of the weld, as an excess of acetylene will produce a carbonized weld, while too much oxygen results in oxidation. It is, however, quite possible, if due care is exercised, to produce excellent work with this torch, and it is being extensively used for all classes of welding. This torch is generally made in such a manner that the size of the flame cannot be varied, consequently a number of torches are required if it is desired to take care of all classes of work, each one consuming a different quantity of gas.

THE MEDIUM PRESSURE TORCH.

The medium pressure torch (Fig. 1), better known in this country as the high pressure, has the advantage of a perfectly constant mixture, as both the oxygen and acetylene come into contact under appreciable pressure. All the advantages of the high pressure torch are retained, without the attending disadvantage of being compelled to use dissolved acetylene. Both gases being under pressure, and the flame of each being fixed by the size of the holes in the inner end of the tip, in which the gases combine, the mixture is unaffected by variations at the orifice, only the size of the flame being changed by variations at this point. The character of the flame remains the same after the adjustment has once been made. This adjustment being carried out by varying the pressure of the gases at the reducing valves, the torch can be extinguished and lighted again any number of times without requiring readjustment.

Each torch is supplied with a number of tips, which give flames of different sizes, thus enabling a large variety of work to be carried out with the same torch and without detaching the hose connections. The small holes at the end of the tip are intended to prevent back flashing, which will sometimes occur when the operator touches the work with his torch. The small holes at the inner end of the tip prevent the flame from extending further into the torch.

This torch is generally used with acetylene produced by a special pressure generator working up to a maximum pressure of fifteen pounds per square inch, this being perfectly safe, as may be judged from the fact that it has been passed by the National Board of Fire Underwriters. The complete equipment is shown in operation in Fig. 2. The acetylene can also be drawn from a tank of dissolved acetylene. A reducing valve is used in either case to regulate the pressure according to the size of the tip. This tank equipment is ideal for portable work, as the weight to be transported is not great, thus enabling the apparatus to be used on work that cannot

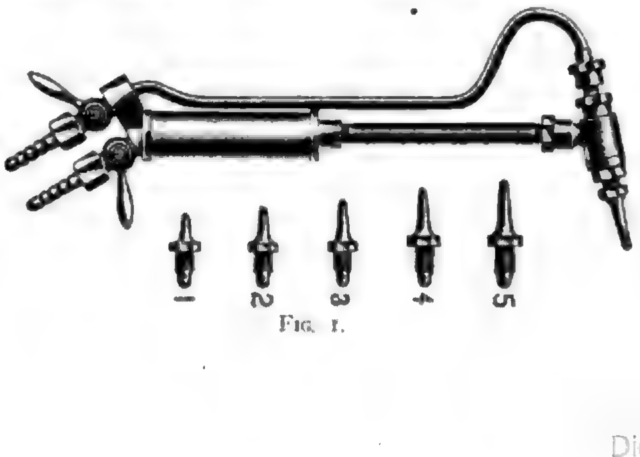


Fig. 1.

TABLE I.

All cylinders are charged at 150 pounds pressure.

Diameter Inches.	Length Inches.	Capacity Cubic Feet.	Weight Pounds.
7	24	50	50
8	30	80	75
10	30	125	105
12	36	225	120
14	48	400	349
16	48	500	435

be moved, or where the cost of transportation to the plant would be prohibitive.

Of course, acetylene stored in this way costs considerably more than that produced by direct generation, but the additional cost is a small matter in most cases where the work cannot be brought to the apparatus. Table I gives some data on dissolved acetylene tanks, which will help the reader to realize their advantages for transportation.

INTRODUCTION INTO AMERICA.

So far as is known, the first oxy-acetylene torch to be used in the United States was sent by Mr. Fouché, while he was still experimenting (1903), to Mr. Bournonville, who was then chief engineer of the Commercial Acetylene Company, and with this torch Mr. Bournonville was successful in welding copper and steel without the use of any flux whatever. Mr. Bournonville then began a series of experiments, but it was several years later before the matter was taken up in this country on a commercial basis. Though Mr. Bournonville continued to experiment, he finally decided that it was better to adopt the ideas of the French inventors and, therefore, spent some time in France investigating the matter. He then purchased the patents for the high pressure torch for the Davis-Bournonville Company. The low pressure torch has also been introduced into this country, and there are now torches on the market here which excel those produced abroad, at any rate in structural details, though the Frenchmen are still away ahead in the number of plants in operation and the variety of work being turned out.

REASON FOR HIGH TEMPERATURE OF THE FLAME.

As is well known, acetylene is composed of 92.3 per cent. of carbon, the remainder being mainly hydrogen, and it contains more heat units than any other gas, two and one-half times as many as coal gas, five times as many as hydrogen. When acetylene is burned in the atmosphere the combustion is very incomplete, owing to the large proportion of carbon in the gas and the small proportion of oxygen (20 per cent.) in atmospheric air. The resulting flame has a temperature of only 1,800° Fahr., which is considerably less even than that of a coal gas flame.

When pure oxygen is used in the correct proportion with acetylene, and thoroughly mixed with it, complete combustion of the carbon takes place. This, together with the elimination of the nitrogen of the air (80 per cent.), produces an intense heat, and gives the hottest flame known.

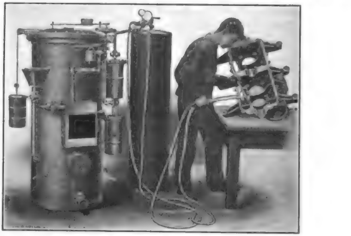


FIG. 2.

Owing to the fact that oxygen and hydrogen refuse to unite at temperatures above the dissociation point of water, the hydrogen in the acetylene burns separately with oxygen from the outer air, forming what is called "an envelope consisting of a long, irregular, semi-luminous flame, of comparatively low temperature, which surrounds the small, clearly defined, intensely luminous flame which gives the heat for welding. This envelope protects the welding flame from the cooling effect of the nitrogen in the air and also protects the hot metal from oxidation.

ADJUSTMENT OF THE FLAME.

When a little too much acetylene is being fed to the flame, a less luminous cone is projected beyond the welding flame, giving it an irregular appearance. This is taken advantage of in obtaining the correct adjustment. When this cone just coincides with the welding flame, giving a clearly defined outline, the mixture is correct for welding. If the amount of acetylene is reduced beyond this point, the welding flame becomes "peaked" and pink in color, owing to the excess of oxygen. The condition of the flame can also be judged by the resulting weld, the metal glowing very intensely when the flame is carbonizing, and boiling up when too much oxygen is used.

PROPORTIONS OF GASES.

A curious fact showing the difference between the mixtures obtained in the low pressure torch, as compared with the medium and high pressure torches, is that whereas the former requires 1.70 times the volume of acetylene as oxygen to give the correct flame, the others only require a ratio of 1.30, resulting in considerable economy in favor of the latter. This is probably due to the much more intimate mixture produced by the high pressure gases impinging at right angles on one another.

COST OF OPERATION.

The cost of operating the oxy-acetylene torch as compared with oxy-hydrogen and oxy-coal gas torches, is clearly shown in Table II., which is deduced from figures given in the *Bulletin Technologique* of September, 1907, the calculations being based on generator acetylene at one cent per cubic foot, "compressed" acetylene at 2½ cents per cubic foot, oxygen at 3 cents and hydrogen at one cent, the coal gas being figured at $1.25 per thousand cubic feet. As these figures were based on the use of the high or medium pressure torch, figures are appended which give the corresponding values for the low pressure torch. Table III. gives the cost of welding sheet and plate steel with the medium pressure torch, and includes the operator's wages, which is figured at 30 cents per hour. This table is based on straight forward work; short jobs cost more, owing to the time taken to give the initial heat.

TABLE II.

	Oxy-Acetylene Mixture.	Oxy-Hydrogen Mixture.	Oxy-Coal Gas Mixture.
Number of B. T. U obtained by complete combustion of one cubic foot of gas............	1570	290	616
Temp'rature (Fahr) obtained by complete combustion of the mixture (approx.).........	6350°	4000°	3150°
Cubic feet of oxygen required to burn one cubic foot of gas to obtain the best welding flame (from practical tests made)...........	1.30* 1.70†	0.25	0.67
Cubic feet of oxygen required to obtain 1000 B. T. U. with a welding flame............	0.765* 1.00†	0.86	1.09
Cubic feet of heat producing gas required to obtain 1000 B. T. U. with a welding flame..	0.59	3.44	1.63
Cost of 1000 B. T. U. (cents)...........	2.80* 3.50† (Generator acetylene) 3.78* 4.50† (Dissolved acetylene)	5.92	4.20

* Medium pressure torch used.

† Low pressure torch used.

LIFE OF TIP.

On considering the intense temperature of the flame, it might be anticipated that the tips would prove a source of considerable expense, particularly as they are only made of brass, but this is not the case, owing to the fact that the pressure under which the torch operates carries the flame away from the tip, leaving an unnoticeable space, across which very little heat passes, and this is absorbed by the cool gas passing through. Owing to the higher pressure, this is more particularly the case with the medium and high pressure torches. In these the tip remains so cool that it can be unscrewed by the bare fingers immediately after extinguishing the flame, unless it has been operating on a job where the flame is reflected back on the torch.

RISK OF BURNING METAL.

Of course, though the flame has a temperature between 6,000 and 7,000 degrees, it must not be assumed that the metal even approximates this heat, as its rapid heat conductivity prevents this. There is no danger of burning the metal, except where the flame is projected on small pieces not in contact with a sufficient body of metal to draw away the heat, and these do not cause any trouble, as the operator takes care of this condition. Even the low melting point of aluminum is offset by its greater conductivity, and copper, owing to its high melting point and rapid conductivity, requires a larger flame for the same size of work than any other metal.

TABLE III.—APPROXIMATE COST OF OXY-ACETYLENE WELDING.

Tip No.	Thickness of Metal.	Consumption of Acetylene Per Hour. Ft.	Consumption of Oxygen Per Hour. Ft.	Lineal Feet Welding Per Hour. Feet.	Cost of Labor Per Hour. Cents.	Total Cost Per Hour.	Cost Per Lineal Foot.
1	$\frac{1}{32}$ to $\frac{1}{16}$	2.8	3.6	50	30	$0.43	$0.0087
2	$\frac{1}{16}$ to $\frac{3}{32}$	4.5	5.7	30	30	0.51	0.017
3	$\frac{3}{32}$ to $\frac{1}{8}$	7.5	9.7	25	30	0.66	0.026
4	$\frac{1}{8}$ to $\frac{1}{4}$	11.7	15.0	16	30	0.86	0.054
5	$\frac{1}{4}$ to $\frac{3}{8}$	18.0	23.0	10	30	1.17	0.117
6	$\frac{5}{16}$ to $\frac{7}{16}$	25.0	32.0	7	30	1.51	0.216
7	$\frac{7}{16}$ to $\frac{1}{2}$	32.5	41.5	5	30	1.87	0.374
8	$\frac{1}{2}$ upward	48.5	62.0	..	..	2.64	....

PRINCIPLE OF THE PROCESS.

The principle of the oxy-acetylene welding process is based on the fact that the flame has such a high temperature that heat is supplied to the metal much faster than it can be conducted away by the surrounding material and dissipated by radiation, thus fusing the metal before the heat is wasted on the surrounding parts. Coal gas flames give a temperature slightly higher than the point of fusion of most metals, but owing to the conductivity of the metal the heat is carried away as rapidly as it is supplied by the low pressure flame, and unless the part is small the heat continues to be absorbed by the metal until the radiation from the surface of the heated portion is sufficient to balance the heating effect of the flame. The metal at no point then exceeds a certain temperature, which is a balance between the temperature of the flame and the rate of conductivity and radiation of the metal. Under certain conditions cast iron can be brought to a plastic state, in which condition it can be "rubbed" together, but this can scarcely be termed welding, though it answers for some purposes.

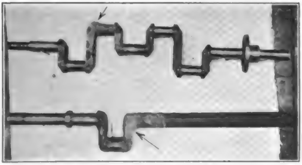


FIG. 4.

ILLUSTRATIONS.

As a practical illustration of what can be accomplished with the oxy-acetylene torce, illustrations are given, showing parts made from different metal that have been successfully welded by the process. Fig. 3 shows the cast iron head from a 12 horse power racing motorcycle, part of the flange having been broken and welded in, and at the same time metal has been added around the exhaust port to give strength to support an exhaust pipe. Fig. 4 shows two crank shafts that have been welded, metal having been added to give additional strength, it being proposed in the case of the four throw shaft to shorten the bearing somewhat and leave as much of this added metal as possible. Fig. 5 is an aluminum crank case from a six cylinder imported car, the broken feet of which were satisfactorily welded on, metal being added to the inside so as to nearly fill in at the weld, thus assuring ample strength. The welds are indicated by the arrows.

LITERATURE.

Owing to the scarcity of literature on this subject it may be of interest to those interested to learn of a pamphlet entitled "Autogenous Welding of Metals," by L. L. Bernier, also that there is a well written section on the subject in "Calcium Carbide and Acetylene," a bulletin of the Department of Chemistry of the Pennsylvania State College.

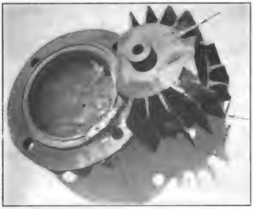


FIG. 3.

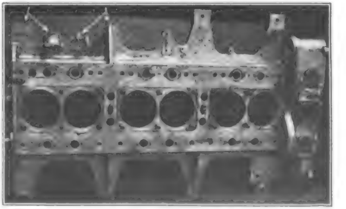


FIG. 5.

Some Examples of Recent German Automobile Design.

By Ernst Valentin.

The German automobile industry has had quite a peculiar course of development. In the early years of the automobile movement it showed the way with its designs for the whole of Europe; later it was surpassed by the French and the Italians, while at the present it is again undeniably marching at the head of all nations.

With the exception of the Daimler firm, which has remained faithful to its characteristic Mercedes type up to quite recently, the other large German makers passed through many changes in design, until they arrived at the now standard arrangement of the parts generally recognized as correct in Europe. In front, behind the water cooler, a gasoline motor with upright cylinders, then the clutch which forms the connection between the crank shaft and the change speed gear, next the change speed gear, with its three or four sets of toothed wheels, and finally the drive to the rear wheels through chains or Cardan shaft.

This adoption of two standard types, the so-called shaft driven type for cars up to about 28 horse power, and the chain driven type for cars with bigger motors, and especially heavy commercial vehicles, has facilitated the introduction of standards, which have greatly favored a reduction in manufacturing costs and the adoption of motor vehicles by the army administration. The Automobile Technical Society, a body of automobile engineers, has even recently commenced to issue tables of standards for the individual parts required in automobile construction, as, for instance, for screws, bolts, nuts, flange connections, levers, etc. In the present article a number of standard German automobile designs will be briefly described.

MOTORS.

Fig. 1 is a sectional view of the motor of Benz & Co., of Mannheim, which came into prominence through their racing successes the past year. This type of motor is used by the firm both for its chain driven and shaft driven cars. The cut shows a sectional view through one of the four cylinders of the motor. Two and two cylinders are cast together. The first thing that impresses one favorably in inspecting the drawing is that the separate parts, such as the bearing supports, etc., are not subsequently fastened in place with screws and rivets, as was often the case in former years, but that, on the contrary, provisions were made in the first place in the pattern for the brackets P for the cam roller levers, the brackets R for the ignition roller levers, the support for the magneto V and for the hand hole cover with oil glass fitting W, etc. Besides, the crank case has been so enlarged that it can be carried directly on the main frame. The sub-frames, formerly so much used, which served solely for carrying the motor and the separate change gear, are now found rarely or not at all on big cars, for the reason that the supposition that such sub-frames would facilitate the assembling, has been proven to be incorrect. Moreover, a crank case with integral crank arms extending from one side frame member to the other so much stiffens the frame of the car that no special cross members are necessary, and thus weight can be saved.

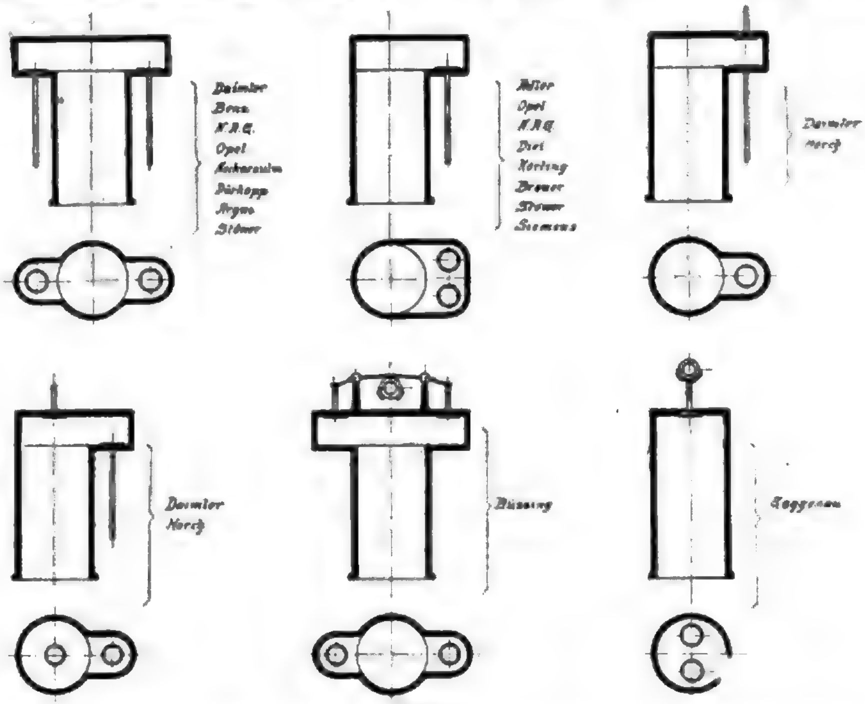


Fig. 2.

One matter on which it has so far been found impossible to agree in Germany is that of valve location. As is shown by the accompanying table, Fig. 2, not only are the valve arrangements of the leading firms entirely different from each other, but in some cases one and the same firm even uses different valve arrangements. There is also considerable variety as regards the arrangement of the cylinders relative to each other. Fig. 3 shows a diagram of the castings for the cylinders of two cylinder and four cylinder motors. Beginning at the left, we see, first, the arrangement of two cylinders cast together; next, two separate cylinders; then four separate cylinders; then four cylinders cast in pairs, and finally four cylinders all cast in a single block. After each diagram are mentioned the names of the firms using that particular construction.

The valve operation is generally so timed that the inlet valve opens 2-4 mm. after the upper dead centre position of the crank, and closes 1-2 mm. after the lower dead centre. The exhaust valve opens 12-18 mm. ahead of the lower dead centre, and closes 1-2 mm. after the upper dead centre position.

The practice of using a fixed point of ignition, especially in connection with the

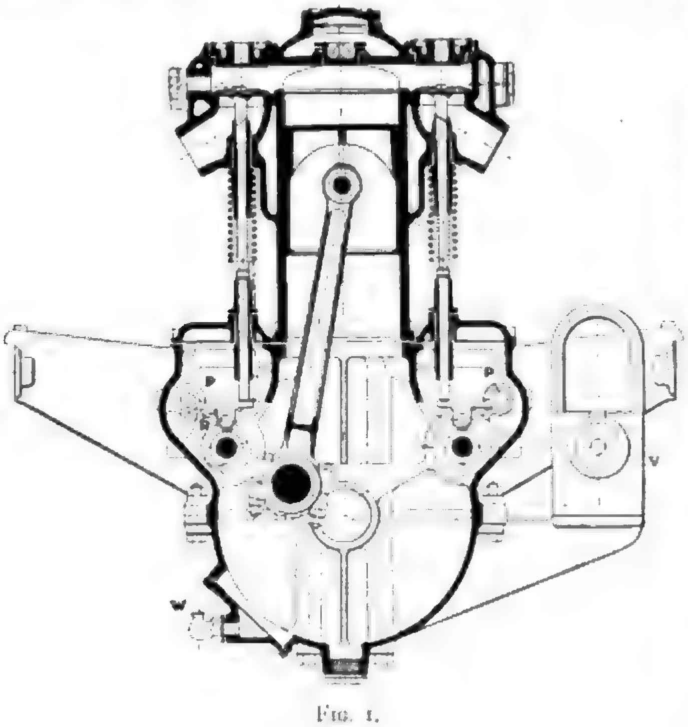


Fig. 1.

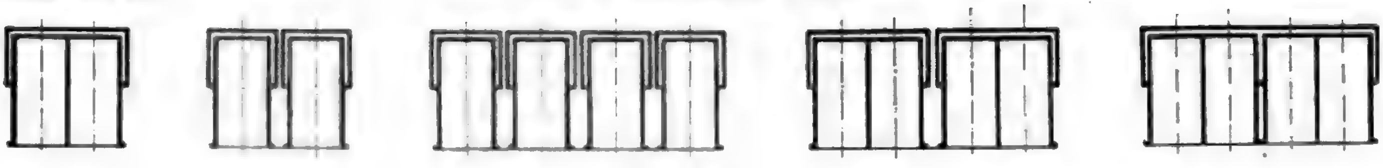


FIG. 3.

Benz.
Adler.
Opel.
Duerkopp.
Argus.
Stoewer.

Beckmann.

Beckmann.

Daimler.
Benz.
N. A. G.
Opel.
Neckarsulm.
Adler.

Dixi.
N. A. G.
Siemens.
Breuer.
Gaggenau.

low tension magneto system—in other words, doing away with spark advance and retardation—has generally been discarded again. The spark lever is also made independent of the throttle control lever. Fig. 4 shows a diagram of the general arrangement of the Benz ignition mechanism. N is a cam, on which rests a roller secured to the lever R. By moving the lever W around its pivot the cam roller can be moved to positions of early and late ignition. The lever C₁ forms a switch, and serves to electrically disconnect the make and break mechanism from the magneto while the motor is running.

Fig. 5 shows a make and break mechanism without provision for varying the point of ignition, which is used on the motor of the Neue Automobil Geslschaft, shown in Fig. 6. In contrast to the arrangement of Fig. 4, the two terminals of the make and break device are normally out of contact. The igniter rod is raised only shortly previous to the moment of ignition, and is then abruptly dropped by the heavy spiral spring. In former constructions, on the contrary, the contact was normally closed, and was only opened by the make and break mechanism at the moment of ignition. This difference in principle also explains the difference in the two operating cams, the cam of the Benz motor having a depression and that of the N. A. G. motor a protuberance.

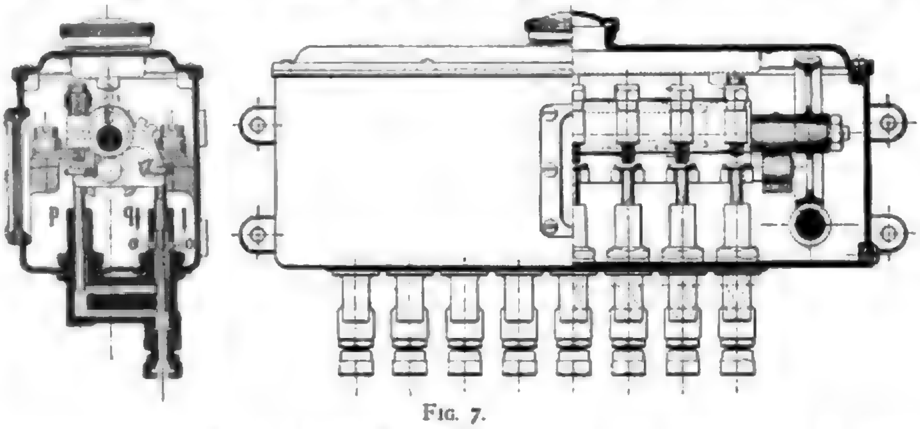


FIG. 7.

Important improvements have recently been made in the automatic lubrication of the motors. The lubrication of the motor requires great care in Germany, and especially in Berlin, for the reason that the police proceed very strictly against automobilists whose motors discharge smoke

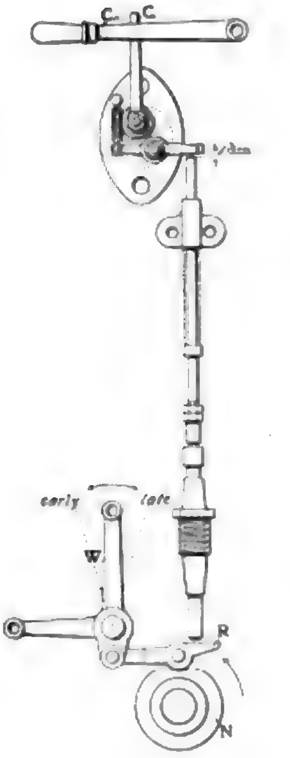


FIG. 4.

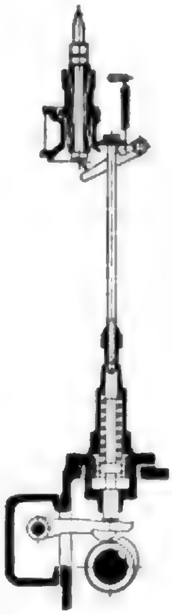


FIG. 5.

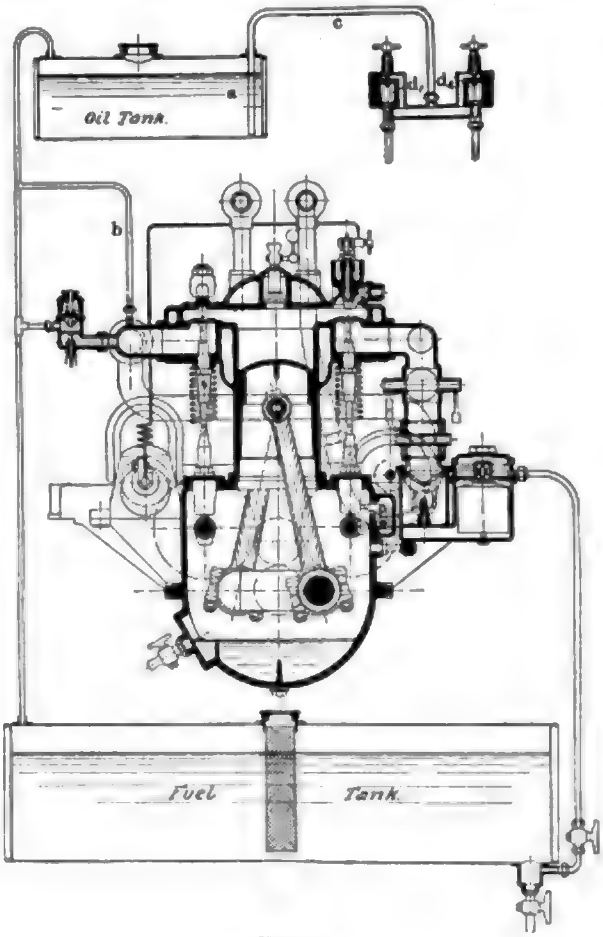


FIG. 6.

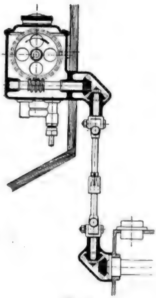


FIG. 8.

with the exhaust. It is known that particularly automatic lubricating systems tend to cause a smoke exhaust, for the reason that the driver, in the case of most such motors, has no means at his command for adjusting the lubrication. This is the reason why many motorists in Berlin prefer the old method, by which oil is supplied to the crank case at intervals by means of a special hand oil pump. The Friedmann pump, represented in Fig. 7, is very extensively used. In this pump an eccentric E operates the two pistons *p* and *q*, of which the first serves to feed and the second to distribute the oil. The oil in the reservoir enters the pressure chamber through the openings *o o*, and from there it is forced by the stroke of piston *p* to the point of application. The device is advantageously driven from the motor by means of bevel gears, as shown in Fig. 8. It is absolutely wrong to use for this purpose, or for any other purpose in automobile work, vertically running chains, for the reason that these, as soon as they become a little loose, begin to sway sideways, and then easily "climb" the sprocket.

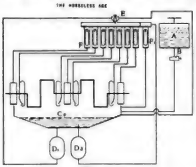


FIG. 9.

A peculiar system of automatic lubrication is used on the Adler cars. From a tank, A, as shown in Fig. 9, oil is admitted to the crank case by opening a valve, B, until it overflows through the gauge cock C. When the motor is in operation the oil pump D_1 draws oil from the crank case and forces it through the tube L and the adjustable valve E into the sight feeds F and the leads to the various points of application. The excess of oil is returned to the crank chamber. A second pump, D_2, serves to return the oil through a test sight feed, F_1, back to the crank case. As this test pump draws the oil from a point in the crank case below which the level of oil must never be allowed to fall, the supply of oil in the crank chamber need not be replenished from the tank A as long as the test sight feed F_1 shows a stream of oil. The interior of the sight feeds F, of which each one is separately adjustable, is shown in detail in Fig. 10. The method of supplying oil to the crank pin bearings is illustrated in Fig. 11. One of the oil leads coming from the sight feeds passes through a hole, *a*, in the crank chamber casting direct to the crank shaft bearing. Another oil lead discharges into the oil guard ring *b*, which delivers the oil by means of centrifugal force into the drill hole of the crank shaft, from where it flows through holes *f* to the crank pin bearing.

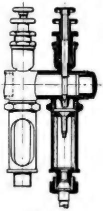


FIG. 10.

The simplest lubrication system is undoubtedly that by means of the pressure of the exhaust. This system, as applied to a motor of the Neue Automobil Gesellschaft, is shown in Fig. 6. The oil in the tank *a* is under pressure from the exhaust gases which are conducted to the tank through the tube *b*. The oil then flows through the tube *c*, extending down to the bottom of the tank, into the two adjustable sight feeds d_1 and d_2. The general design of this motor appears rather heavy, the reason being that the motor is intended for the commercial vehicles of this firm. For racing purposes the motor is very materially lightened in all parts. Thus, for instance, a connecting rod, which has been worked down to the very smallest dimensions in all parts, is shown in Fig. 12, and Fig. 13 shows the crank shaft of the six cylinder motor of the N. A. G., in which relatively large holes are bored through each journal and through the flange to which the flywheel is to be secured, with the object of reducing the weight to a minimum.

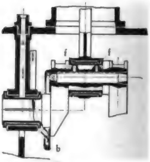


FIG. 11.

In the motor of the Ottenser Maschinenfabrik the oil tank and the fuel tank are placed in communication in such a manner that the exhaust gases pass through the oil tank before they enter the fuel tank, and the gases will escape and the fuel cease to flow to the carburetor as soon as the oil tank has become empty.

There is also very little uniformity with respect to the methods of supporting the fan for creating the necessary air draft through the radiator. Some firms support the fan from the radiator, as, for instance, the Neckarsulm Cycle Works, whose motor is shown in Fig. 14. The fan is here carried by a crossbar, which extends across the radiator on its rear side. The drive is effected in the well known manner by means of a leather belt. It is undoubtedly more advantageous to carry the fan on the motor itself. Such a construction is shown in Fig. 15, which represents the motor of the Stoewer firm of Stettin. In this case the fan is supported on the front of the cylinder block by means of a special cast base. In this case, too, the drive is by means of a flat belt.

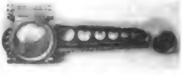


FIG. 12.

It is certainly most advantageous to rigidly connect the fan with the crank case, in order that the expansions caused by tem-

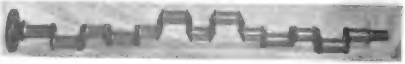


FIG. 13.

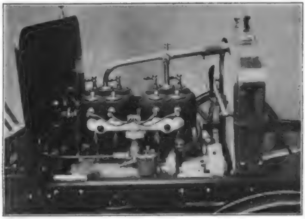


FIG. 14.

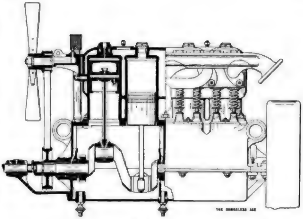


FIG. 15.

perature variations may not affect the drive of the fan. Such an arrangement is shown in Fig. 16, which represents the Dixi motor of the Fahrzeugfabrik Eisenach. In this case the fan is driven from the crank shaft direct by spur gears. A notable innovation of this motor resides in the fact that the cooling pump is mounted on the same shaft as the fan, which, though it may tend to simplicity, is subject to the objection that in case the pump has to be removed, as becomes necessary from time to time for the purpose of renewing the packing, this cannot be accomplished so easily as when the motor is mounted separately in the usual manner.

A peculiar arrangement is employed for carrying the fan on the Daimler motors mounted on the Zeppelin airship (Fig. 17). In front of the cooler is arranged a special bracket of channel steel, which bracket carries a tube hinged to it at the top. On this tube is carried the fan, which is driven by a very broad flat belt. The illustration, which shows the motor from the exhaust side, shows very plainly the arrangement of the cylinders, which are cast in pairs and provided with inlet valves located in the cylinder heads. These valves are operated by means of tappet rods and levers. The make and break mechanism is driven through a positive clutch from the same shaft which drives the circulation pump.

While the motors shown in Figs. 1, 6 and 14 still show the four cylinders cast in pairs, Figs. 15 and 16 show the new "block" arrangement of four cylinders, which is coming to be extremely popular in Germany of late, especially for small vehicles. Where this system is used it seems, however, advisable not to cast the whole cylinder block in one piece, as is shown in these illustrations, but to provide a separate plate on top, screwed to the casting, in order that in case of freezing of the water in the jacket not the very expensive cylinder casting but the somewhat thinner and less rigid metal plate will burst.

In connection with Fig. 15 attention might be called to the bearing support for the starting crank, which is cast integral with the crank case. As this bearing support is shaped in the form of an oil guard, it represents a convenient means for catching the oil that may work from the crank casing through the forward bearing. This motor is also provided with a thrust ball bearing directly back of the forward crank shaft bearing, on which the thrust due to disengaging the clutch is taken up.

CLUTCHES.

Many changes have taken place in the design of clutches in the course of the last few years. While formerly almost none but leather faced cone clutches were used, a few years ago a great many designers adopted the metal to metal, and especially the multiple disc clutch. Recently, however, there has been quite a noticeable reversion to the leather faced cone. In any case, the practice of placing the metal to metal clutch inside the change gear box, as was formerly occasionally done, has been entirely given up, for the reason that this not only makes it difficult to inspect and adjust the clutch, and also because the bronze dust worn off from the bronze discs of the clutch tend to increase the rapidity of wear of the toothed wheels. In the newer designs the tendency is to so arrange the clutch on the car that it can be adjusted and removed without disturbing any other parts. The Adler Works, in Frankfort-on-Main, which combine the motor and change gear box in a single rigid unit, place the clutch between the motor and the gear box in such a manner that it lies between the two oil tight housings, and is readily removable. Figs. 18 and 19 show the gear box and the cone disc type of

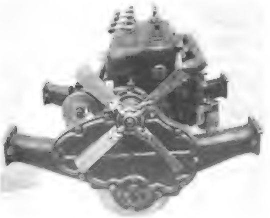


FIG. 16.

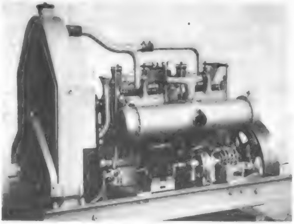


FIG. 17.

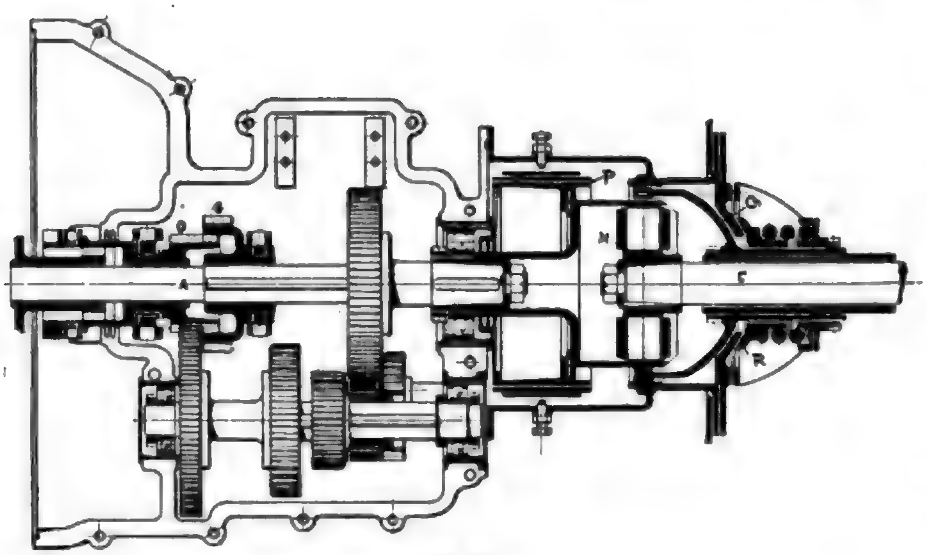


FIG. 18.

coupling. The metallic cone A is connected with the driving pinion O in such a manner that although it may move freely in an axial direction, it always drives the pinion. The housing B, which is screwed to the flywheel end, carries a corresponding female cone, C, which is pressed against cone A by means of springs D. By pressing on the pedal G the sleeve L, which also drives the driving pinion O, and which is actuated through the intermediary of levers J and K, acts on the levers M and overcomes the force of the springs, whereby the clutch is disengaged.

The Adler Works also employ another clutch, which is illustrated in Fig. 20, and which can be substituted for the cone clutch without necessitating any change in the motor or gear box. In this clutch the flange A, which is clutched to the driving pinion, is provided with two metal discs, B_1 and B_2, which are pressed by coiled springs D against the flywheel F and a disc lying between D_1 and D_2, respectively. The disengagement of the clutch is effected through the same lever system as described in connection with Fig. 19, by means of a pressure ring, C.

An entirely different metal to metal clutch is that employed by the Horch firm, which is illustrated in Fig. 21. The flywheel of the motor carries a drum, *a*, inside of which are arranged metal rings, *b* and *d*, of triangular cross section, the sections of adjacent rings being reversed and overlapping each other. By means of a second drum, E, fastened to the driving shaft, the rings are pressed against each other, so that *a*, *b*, *d* and *e* are clutched together as a rigid unit. The necessary clutching pressure is provided by the spring *f*, while a sheet metal plate, *c*, serves to render the whole oil and dust tight.

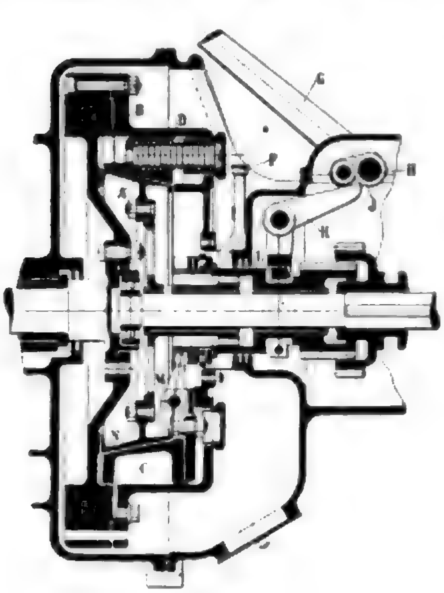


FIG. 19.

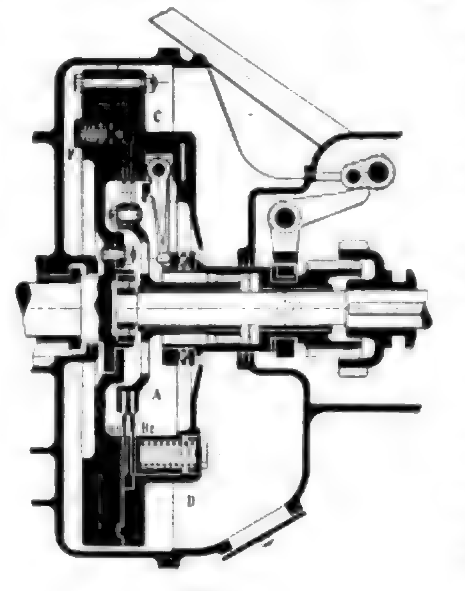


FIG. 20

In the following figures are shown a number of leather faced cone clutches. The first of these, Fig. 22, is of the type in which the pressure is in the direction toward the flywheel. This clutch is used by Scheibler in Aix-la-Chapelle for heavy trucks. The pressure of the coiled spring can be adjusted by means of a clamp nut from outside, as can also the position of the disengaging pedal, by adjusting the thrust ball bearing, without removing the whole clutch. The universal joint connecting the clutch with the change gear shaft is of specially careful design, and provided with bronze bushings which can be oiled from the outside. Besides, the joint is centered by means of a small spherical headed bolt under spring pressure.

In contrast to the clutch just described, the one shown in Fig. 23 has its mechanism enclosed, so that an adjustment of the spring pressure is not possible without taking the clutch down. The plan view shows very clearly the method of operating the clutch. By pressing on the clutch pedal *a*, which has a bearing on shaft *b*, which latter at the same time carries a second pedal, *c*, for operating the transmission brake, a forked lever, *d*, is operated, which moves around a stationary bolt, *f*. The forked lever contains a large ball bearing, *e*, which is connected to the clutch. The transmission of power from the clutch to the change gear shaft *h* is effected by means of a universal joint, *i*. As may be judged from the relatively substantial construction of the separate parts, this clutch is intended for a motor truck, the design being that of the firm of Erhardt in Dusseldorf.

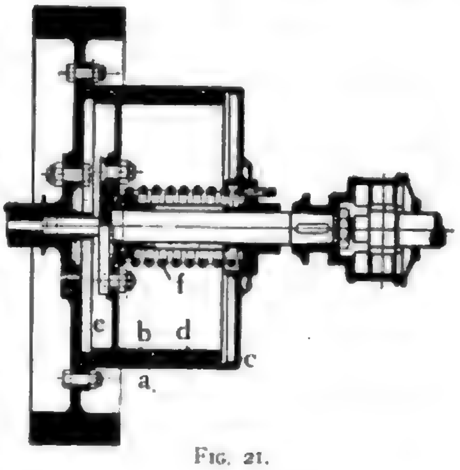


FIG. 21.

In the clutches thus far shown the pressure of the coiled springs is taken up in the clutch itself, so that while the motor is running there is no end thrust on the crank shaft. It may here be pointed out that in designing such self-contained clutches the majority of designers forget that there is an end thrust on the crank shaft while the clutch is held out of engagement. In order to take care of this thrust it is advantageous to provide a thrust ball bearing in the crank shaft (see Fig. 15). For this reason many designers do not make provisions for taking up the clutch pressure on the clutch shaft itself, but take up the thrust at some fixed point of the frame or the gear. Fig. 24 shows such an arrangement (Opel). The extension Z carries a sheet metal leather faced cone secured to a bushed and flanged hub. The cone

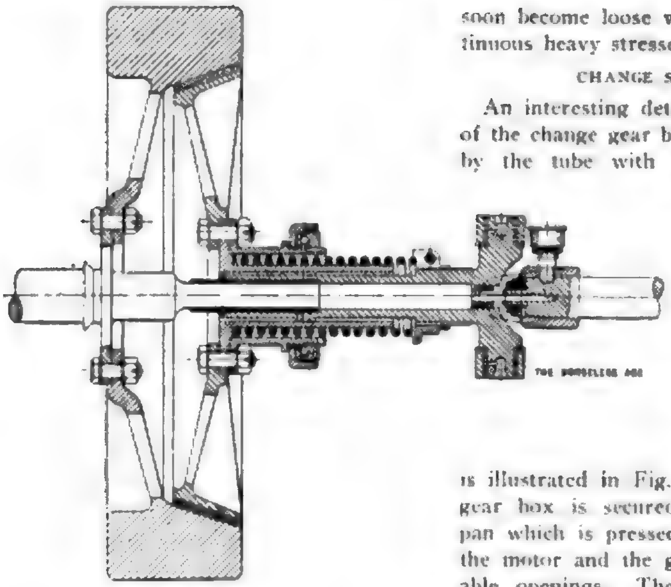


FIG. 22.

is pressed into the flywheel by means of the coiled spring *f*, the pressure of which can be adjusted from outside by means of the nut *m*. The end thrust is taken up through a thrust ball bearing *d*, located in front of the regular bearing *l*, by the change gearing housing.

The Daimler Motoren Gesellschaft in their new express delivery wagon have retained their tried construction by which the clutch engaging pressure is furnished by a spring mounted outside of the clutch itself. The transmission of the clutch engaging pressure is effected by means of the forked lever, and the pressure can be relieved by pressing on the pedal, which acts on the collars on the clutch shaft. This design greatly facilitates adjustment of the spring and dismounting of the clutch. In connection with this car special attention may be called to the cast steel wheels provided with solid rubber tires. It has recently become the general practice to use wheels of this material for heavy trucks, for the reason that wooden spokes will soon become loose when subjected to continuous heavy stresses.

CHANGE SPEED GEARS.

An interesting detail is the arrangement of the change gear box, which is connected by the tube with the differential housing of the jack shaft bearing, into a single unit. This permits of supporting the casing at three widely separated points in a very advantageous manner. Another system of supporting the gear casing is illustrated in Fig. 24. In this case the gear box is secured to a special underpan which is pressed in such a form that the motor and the gear case fit into suitable openings. The frame belonging to this construction is shown in Fig. 26. This design obviates the necessity of fitting a special mud pan underneath the mechanism.

The mode of operation of this change gear can readily be explained by means of Fig. 24. The main driving pinion is driven from the clutch through the sleeve *h*, while the secondary, square shaft *b*, of the change gear, which also carries the transmission brake, is connected to the Cardan shaft leading to the rear axle. The three different speeds are engaged by a longitudinal movement of the sleeve *s*. All of the shafts run on ball bearings which are mounted directly in the change gear housing and are closed to the outside by means of special bronze caps.

In the Adler change gear, shown in Fig. 18, the ball bearings are mounted in special bronze bushings, in order that the aluminum of the housing, which has not a very high crushing strength, may be relieved of undue strain. The direct drive is obtained in this case by means of a sliding gear, *g*, which is also provided with internal teeth, and which may be brought into mesh with the external teeth of the pinion *o*. The transmission brake P is of the contracting type, and two laterally adjustable screws serve the purpose of limiting the motion of the brakeshoes. The drawing also shows the peculiar construction of the universal joint M, fixed to the Cardan shaft C. The joint is completely enclosed by means of a spherical sector R, which is pressed by a coiled spring against the spherical portion Q of the casing. An interesting feature of the Adler change gear are the means provided to prevent loss of oil from the housing. Such a waste of oil not only frequently renders the transmission brake inoperative, but oil also drops onto the floors and pavements wherever the car stands or runs.

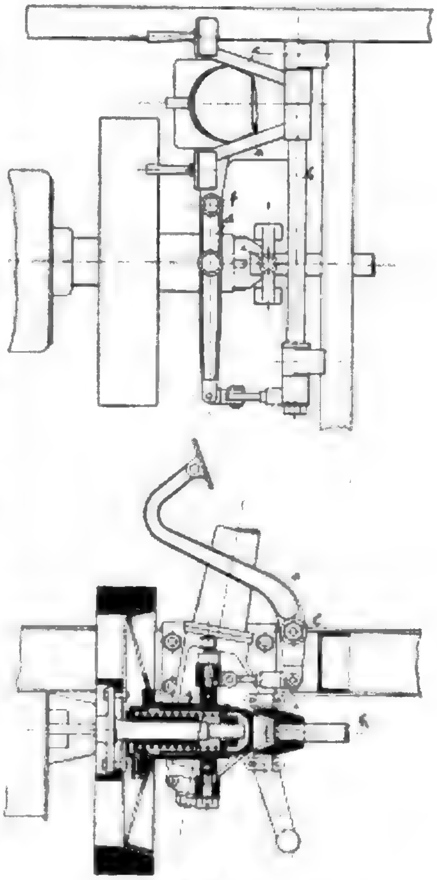


FIG. 23.

Fig. 27 shows, first, that the oil filling opening *c* is located so low on the casing that it is impossible to introduce an excessive amount of oil into the latter. Besides, between the two sets of gears there is a tube *b* running in the direction of the length of the casing, into which the metal dust, which is inevitably formed in sliding gear cases, may settle, through the narrow opening on top. In order that the oil may not be carried up on the sides of the gears and thrown out through the bearings, an oil guard *b* is located near the gears at about the height of the pitch line, as shown in Fig. 28. Another device designed to prevent oil from working its way along the shaft and out through the bearing is illustrated diagrammatically in Fig. 29. A spe-

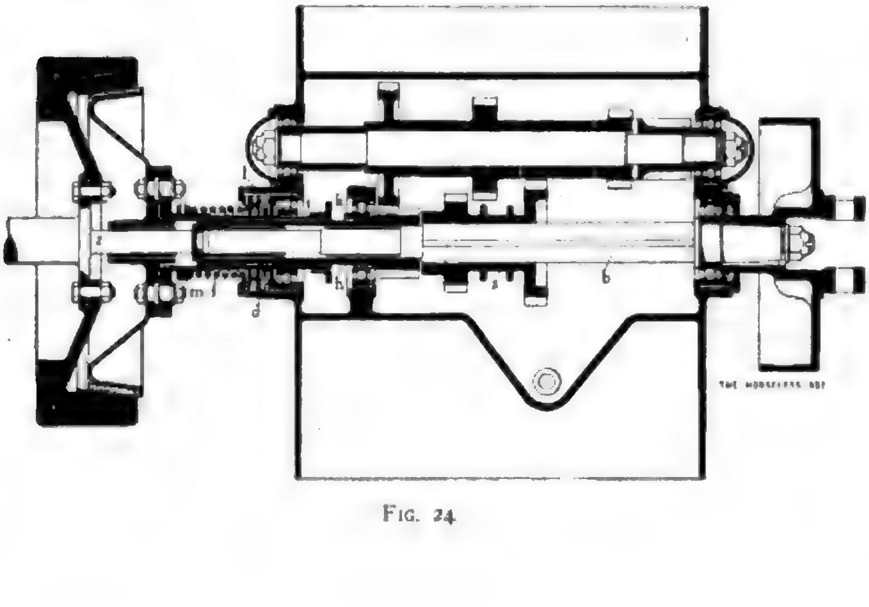


FIG. 24.

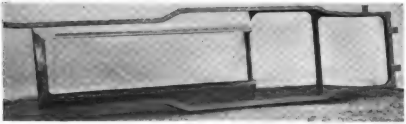


FIG. 26.

cial "wiper" is pressed against the shaft from below by means of a small coiled spring, and so prevents the oil from traveling along the shaft.

Fig. 30 furnishes an instance of the use of ball bearings even for very heavy trucks, the design being due to Scheibler. In this case, too, the ball races are fitted into special bronze bushings in a cast iron gear case. The main driving shaft *a*, which is driven from the clutch through the Cardan shaft *b*, is of the fluted type, being provided with four integral keys. On this shaft the four sliding pinions, formed into two pairs, may be shifted endwise. The intermediate shaft *c* is forged integral with the flanges to which are secured the large gear wheels. The bevel pinion is mounted on one side in a large ball bearing, and on the other in a bronze bushing, and its end thrust is taken up by the two thrust ball bearings *f* and *g*. The bevel gear *h* and the differential housing are located in the change gear box. The same method of gear case support, as explained above in connection with the Daimler construction, is used in this case, the housing being supported in three points *z*, *y* and *z*. The gear shifting is effected by means of three round sliding rods, *l*, *m* and *n*, which actuate the two pairs of pinions for the forward speeds and the reverse pinion by means of three forked arms. These sliding rods are operated by what is known as the Mercedes selective system.

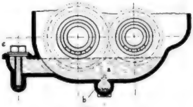


FIG. 27.

This method of selective operation, which recently enjoys great popularity in Germany, to the detriment of the so-called progressive gear, is represented in Figs. 31 and 32. In the here represented chassis of the Neckarsulm Cycle Works there will be seen a sort of pocket on top of the change gear box, in which are located the selectors, by means of which the gear lever shaft connects with the different sliding rods. The lateral movement of the hand lever causes only a change in the engagement of the sliding rods, while a motion of the lever in a plane perpendicular to this motion, parallel to the direction of the vehicle, effects the change in the gear engagement. The gear lever is locked in any position by means of a sort of latch.

The brake drum in Fig. 31 is provided with five flanges, to help radiate the heat generated when running on the brakes for long distances. These flanges considerably increase the radiating surface, to which the cooling effect is proportional. The brake drum is also provided with ratchet teeth, into which a pawl is adapted to engage, to prevent a reverse motion of the car when stopping on steep up grades. Fig. 32 shows the special construction of the frame cross member passing around the brake drum. It is strongly curved downward in the middle, in order to permit of moving the gear box upward, and also to serve as a support for the forked forward end of the Cardan shaft housing, which serves as a torsion brace and also transmits the push of the rear axle to the frame.

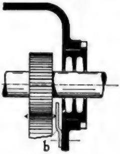


FIG. 28.

The rear axle itself is shown in Fig. 33. It is formed of pressed steel, in two halves, with bolted longitudinal top and bottom joints, which serve at the same time as reinforcing ribs. Such pressed steel parts have proven perfectly satisfactory in every particular. The axle itself is thus provided with a very rigid and oil containing housing, and when manufactured in large numbers, such axles will be found cheaper and lighter in weight than the usual live axles screwed or braced together of several parts.

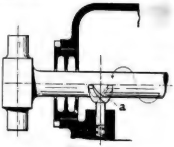


FIG. 29.

Pressed steel construction as applied to the manufacture of real axles, has been carried even further by the Siemens-Schuckert Works in their new chassis (Fig 34). In this instance the entire rear axle housing consists of a single piece of sheet steel, which is made from two parts by the autogenous welding process. By comparing the two designs shown in Figs. 33 and 34, respectively, there will be observed a difference in the method of linking the live axle to the frame. In Fig. 33 both the forward thrust and the torsion is taken up by the tube enclosing the driving shaft, which tube is hinged to the frame at its forward end. In Fig. 34, on the other hand, the tube surrounding the Cardan shaft takes up only a portion of the torsional effect, and none of the forward thrust. To

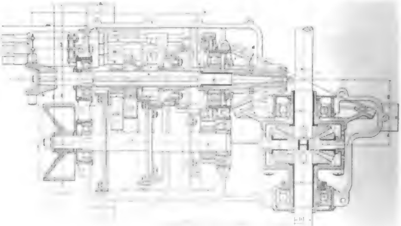


FIG. 30.

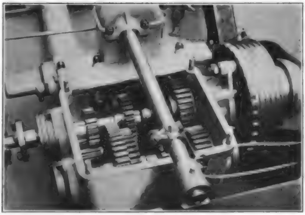


FIG. 31.

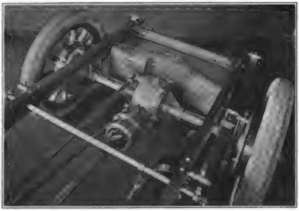


FIG. 35.

take all of the thrust and the greater portion of the torsion there are provided two distance rods connecting the rear axle housing with the frame, which are not seen in the figure, as they are directly below the frame.

In a similar manner as in Fig. 33 the forward thrust and the torsion are taken up at the universal joint at the forward end of the Cardan shaft in the Adler cars.

In connection with all of the live axle linkages thus far shown it is necessary to shackle the rear springs at both ends. This, however, is not necessary if no special part is provided for transmitting the driving thrust from the rear axle to the frame, and the springs themselves are depended upon for this purpose. For this construction, which is at present widely used in Germany, the design shown in Fig. 35 was the model or original. In this construction the rear springs are hinged directly to the frame at the forward end, so as to be able to transmit the driving thrust. To the differential housing, on the other hand, are secured two special rods, which end forwardly near the forward universal joint in a ball or similar shape. Also the "cut out" of the fuel tank directly back of the driving gear housing, as shown in this illustration, is used by many different firms, and the same arrangement may be seen in Fig. 33.

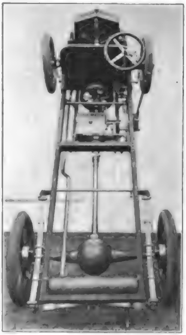


FIG. 34.

Ball bearings are also used very extensively in rear axles. Thus, for instance, Fig. 36 shows a cross section of the Adler rear axle. The driving shaft A carries the bevel pinion B, which carries on its hub a substantial radial ball bearing. Directly behind this bearing are provided two ball thrust bearings, in order to hold the pinion firmly in both directions. In the same manner the bevel gear is held firmly in a lateral direction by two ball bearings. The rear axle driving shafts E, driven through the differential, are also carried on two sets of ball bearins.

In the case of rear axles which are linked to the frame according to the second described method, the bevel pinion must be separately carried, for which purpose generally two or three ball bearings are used. Fig. 37 shows the construction of Opel, who so arranges the ball bearings at this point that they act both as radial and thrust bearings. Some firms building small, cheap cars, prefer the use of parallel bearings to ball bearings in the rear axle, for the reason that the available space in the axle of a small car does not permit of using sufficiently large ball bearings, as may be

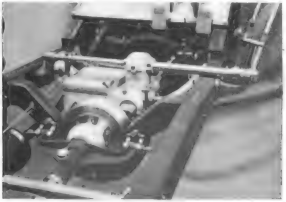


FIG. 32.

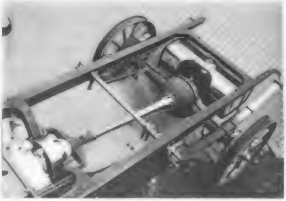


FIG. 33.

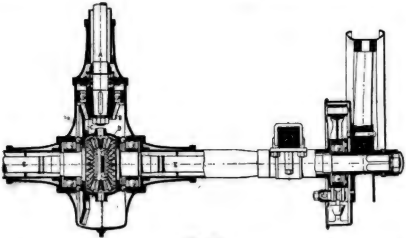


FIG. 36.

seen from the cut of the rear axle of the small Piccolo car, built by Ruppe in Apolda, shown in Fig. 38. In this case all of the bearings, except those in the rear wheels themselves, are of the parallel type. The Adler axle also shows very well thought-out means for preventing waste of oil from the rear axle housing. As shown in Fig. 39, the filling opening is placed at the height at which it is intended to carry the level of oil in the casing, and, besides a small oil reservoir *c* is provided, in which is arranged a roller wiping off the oil carried up by the bevel gear, into this reservoir, from where it flows through special drill holes back to the bottom of the housing.

Between the two standard types of chain and shaft driven cars lies the construction which is still used by the Daimler Company in their commercial vehicles, in which the rear wheels are provided with internal gears, which are driven from a jack shaft carried in special bearings. Here, too, the tendency of replacing parallel bearings with ball bearings is apparent. In consequence of the great weight of these cars it is generally necessary to relieve the regular ball bearings of thrust loads, by providing thrust ball bearings for thrusts in both directions. A noteworthy feature of the Daimler truck is the peculiar construction of the differential gear, which comprises two separate pairs of bevel gears, for the separate drive of each axle shaft. This construction possesses the advantage, in comparison with the usual design, that the bevel gears keyed to the axle shaft may be made considerably larger and stronger.

There have been no important innovations in connection with the chain drive, probably because the correct linkage of chain driven axles, by means of chain tighteners pivoted as nearly as possible at the centre of the chain sprockets, was recognized at an early date. Attention is called to the elastic chain tightener of Büssing, in Brunswick, a firm which occupies itself especially with the construction of heavy trucks and omnibuses. This design is shown in Fig. 40. The heavy compression spring *a* permits of a very smooth start of the vehicle, for the reason that the entire driving thrust of the wheels does not come on the frame all at once. The frame supporting springs in this chassis, contrary to the usual arrangement, are not carried by shackles, but move in slots in the frame.

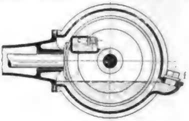


FIG. 39.

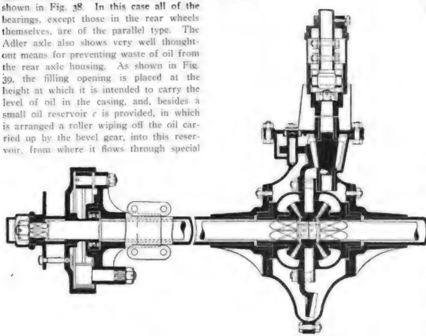


FIG. 38.

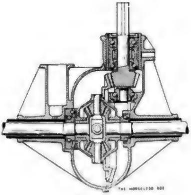


FIG. 37.

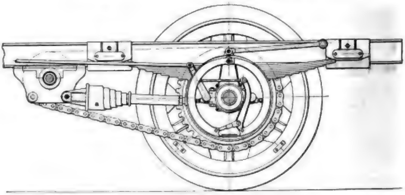


FIG. 40.

Twelve Months' Progress in Engine Construction.

By Roy Lindsay.

Since the last Engineering Number of this journal was published slow but steady progress has been made in every detail of motor car construction. So far as concerns only cars made in Enlgand, the Royal A. C.'s rating formula for competitions has urged manufacturers to obtain the maximum power at the road wheels from a limited bore in a four cylinder engine. Concentration of effort in any particular direction is bound to eventuate to the benefit of the purchaser—not financially but technically—provided the results can be averaged over a sufficiently long period, and that rules or regulations leading to such results are universal in one or more countries. This has been exactly the case in England in 1908. The march onward concerns every type of vehicle from the little 6 horse power single cylinder up to the 60 horse power six cylinder, and can be generally summarized as tending to greater silence, increased engine flexibility, reduced loss of power in bearings and transmission, protection of wearing parts from ingress of dust or mud, avoidance of smoking by regular mechanical lubrication devices, improved springing, improved body construction and a reduction in the total weight of the chassis from the employment of nickel or chrome steel alloys. Some few of the best makers have also been giving attention to increased strength of certain parts in which cast iron has been hitherto considered good enough, and substituted the more costly crucible cast steel, while others are endeavoring to increase as much as possible the use of pressed steel, as, for instance, in brake drums, rear axle casings, etc.

CARBURETION.

To improvements in the heart of the engine—the carburetor—may be ascribed much of the increase of power secured from small engines in comparison with results procured from similar sizes less than eighteen months ago. Scientific investigators like Dr. R. W. Brewer, Mervyn O'Gorman and G. H. Baillie, have probed the subject in a most thorough and effective way, their theorizing in the laboratory having invariably been accompanied by road tests, of which the results were carefully tabulated. Much still remains to be done in this direction, and while it is fairly safe to assume the impossibility of ever reaching the flexibility possessed by a steam engine, the control over the power exerted by the internal combustion engine at a small number of revolutions is the path toward which future study must be directed. The inter-relations of many obscure points have still to be investigated, but the results so far obtained indicate that the most likely means to the end is not to rely upon vacuum in the cylinders to suck in the gas. At the other end of the scale we have manufacturers who, without any theorizing, have succeeded in increasing power by increased engine speed, and their experiments, confirmed by the winning of important competitions, have gone to prove that the prevailing tendency toward so called automatic carburetion is altogether wrong. The most striking instance of a reversion to the early system of control, whereby a driver can himself regulate the air supply according to his own judgment, is the really extraordinary record created by M. Naudin at Brooklands track on the 28th of October. Driving a Sizaire-Naudin stripped racing chassis, having a single cylinder engine with a bore of 100 millimetres by a stroke of 250 millimetres, the following speeds were attained: Half mile at the rate of 66.48 miles per hour; 50 miles in 45 minutes 54.247 seconds, equal to a speed of 65 miles 755 yards in one hour, and 100 miles in 1 hour 31 minutes 53.42 seconds, equal to an average speed throughout of 65.295 miles per hour. This seems impossible, but the absolute correctness of the automatic timing apparatus at Brooklands track is unquestionable. The enormous length of stroke of this engine, two and one-half times the bore, and very high compression were two of the important factors; but the makers of this vehicle have studied the problem of carburation far more closely than have any of their competitors. The mixing chamber for this engine has a series of air ports, controlled by separate levers, either one of which permits air to enter at varying heights above the jet, and when these are all open the total area is so large that theoretically the engine ought to stop by reason of the attenuated charge. Practice is just to the contrary, and the writer, who made a very close inspection of the carburetor, is confirmed in the opinion he has always held and expressed in the pages of this journal, that to obtain the best results not only should the quantity of air be variable but also the quantity of spirit per charge, and that such control should be at the driver's command and not dependent upon engine suction.

KEROSENE CARBURETORS.

The use of kerosene in motor boat engines has been brought in Europe to a high state of perfection, particularly in the Gardner engine, and with this type, after it has become sufficiently hot, the regular practice is to allow water to enter the carburetor to the extent of about 20 per cent. of the kerosene. The inherent odor of kerosene must always oppose its use on pleasure motor vehicles, yet the exploitation of commercial motor wagons opens up a vast field, in which this defect is a minor consideration. There is actually on the market an English kerosene carburetor that has met with great success in India, where gasoline is expensive and difficult to procure away from the big towns. Known as the Johnstone-Buddicombe, this carburetor was subjected by the writer to many severe tests early in 1907, and undoubtedly provided more power at hill climbing and on the level than was possible with a gasoline carburetor of the best available type, carefully tuned up and fitted to the same engine. With kerosene only the characteristic smell could be detected at the end of the exhaust pipe. The addition of water to the extent of 10 per cent. reduced the smell, which disappeared altogether when the maximum of 25 per cent. of water entered the carburetor. (Fifteen minutes was found to be the minimum time, after starting up the engine, before water could be turned on by a drop or two per second, and gradually increased up to the 25 per cent. within the next five minutes. Earlier admission of water caused the engine to stop.) The usual test, of holding a clean handkerchief against the exhaust outlet beyond the muffler failed to reveal the slightest sign of unburned fuel at any time during the progress of the test. The injection of a minute quantity of water into the cylinder, when gasoline is the fuel, is known to have been attempted with successful results in India, where the intense dryness of the atmosphere during the summer altogether upsets a carburetor tuned up to accord with the atmosphere prevailing in Western Europe. Although the injection of water with a charge of carburetted gasoline has been vouched for as successful, the haphazard methods of the untrained investigators who tried the plan make it doubtful whether they were not deceived in trusting to the sense of hearing. On the other hand, there is the well accepted fact, known to every observant driver, that while an engine will "pull" well on a hot day, it will pull very much better in the evening of the same day, more particularly if any dew settles on the ground. The admitted better result may be caused either from increased humidity of the atmosphere or that colder air striking the radiator enables the water therein to be brought to the most efficient temperature.

ENGINE DESIGN.

Just why nearly every maker in Europe is turning out a monobloc or four cylinders in one casting is a mystery, and can only be explained on the suppositon that it is fashionable, for the instincts of a trained engineer rebel against the abortion. About the only point in its favor is the facility with which the four cylinders can be bored out at one setting with suitable jig, insuring proper facing up of the base at one operation. Purely from the factory point of view this may be advantageous, but there the advantage ceases, the complicated casting involved precluding the complete surrounding of each cylinder by proper water jacketing space. Cylinders cast in pairs are bad enough in this respect, and it is still too often the case that the adjoining walls have no separating jacket, with the consequence of such a construction requiring an abnormal quantity of oil to keep the surface in anything like condition. Such engines are notoriously bad when put at pulling up long hills on second gear, the temperature of the water that only surrounds parts of the cylinders being raised too quickly to the boiling point. The general tendency to have a second single casting, acting as a cap to the whole of the water spaces above the cylinder heads, certainly makes it easier for the foundry to produce a casting free from dead ends than where the cap is cast integral with the cylinders.

It is pretty well agreed that a single cam shaft, actuating all valves on one side, is the most desirable arrangement, and probably not 1 per cent. of engines made for 1909 will have

OVERHEAD VALVES

of any kind. When these latter are fitted the usual practice is to place the inlets directly over and entering the same chests as the exhaust valves. But the question can reasonably be asked whether this is not reversing the natural order? The entry of the cold gas into the cylinders can be looked after well enough by piston suction, but the greatest trouble is to dispose of the exhaust quickly enough. The natural tendency of gas above atmospheric temperature is to ascend, yet we find in all modern internal combustion engines that the very hot exhaust gas is forced to take a tortuous course at a sharp angle from cylinder to valve chest, then at another sharp angle past the valve and its seat, and is constricted still further by impinging against the wall of the pipe attached to the chest, and again has to pass downward immediately at the exit from the chest or when reaching beyond the last of the four cylinders. Let the reader follow the sequence of happenings in his mind, and he will understand that making the exhaust of any cylinder pass along four right angled turns, in immediate contiguity to where the gas is hottest, and consequently where the greatest pressure exists, must entail back pressure. There seems no reason for engineers worrying to design a muffler that will give silence without back pressure, at a place where the gases have cooled so considerably that, if left to themselves, they will quietly emerge, if the main exhaust pipe is long enough. The writer ventures to suggest that the proper positon for the exhaust valve is not in line with or below the inlet but overhead, taking the outlet pipe in a gradual upward bend, until it reaches the dashboard, where another gradual bend downward, with a sweep sideways, would take it beneath the floor board in the usual way. The difficulty, of course, lies in cooling the cage and its surrounding parts, but this could be overcome with a by-pass off the main water circuit which would be quite effective. The ideal construction would be to place the exhaust valve obliquely in the rounded space between the wall and domed combustion head, but this would involve the breaking of gas tight joints when the valve and its seat would need grinding in, and is therefore impossible, the average user hardly being the sort of person to trust with such a job.

Very light and extremely thin radiating flanges cast on the pipe that is bolted to the exhaust ports have been used on the monobloc Darracq engine employed for taxicabs this past year, and also by the English Thornycroft Company for their 35 horse power and 45 horse power engines. Good results ought to follow the extending of this system right up to the entering orifice of the muffler, and as mufflers are now generally constructed of sheet iron, the cooling effect could be further increased by riveting light radiating flanges of similar metal to the exterior. With the muffler placed in the standard position—parallel with the side frame member—each flange could be of slightly increasing diameter from front to rear, and the draught beneath the car, impinging on the flanges, would help cool the muffler. There are some lessons to be learned from watching progress in the water cooling system that ought to be applied to exhaust piping. Theoretically, the more quickly exhaust gas can be reduced in temperature the easier will it be to get rid of it quietly with the least imposition of back pressure.

Some makers have needed quite a long time to understand the necessity of graduating water outlet pipes in thermo-siphonic water circulation to obviate surface friction. Yet in nearly all modern cars it will be found that the area of the exhaust pipe of a four cylinder engine is just the same, close to the dashboard, as it is adjacent to the first cylinder, and such area is usually about the same or not very much exceeding that of the port outlet of one cylinder. Here and there can be discovered something larger in the form of a cast iron expansion box bolted close up to the ports, and the exterior dimensions of the device give the impression of usefulness which is discounted when the interior bore is measured. The area of the exhaust pipe beyond the rearmost cylinder should always exceed the total area of all the exhaust ports; it would be highly interesting to try the experiment of a pipe of gradually increasing bore carried right away to the rear of a chassis, without employing a muffler of any kind. Another plan that, so far as the writer's knowledge extends, has not been tried on a motor vehicle would be to carry the pipe twice right around the full extent of the chassis framing, omitting any muffler in the circuit. This idea is based upon experiments carried out by Crossley Brothers, gas engine makers of Manchester, England, who many years ago proved that the harsh beat of a large single cylinder gas engine could be effectually silenced by taking the exhaust through a pipe at least 60 feet in length of the same internal diameter throughout.

GUN METAL VALVE GUIDES.

Credit must be given to at least three European makers who this past year have fitted gun metal bushes for the valve stems to work in, a refinement that has maintained good compression for a longer period than usual by preventing heat distortion of the stems and keeping the heads true to the seats. This is too costly a method for medium priced cars and is only applicable when a buyer is prepared to pay the proper figure for the right construction. Easier detachment of valve springs has been catered for in several directions, the simplest of all (a revival of something that was tried on a motor bicycle engine in 1903)) being to cut a thread on the valve stem, run a nut up it to compress the spring, with a light washer between spring and nut to take the thrust, and pass the usual copper pin through a hole in the stem. Toward the general silencing of the valve mechanism considerable progress has been made; firstly, by completely enclosing the tappets, stems and springs in pockets, with quickly detachable cover plates; secondly, by coiling light springs round the tappet rods so as to keep them in constant contact with the cams; thirdly, by interposing vulcanized fibre between tappet and valve stem, inserted in the adjusting head of the tappet. The "ringing" sounds set up by timing wheels was attempted to be nulified by one or the other of the wheels in mesh being made from vulcanized fibre, strengthened by a brass facing plate, but the bad wearing properties of fibre caused it to be discarded. Drilling holes in the webs of the timing wheel and plugging them with lead was quite all right—until the plugs fell out and caused a general hash of all the timing gear. Experiments are being made at the time of writing with a new alloy that is said to wear as well as phosphor bronze, which gives out only a dull leaden sound when struck and is inaudible when the wheels are moving.

WATER CIRCULATION.

The advent of the taxicab, in particular the model constructed by Renault, has greatly helped to prove the water circulaing pump, with all its attendant troubles, to be a useless appendage, and copyists of the Renault system are falling over each other in their endeavor to claim credit that does not belong to them. In at least one respect the Renault arrangement is still unapproached, because the placing of the radiator in front of the dashboard and the position of the flywheel immediately beneath in what is an enclosure insure that the draught created by the blades riveted to the flywheel rim compels all the air to pass over every one of the radiator tubes. Moreover, dependence is not placed upon the car moving through the atmosphere for creating an artificial breeze, as more than half the tubes are hidden beneath the bonnet and are subjected to contact with the hot air surrounding the engine. Only careful statistics could afford an inquirer the exact number of makers in Europe now using thermo-siphon system and the number is being added to month by month. Some few have been able to glean experience over a fairly long period, and these are certainly in agreement that the most satisfactory results are obtainable with a flanged tube radiator. Consideration of the principles underlying natural convection would have shown this to have been the case, without the necessity of experiment, for the infinitesimal passages of a honeycomb are bound to choke the free flow of the liquid. After all, it is but one more mail toward the coffin for the final interment of the honeycomb radiator. The sooner it disappears the better for the pockets of the people who buy motor cars. It is perhaps needless to insist upon the absence of intricate water passages in cylinder castings, or on extremely large inlet and outlet pipes, the latter rising to a much greater height to reach the top of the radiator than when a water pump is in circuit and with the shortest possible distance between a radiator and engine. The shape of the radiator itself also has a considerable influence in attaining the best results for thermo-syphon cooling. The average type, that presents nearly a square surface in front is about as good as can be expected when we remember that every item in motor car construction is only a compromise between the engineering ideal and the commercial profit maker. The worst possible shape is the circular, of which the Hotchkiss and Delaunay-Belleville are the leading examples; these are quite right with a pump and fan. About the best possible shape is a triangle, having the base line reversed so as to be at the top and the meeting point of the two sides coming at the bottom; by leading the water in through two pipes, as in the Minerva, the heat has a much better chance of being radiated, and, what is equally important, all the water must leave by the lower point of the triangle, eddying, or, rather, stagnation at one side, being rendered impossible. The only objection that can be raised against natural water circulation is the likelihood of a leak reducing the level below that of the mouth of the outlet where the radiator is joined; this is reasonable enough and could be obviated by fitting a gauge glass on the dashboard. Some makers contend that weight is added by extra size of cylinder jackets, pipes and radiator; quite correct, but the little is not worth worrying about when it is compared with the total weight of a complete touring car.

A Lighting Novelty.

An English novelty house has brought out a combined carbide and match carrier for use on either motorcycles or cars. The device consists of a tube, with two compartments, the smaller for matches and the larger for carbide. The match compartment is fitted with cotton wool pads to prevent ignition, while the carbide is retained from moving about within the compartment by a spring actuated pad attached to the cover. The covers of both compartments are fitted with damp proof washers, and are held in place by bayonet catches. A match striking strip is fitted to one side of the tube.

Piston Pins.

By Morris A. Hall.

The writer deplores the usual method of guessing at the size of this part, and will endeavor to give a clear idea of the forces acting upon it, and the strains within it, together with a number of examples showing the many different shapes and forms this apparently simple part assumes in practice.

During the suction stroke the piston head is acted upon by no force at all, power being required to move it; during the compression stroke it is acted upon by a force gradually increasing from atmospheric pressure, 14.7 pounds per square inch, up to the maximum compression pressure of, let us say, 70 pounds per square inch, power being required to do this work; during the expansion stroke it is acted upon by a force gradually decreasing from the explosion pressure of four to five times the compression, or 280 to 350 pounds per square inch, down to a much lower pressure, usually 40 pounds Finally, during the exhaust stroke it is acted upon by a pressure varying from this exhaust pressure, 40 pounds, down to atmospheric pressure, power being required to move the piston and gases.

So we can see plainly that the power applied to the piston comes alternately from one side and then the other, the piston pin being the connecting link, and therefore subject to bending. Moreover, it either rotates slightly in the piston, or the connecting rod rotates slightly upon it. There are thus two conditions to be satisfied: First, the pin must have sufficient bearing, so that lubrication will not be difficult and the danger of pins seizing will be remote. Both the diameter and length of this bearing are usually figured from the M. E. P. The second condition is that the pin must be strong enough to resist bending. The only case in which instantaneous shear may occur is when the explosion takes place on dead centre, so that bending will be given most consideration.

The mean effective pressure, or M. E. P., is a matter for discussion. A formula advanced by Grover some years ago has been generally accepted and gives good results, although it is not useful for high pressures above 100 pounds. It is M. E. P. = 2 C — .01 C², in which C is the compression pressure. Substituting the pressure assumed above we have M. E. P. = 2(70) — .01(70)² = 91 pounds. Generally speaking we may say that the M. E. P. ranges from 70 to 100 pounds. Then, during the explosion stroke the piston, through the medium of the piston pin, communicates the pressure upon it to the connecting rod, and during the other strokes the connecting rod through the medium of the pin communicates pressure or at least gives movement to the piston. The piston may be considered as the load and the connecting rod as the support, the pin being then a round beam supported at the middle and uniformly loaded at the ends; or, inversely, the rod may be considered as the load and the piston as the support, in which case we have a beam supported at the ends and uniformly loaded in the middle. Let us take the latter view. Then the greatest bending moment is $\frac{Wl}{8}$ and the normal stress due to the load is $f = \frac{Wl}{8Z}$ .... (1)

Z for a solid round section is $\frac{\pi d^3}{32}$, in which d is the diameter; Z for a hollow circular section is $\frac{\pi}{32}\left(\frac{D^4 - d^4}{D}\right)$, in which D is the outside diameter and d the inside diameter.

Substituting these values the fibre stress becomes

$$f = \frac{Wl}{\frac{8\pi d^3}{32}} = \frac{4Wl}{\pi d^3} \text{ .... (2)}$$

for the solid and

$$f = \frac{Wl}{8\left(\frac{\pi}{32}\right)\frac{D^4 d^4}{D}} = \frac{4WlD}{\pi(D^4 - d^4)} \text{ .... (3)}$$

for the hollow section.

Now W equals the explosion pressure times the area of the piston, or $P \times \frac{\pi D_c{}^2}{4}$, then equation 2 becomes

$$f = \frac{4P \times \pi D_c{}^2 l}{4\pi d^3} = \frac{P \times D_c{}^2 l}{d^3} \text{ .... (4)}$$

and equation 3 becomes

$$f = \frac{4lDP \times \pi D_c{}^2}{\pi(D^4 - d^4)4} = \frac{P \times D_c{}^2 lD}{D^4 - d^4} \text{ ..... (5)}$$

In both of these formulæ for any given motor $P \times D_c{}^2$ is a constant, for the explosion pressure at constant speed is constant, as is the square of the diameter. Then let $P \times D_c{}^2 = C$, and these formulæ may be changed:

$$f = \frac{Cl}{d^3} \text{ .... (6)}$$

$$\text{or } l = \frac{fd^3}{c} \text{ .... (7)}$$

$$\text{or } d = \sqrt[3]{\frac{Cl}{f}} = C_1\sqrt[3]{\frac{l}{f}} \text{ .... (8)}$$

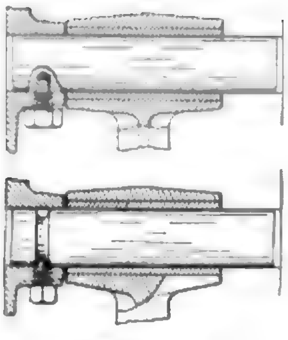
$$\text{also } f = \frac{ClD}{D^4 - d^4} \text{ .... (9)}$$

$$l = \frac{f(D^4 - d^4)}{CD} \text{ .... (10)}$$

$$\text{or } \frac{D}{D^4 - d^4} = \frac{f}{Cl} \text{ .... (11}$$

from which we may say that the normal stress varies as the length and inversely as the cube of the diameter, so that we have but to assume the pressure f with a proper factor of safety, and we will at once have an expression containing the length and diameter of the piston pin in the connecting rod. By assuming either one we obtain the other.

In this work it is customary to use a figure for f of not over 15,000 pounds. This gives a factor of safety varying from 4 in hardened machine steel up to 12 and higher



Figs 1 and 2.

for the very best grades of chrome nickel and other special steels.

Inserting this value in equation (8) we get

$$d=\sqrt[3]{\frac{C\,l}{15000}}\;\ldots\ldots\ldots\ldots(12)$$

If we take a 5½ inch diameter cylinder and 300 pounds explosion pressure, then

$C = 23.595 \times 300 = 7,078$ pounds.........(13)

$$\text{and } d=\sqrt[3]{\frac{7078\,l}{15000}}=\sqrt[3]{.471\,l}\;\ldots\ldots(14)$$

Usually l is made 60 per cent. of the cylinder bore; that is, $5\frac{1}{2}\times .6 = 3.3$ inches.

$$d=\sqrt[3]{.471}+3.3=\sqrt[3]{1.557}=1.16=1\tfrac{1}{8}\text{ inch scant}\ldots\ldots(15)$$

Calculating a hollow pin for the same conditions from equation (11), we have

$$\frac{D}{D^4-d^4}=\frac{15.000}{7078\times 3.3}=.642\text{ inch}\ldots\ldots(16)$$

Assuming the outside diameter or D = 1¼ inches, this works out to .84 inch inside diameter, which is nearly seven-eighths inch.

The writer knows of a case where a pin of the above dimensions has been used for years under the severest service, and not a pin has ever been replaced for breakage. The outside diameter is 1¼ inches, and the inside diameter seven-eighths, agreeing exactly with the results from the formulæ. From which we see that practice and theory occasionally agree.

The usual method of treating the problem is one of bearing pressures. The maximum bearing pressure allowable is predetermined, and the projected area in the connecting rod is so proportioned to the M. E. P. as to allow this much pressure per unit area. The various authorities differ in the figures for allowable unit pressure, these ranging all the way from 600 pounds to twice that, or 1,200 pounds per square inch. Unwin says the limit of pressure is 800 pounds in ordinary engines, and 1,500 pounds to 2,000 pounds in locomotives. He gives these two formulæ:

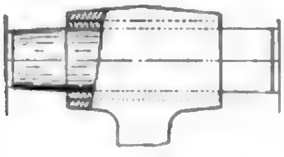


Fig. 3.

$$d_1=\sqrt[4]{\frac{1.28}{p_1 f}}\sqrt{P}\;\ldots\ldots\ldots\ldots(17)$$

$$l_1=\frac{P}{p_1 d_1}\;\ldots\ldots\ldots\ldots(18)$$

in which P is the greatest total load in pounds.

p_1 is the pressure in pounds per square inch.

f is the working stress in pounds per square inch.

d_1 is the diameter in inches.

l_1 is the length in inches.

T. Huyler White gives 800 pounds as the maximum pressure, and advocates the following formula:

$$\text{Diam } d_1=.06\sqrt[3]{P_2 L D^2}\;\ldots\ldots\ldots\ldots(19)$$

in which P_2 is the maximum pressure in pounds per square inch.

L is the crank radius or $\frac{\text{stroke}}{2}$ in inches.

D is the cylinder diameter in inches.

Roberts says the pressure should not exceed 750 pounds, the length should equal the length of the crank pin and the diameter is figured from the formula:

$$d_1=\frac{\text{Cyl. Area}\times\text{M. E. P.}}{750\times l_1}\;\ldots\ldots\ldots\ldots(20)$$

Grover says a pressure of 600 pounds, as calculated from the M. E. P., will give suitable proportions to the pin. Also, the length may be as high as $1.4\,d_1$. That is,

$$d_1=\frac{\text{Cyl. Area}\times\text{M. E. P.}}{600\times l_1}\;\ldots\ldots\ldots\ldots(21)$$

and

$$l_1=1.4\,d_1\;\ldots\ldots\ldots\ldots(22)$$

Fay says that the maximum pressure may be run up as high as 1,200 pounds with safety, but he advocates 800 pounds as a better average figure.

Lucke makes the statement that the pressure on the wrist pins of large marine engines is never allowed to exceed 1,200 pounds, which agrees with the first part of Fay's statement. He gives the formula

$$P_b=\frac{F}{l_p d_p}\;\ldots\ldots\ldots\ldots(23)$$

in which P_b is the bearing pressure per square inch in projected area.

$$F_p=\frac{\pi d^2}{4}\times P_m\text{ (maximum pressure).}$$

He also gives the following empirical formulæ for small engines:

min. $d_p = .15d$......................(24)

d = diameter of cylinder.

max. $d_p = .25d$......................(25)

mean $d_p = .22d$......................(26)

The bearing length is usually $l_p = .5d$.

Also these formulæ for medium and large engines, which should have relatively larger pins:

min. $d_p = .22d$......................(27)

max. $d_p = .45d$......................(28)

mean $d_p = .31d$......................(29)

and he closes the subject by advocating for all sizes the formula

$d_p = .35d$......................(30)

particularly when $l_p = .6d$.

Rice gives a series of empirical formulæ calculated from the data of 75 engines as built in the spring of 1906.

$dl = .00445\,p\,D$......................(31)

in which D is the cylinder diameter.

$l = 2\frac{1}{4}d$......................(32)

p is the maximum pressure per square inch in cylinder.

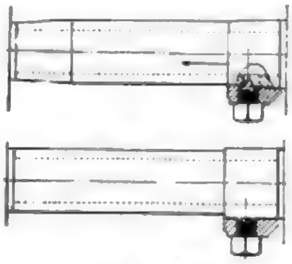
$$d\,l=\frac{.7854\,\pi\,D^2}{7}\;\ldots\ldots\ldots\ldots(33)$$

d is the diameter of the pin.

$d = .225$ D......................(34)

l is the length of the pin in connecting rod

If we take our case as before, 5½x6 inch engine, 300 pounds explosion pressure, 70 pounds compression pressure, 91 pounds M. E. P., and apply the different formulæ, we get the results given in the accompanying table. This table shows up the right and wrong ones at once, particularly if we reject the very bad ones and average the others. Averaging the seventeen test cases, the others being underscored in the table, we get an average value of nearly 1¼ inches for the diameter.



Figs. 4 and 5.

Authority.	Diameter. Inches.	Length. Inches.	Remarks.
Theory form. (15)...	1 1-8	3.3	
Unwin form. (17-18).	1 1-2	5.9	Steam practice.
White form. (19)....	1 13-16	..	No length.
Roberts form. (20)..	7-8	3.3	
" " (20)...	31-32	3	
Grover for. (2 & 22).	1 3-32	1 1-2	
Fay formula........	13-16	3.3	
" "	29-32	3	
Lucke form. (23)...	1 25-32	3.3	
" " (23)....	2	3	
" " (24)....	13-16	2 3-4	Minim'm for small engs.
" " (25)....	1 3-8	2 3-4	Maxim'm for small engs.
" " (26)....	1 7-32	2 3-4	Mean for small engs.
" " (30)....	1 15-16	3.3	
Rice " (31)....	1 13-16	4 1-16	
" " (31)....	2 7-32	3.3	
" " (32)....	1 1-2	3.3	
" " (33-34)	1 1-4	8.6	
" " (33-34).	1 1-4	2 3-4	Corrected π left out.
" " (33)....	1 1-16	3.3	Corrected, π left out.

Average of 17 = 1 1-4 inches d.

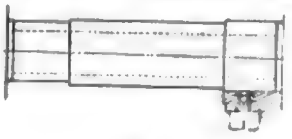


Fig. 6.

The oldest and simplest way of fastening the pin is a drive or press fit, the pin being absolutely plain. This is a somwhat uncertain method, and pins fastened thus back out and score the cylinder, thus scoring the rings and piston as well. A new pin is inexpensive, and a new piston comparatively so, but the replacement of a cylinder is a tedious job and costly. In the case of a serious "floating" pin we would need a new cylinder and pin, possibly a new piston and new rings also. From this it may be seen that the matter of fastening is very important, fully as much so as the size of the pin. The weight of moving parts is also a factor, which leads us naturally to the hollow pin.

One of the earliest methods of fastenings, and one that is retained today on many engines, is shown in Fig. 1. This consists in the use of a set screw or a pair of them having one end turned down to a smaller diameter than the bottom of the threads. The pin has a hole or a pair of holes into which this end or teat is a snug fit. The boss in the piston is tapped to receive the threaded portion of the set screw. This is not the general method, but a modification of it is nearly as popular, quite as good and much cheaper, in that it saves one operation in the machine shop. It is shown in Fig. 2, and consists in turning a deep groove in the pins near the ends, this groove taking the place of the hole in the previous case. The set screw must be screwed in very tight, so as to prevent the pin from turning.

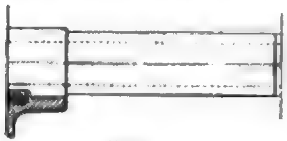


Fig. 7.

Another very good method, which is often used with a plain pin, consists in turning a piston ring groove in the piston on the centre line of the pin. Then, after the pin is in place, an extra ring is slipped into this groove. This prevents the pin from coming out and is also very cheap. A further gain is made in that the use of an additional ring helps to hold the compression.

Then there is the method of using tapers which has not met with much favor and is used on only very few good engines. The taper may be a diminishing one, as in Fig. 3, or it may be an increasing one, the opposite way around. Another taper arrangement, used on one of the best known cars manufactured in Cleveland, is shown in Fig. 4, and consists of two equal tapers, one on each end. This is an adaptation of the shape of crosshead pins in the steam engines. The benefit ascribed to the taper is that the pin can only back out in one direction, thus reducing the danger by 50 per cent., as a fastening is needed for but one end. Fig. 4 also shows a good method of fastening a taper pin. There is an offset hole in the pin into which the cone pointed set screw is forced, the cone point forcing the pin farther into the taper. Brush uses a modification of this method. In general, if the locking pin fails to work, the taper pin will "float" quicker than the plain one on account of the pressure coming on an inclined plane.

The advantage sought in making the two ends of different diameters is the same as that secured by using the taper; the pin can then float only in one direction. For this reason some pins have two diameters and only one set screw, usually bearing on the larger diameter. The enlarged part may extend through the bearing, as shown in Fig. 5, or through the bearing and rod, too, which is an inversion of the construction shown. The latter has this advantage, that the bearing area in the connecting rod is much greater. This has been carried by several makers to the extreme of using three different diameters, as is shown in Fig. 6. This construction is good but expensive, requiring three special reamers for the three different sized holes.

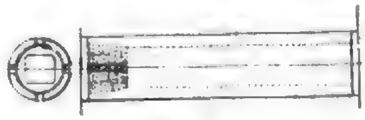


Fig. 8.

Fig. 7 shows the use of a screw tapped into the end of both the piston and pin. Here the enlarged diameter of the end is not intentional, but necessary to provide metal around the threads. It has the big disadvantage (as the writer found out to his sorrow) that after the pin has been removed it is very difficult to replace it in such a way that the threads will match up. If this is not the case the screw will not enter. There are two ways in which they may not match, viz., first, along the axis or in and out of the piston, and, second, concentrically.

Screws are being used more and more, but they partake generally of the form of an expander. Fig. 8 shows one of these, a taper threaded plug being used to expand a split end against the hole in the piston. It has the disadvantage that there is contact only along two narrow concentric lines at the ends of the pin.

A better use of a screw and a split end is shown in Fig. 9. Here the pin is drilled and tapped from one side only. Then the pin is split in a plane at right angles to this. In screwing the locking pin in the threads pull the lower side down while the upper end of the screw pushes the upper side up.

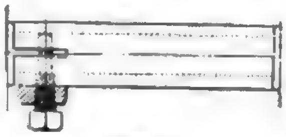


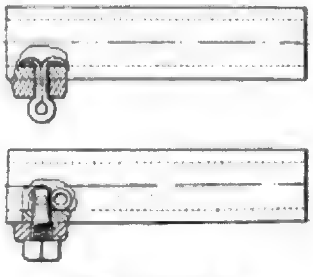
Fig. 9.

Cotter pins and split pins provide many methods of fastening. One method, used on the Cartercar, is illustrated in Fig. 10. A split pin is put through the hole in the boss and in the pin. Then the ends within the hollow piston pin are spread, securing it in place.

A taper pin driven in is in fairly general use; one maker using this drills a hole through the end of the taper pin, and uses a split cotter through this hole to keep the taper pin from falling out. It is hard to see of what use the taper pin is. Why not use the cotter pin alone, as described above? Another maker uses a split pin in a similar manner to retain the set screws. The latter have the end turned down, this turned portion or teat being left rather long. Near the end is a hole for a small cotter pin which is spread inside of the piston pin. This most excellent method of preventing the set screws from working out is illustrated in Fig. 11. It is used on the Corbin among others.

This method is applied somewhat differently on the Locomobile. In place of the two split cotters a long wire is used which has two bent ends. These are hooked into the two holes in the two set screws within the hollow wrist pin, thus neither one can be turned without removing the other. The bent ends prevent the wire from working out.

The standard method of wiring the set screws is a modification of this. As shown in Fig. 12 the wire used passes through the heads of the set screws, and is then bent out to the form of a circle closely approximating the inside of the piston. This is done to keep it away from the connecting rod.



Figs. 10 and 11.

A Scotch car, the Argyll, uses one set screw passing through two bosses on the same side of the piston, one above and one below the pin. The screw is very long, and passes right through the pin, even extending through the upper boss. It is figured that with all this threaded portion to unscrew before anything can happen, the fastening is perfectly safe.

On the Auburn and Northern engines a modification of an old way is used, which is both simple and reliable. Two very long plain set screws are used. The piston pin is drilled and tapped to take these on one side only. Then, in use, the set screws are screwed through the boss and one wall of the pin, continuing until the end of the screw, which is hardened, digs into the other side of the piston pin wall, thus locking itself in place.

On the Rutenber engines is used a more refined method, which is very effective. The piston pin has two diameters, and the smaller end is threaded inside as well. The piston is bored out, and each end is counterbored, one quite deeply for the enlarged portion of the pin. The other end is not counterbored as deeply, and takes the head of a screw which screws into the small end of the pin. A lock washer under the head insures against the screw backing out. Fig. 13 shows this construction very plainly, and from this it will be seen that the pin is held between two shoulders, and consequently cannot move either way.

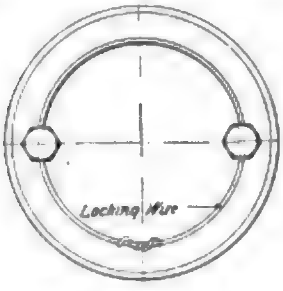


FIG. 12.

. Then there is the alternate method of fastening the piston pin in the connecting rod, which numbers among its advocates such makers as Moore, Dorris, etc. The main advantage claimed for this method is lightness, although some claim cheapness.

Generally speaking, there are but two methods of holding the pin to the rod; one of these is by a split rod end and an external clamping bolt; the other is by means of a screw, bolt or pin passing through, or partly through, the piston pin and rod end.

In Fig. 14 is shown a form of the split end and clamping bolt method. Here the clamp is shown set at an angle to the axis of the rod. In practice this angle varies all the way from 30 degrees to 150 degrees. Fig. 15 shows one form of the second method, the bolt passing through the rod end and pin at an angle to the axis of the rod. This angle may vary also, and is frequently about 40 degrees.

Of course a through bolt parallel to the rod axis would be impossible, but the next thing to it, a set screw set in parallel to the axis and passing through one wall or both, is used. This set screw method is also used with the screw at various other angles with the rod. A split pin spread inside of the rod could be used thus, but to the writer's knowledge it never has been.

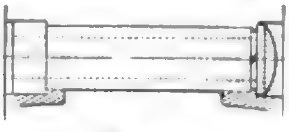


FIG. 13.

Fig. 16 illustrates the use of a through pin. The maker using this construction seems to think that the piston pin will never need to be taken out. At least, he uses a soft steel pin and rivets over both ends. This latter must be a very hard thing to do inside the piston, while removing it, which means cutting off one riveted end, must be a still harder job. Aside from this, however, this is a very simple and very sure method.

The advocates of the pin fast in the rod methods base their claim for lightness on two things. Being fastened to the rod, and therefore practically an integral part of it, the rod end may be much lighter. As the pin has only a bearing in the piston bosses, these are made much smaller and lighter. A gain in weight is also made by increasing the diameter, which allows the bosses to be shortened. Most of the pins fastened this way are made of very large diameter and kept tight by machining out the inside until the pin is simply a steel.

Fig. 17 shows a section through a typical pin of this kind (Moore). It will be noted that the extreme ends are very thin, tapering to the thickened portion, where the bolt passes through. This taper is also used to feed oil into the connecting rod, which has a hole drilled for its entire length. Thus oil fed to the hollow pin oils the crank pin.

MATERIALS.

In the matter of materials used we find as many differences as in design, formulæ and methods of fastening. Machine steel, cold rolled steel, steel tubing; tool, nickel, chrome nickel, vanadium, chrome vanadium and other special steels are used, some in the natural state as they come from the mills, some forged over, some hardened and ground, others ground but not hardened, still others neither hardened nor ground. We find the best materials used on the lightest motors, the superior strength and wearing qualities allowing smaller lighter sections.

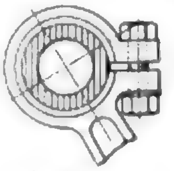


FIG. 14.

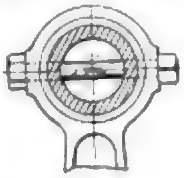


FIG. 15.

Hardened tool steel pins have the big disadvantage of being brittle, and, as a result, are not used as much as formerly. A metal less subject to rupture than this was necessary. In 45 point carbon steel, oil tempered, we have a cheap metal which meets the requirements. At 3 to 3¼ cents per pound this material may be so treated as to give a tensile strength of 150,000 pounds, an elastic limit of 90,000 pounds, and an elongation of 10 per cent. in 8 inches.

Nickel steel is a very tough product, and government specification nickel steel, which is universally used now, may be heat treated so as to obtain 220,000 pounds tensile strength and 100,000 pounds elastic limit. This material gives excellent results, but does not stand up under shock as well as steel containing chrome, vanadium, manganese, wolfram, or any combination of these.

Thus a material like Krupp's EF-60-O special nickel steel is adaptable for this purpose. The makers say of this metal that it is "remarkable for its extraordinary toughness." The minimum figures guaranteed are 110,000 pounds tensile strength and 95,000 pounds elastic limit, which may be more than doubled by suitable heat treatment. The elongation, which is really the best measure of the toughness, varies from the minimum of 16 per cent. in 2 inches upward.

A somewhat similar home product is No. 7 Bethlehem chrome nickel steel, for which the following minimum figures are guaranteed: 95,000 pounds tensile strength, 65,000 pounds elastic limit, 25 per cent. elongation in 2 inches. By suitable heat treatment the company guarantee to increase these minimum figures to 140,000 pounds tensile strength, 120,000 pounds elastic limit, and 17 per cent. elongation.

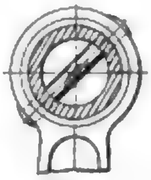


FIG. 16.

As to vanadium, this element raises the tensile strength and elastic limit, but reduces the elongation in considerable amounts. Thus a certain plain carbon steel showed 56,000 pounds tensile strength, 34,000 pounds elastic limit and 35 per cent. elongation. With .10 per cent (10-100 per cent.) added this material had its physical properties changed as follows: 72,000 pounds tensile strength, 60,000 pounds elastic limit and 31 per cent. elongation. A further addition of .05 per cent. vanadium, making .15 per cent. total, increased the tensile strength and elastic limit figures to 76,000 pounds and 64,000 pounds, respectively, and decreased the elongation to 26 per cent. A final additional increase of .10 per cent., making a total of .25 per cent. vanadium, gave 82,000 pounds tensile strength, 72,000 pounds elastic limit and 24 per cent. elongation.

The simultaneous addition of chromium reduces the elongation even more, but this effect is small as compared with the increase in the other properties. Thus the last mentioned steel (.25 per cent. vanadium), with 1 per cent. chromium added, gave these figures: 128,000 pounds tensile strength, an increase of 56 per cent.; 104,000 pounds elastic limit, an increase of 45 per cent.; elongation, 19 per cent., which is a decrease from the former figures of but 21 per cent.

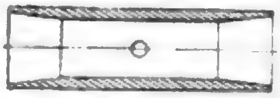


FIG. 17.

Wolfram steel should be used in a natural state without heat or other treatment, which may be done readily, as the raw material will give 150,000 pounds tensile strength and 151,000 pounds elastic limit. Hardening reduces the elongation and makes it brittle.

Manganese is, perhaps, the toughest metal we have, but cannot be softened.

Wind Shields—Points in Their Construction and Use.

By Albert L. Clough.

As a part of the equipment of any motor car which is to be operated at sustained high speeds or to be used under any but the most perfect weather conditions, some form of front protection for the passengers is almost an imperative necessity. In order not to obstruct the view of the road such protective screen must be transparent, and two forms of such front protection are in use—the celluloid storm front, forming a part of a Cape top, and capable of being rolled up and secured to the top when not in use, and the glass front or wind shield, fastened to the dashboard, extending the full width of the front seat and vertically to a point above the faces of the passengers.

This article has reference to the glass front, which forms a permanent but adjustable attachment to the dash, and is independent of the vehicle top. The installation of a glass front enormously increases the comfort of passengers and actually augments the practical usefulness of a car, as with the shield driving may be comfortably practiced under conditions which would prove almost intolerable were no front protection supplied. The strain upon the eyes which the wind pressure due to high speed produces, especially if one does not wear goggles, is well known to result in optical fatigue and headache, but the wind shield practically abolishes this and even renders practicable the discarding of goggles. During certain seasons of the year the air is more or less filled with insects and with leaves and blossoms falling from the trees. The wind shield prevents the impact of such bodies with the face and eyes, and obviates an annoying if not occasionally a dangerous feature of motoring. Inasmuch as the glass front prevents direct contact with the passengers of the rapidly moving air current, leaving only a comparatively calm eddying condition about the occupants, the amount of heat removed from their persons by convection on a cold day is relatively small, and comfort may be secured even when the temperature is quite low. Sand and dust particles, which would otherwise strike the passengers, are largely intercepted by the glass, while rain drops and snowflakes, moving, as they virtually do, in lines rather more horizontal than vertical when a car is at speed, are also prevented from striking the passengers.

No advantage is, however, to be obtained without some corresponding disadvantage, and in this particular case the comfort which results from the use of the glass front is secured only at the expense of considerable expenditure of power, absorbed by the air resistance of the shield, concerning which some later remarks will be made.

It is probable, too, that in case of accident the presence of a large sheet of glass directly in front of the forward seat passengers adds to the danger. To be thrown against the glass, in event of a collision, or to have the glass broken in one's face by some object striking it from the front, would be decidedly dangerous. These objections are not believed to be comparable with the advantages of the glass front.

The chief requirements in a glass wind shield are that it shall offer at all times the exact measure of protection desired; that it shall be sufficiently strong to withstand without breakage all legitimate stresses; that it shall be sufficiently rigid in all its parts so that it may not rattle or creak; that, if adjustable, such adjustments may be made with the utmost convenience; that it shall not interfere with any other part of the car; that it shall be tasteful in appearance and offer as little obstruction to vision as possible.

ADJUSTABILITY.

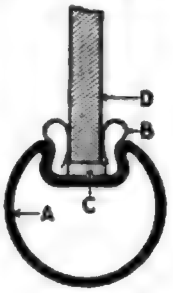


Fig. 1.

These shields may be non-adjustable, affording a fixed complete protection to the passengers, in which form they have the objection of never allowing the occupants of the car to gain the full advantage of the air during delightful summer days. Such fronts are sometimes found useful upon closed cars especially designed for bad weather, and are to be observed upon many of the older touring cars. Or they may be, and commonly are, made adjustable, in which case the desired degree of protection may be obtained when needed, and at the same time the full effect of the air realized when it is wanted. Most of the wind shields produced at present are of the adjustable type. The adjustment of the vertical height of the front is secured in several ways. The shield may be horizontally divided at or near its centre of height, and the upper half may be arranged to fold down behind the lower half, leaving a protection equal in height to the lower half only. This is the single folding type. In addition to thus folding in the centre, the shield may be hinged at its junction with the dash, and, when the upper half has been folded down, the complete folded shield may be swung on its hinges to a position over the dash, where it is entirely out of the way. This is the double folding type. In some of these shields intermediate tilted positions may be provided for.

The shield may be horizontally divided and the upper half arranged to slide downwardly to a position behind the lower half instead of folding, leaving a protection equal in height to the lower half only.

Upon cars equipped with canopy tops a shield is used, the upper edge of which is hinged to the front of the canopy. It parts at a point slightly above the dash and swings backward and upward, the lower edge of the swinging portion being held to the canopy by straps or other fastening devices.

DIMENSIONS AND MATERIALS.

Wind shields are usually from 37 to 44 inches in the horizontal width, being furnished upon specification, to fit any car. The full height varies from 32 or 34 inches in the case of small cars to 37 inches for large cars. To adapt a certain shield to any form of dash, a filler board, with its lower edge appropriately shaped, is used.

The quality of glass used in these fronts is a heavy, polished French plate, usually of three-sixteenths inch thickness and occasionally of one-quarter inch. To hold this heavy glass, subjected as it is to severe pressure and rude shocks, very strong frames or sashes must be used. These frames may be of wood or of metal. Mahogany is the favorite wood, although oak is somewhat used and in the cheaper shields birch or maple, mahogany stained, is employed. The wood frames are securely mortised together, rabbeted to take the glass. The corners are usually rounded and a fine hand finish is applied to the wood. Sometimes the wood frames are brass bound.

Metal frames of brass tubing with round corners are much used. In some cases the tubing is wood filled and the rabbet formed in the filler. In other cases, the tubing is specially drawn so as to leave a groove for the glass or the frame is formed of brass rod with a rabbet milled therein on the inside. Frames made of pressed sheet brass, with or without a wood molding reinforcement, are occasionally employed, and pressed steel is also used in some cases and is finished with baking enamel which matches the color of the car. As a rule, the brass or other metal frame is much less bulky than one made of wood and obstructs vision less. It cannot swell or warp under the influence of moisture and can be finished so as not to be over conspicuous. The wood frame, however, matches the wood dash and presents a rich appearance.

ANTI-RATTLING PROVISIONS.

In order to prevent the breakage of the glass by shocks and to keep it from rattling, special methods of mounting it in its frame are required. The edge of the glass may be bound with piano felt to cushion its contact with the wood or metal or a rubber channel section may be fitted in the rabbet of the sash and the edge of the glass set in this. Some makers use flat springs under the rubber channel to prevent or at least to cushion any lost motion of the glass (Fig. 1).

MOUNTING.

The means of attachment of the shield to the car is usually by a mounting of its bottom edge upon the top of the dash or the filler board and by two stay rod supports attached respectively at about its centre of height on each side. The dash attachment is usually by means of two or more heavy double brass cleats, holding on both the upper edge of the dash and the lower edge of the shield. If the dash is of metal, brass or bronze angle fittings are commonly used. The details, of course, depend upon the particular form of the dash. Sometimes the brass frame of the shield is extended downward considerably at the sides and these downward extensions are secured in brackets fitted to the dash.

As the pressure upon the shield is mostly in a backward direction, due to the air resistance, the stay rods which run forward from the shield sash to the car frame act mainly in tension. These stay rods are usually of brass tubing, which is frequently reinforced by a steel tube within it. The ends are generally of bronze castings and they are frequently of the ball and socket type to allow for differences in angular position of the stays when applied to different cars. Rubber buffers are sometimes used in these joints to guard against rattling. Often, each stay is of two sizes of tubing which telescope and fasten in any position by means of an expansion nut. This allows of adjusting their length to fit any particular car. The front ends of the stays are usually bolted to the car frame, one on each side of the hood, or to the forward spring hangers. Their rear ends fasten to a substantial fitting usually attached at or near the vertical centre of each side frame of the shield. The bolt and screw holes in these fittings have to be very closely drilled, or rattling will in time develop. Not only must the shield supports withstand air resistance but also the very severe inertia stresses which result when the car pitches in a fore and aft direction, as when traversing "thank you marms." It is this sort of thing rather more than the air resistance stresses which loosens up the parts and allows them to rattle. Then there is a certain slight motion or "work" between the dash and the front end of the vehicle frame, which tends to loosen the parts. Lock washers are very largely used in securing the bolted fitttings.

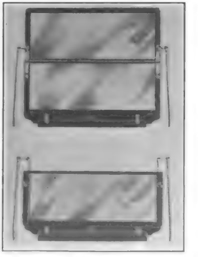


FIG. 2.—SINGLE FOLDING SHIELD, HINGE TYPE.

Single folding shields are arranged to fold in one of two ways. The lower edge of the upper half may be hinged upon the upper edge of the sash of the lower half and its upper edge is drawn down and toward the operator when it is being folded. This requires that there shall be ample space between the steering wheel and the dash line, in order to afford clearance (Fig. 2).

The upper half is usually held in its raised position by some clamping device, fixed to each hinge, which securely stiffens it. A thumbscrew is provided for this purpose on each side, and this same screw usually acts to fasten the upper half securely against the lower half when it is folded, a rubber buffer sometimes being provided between them. Instead of thumbscrews, good sized hand wheels are sometimes used, as being more readily set up without the use of a wrench. The details of the fastening devices are too numerous and diverse to be here enumerated.

Instead of being hinged the lower edge of the upper half may be detachable from the upper edge of the lower half, by freeing two clamps operated by hand wheels. A brass arm on each side connects the lower half with the middle of each side of the upper sash, and in folding the upper section as a whole is drawn toward the operator, without change of plane and then let down back of the lower section, the upper half pivoting on these arms (Fig. 3). The space required for the folding operation in this form is comparatively small, and the steering wheel is readily cleared. The same clamping devices and hand wheels, secure the shield in both positions. All shield makers strive to make the horizontal sash at the folding line as unobtrusive as possible, a light brass channel being generally used. Sometimes no cross sash at all is used, the glass resting on shelves of a few inches length projecting from the side sashes. The idea of obstructing the view as little as may be is embodied in the design of all these shields.

Although but a very short time is required to adjust one of these shields from the extended to the folded position or vice versa, the operator must stop the car and leave the seat to loosen the clamping devices, move the shield and fasten the same in the new position.

AUTOMATIC FOLDING.

To obviate this objection the automatic folding shield has been developed, which can be adjusted from the seat without stopping (Fig. 4). This shield is of the single folding hinged type, and is held in either of its two positions, at will, by the tension of two strong spiral springs, one on each side. One end of each of these springs is fast to the upper sash frame at a short distance from the hinge, and the other end is secured to a brass fitting projecting horizontally forward from the upper end of the side sash of the lower frame. A lug on the forward side of each hinge catches in an easily releasable detent when the shield is raised, and is held therein by the spring tension. To fold the shield the top edge of the upper section is pulled toward the operator and downward, and when partly lowered the spring tension passes the centre and acts to still further lower the upper section on its hinges. When fully down it is held in clips by the spring tension and against rubber buffers. It is raised by merely lifting the free edge of the upper sash until the springs pass their centres of effort, when they draw the upper half into the extended position and into the detents, where it is firmly held.

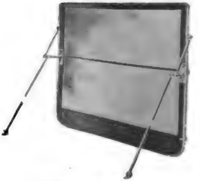


FIG. 3.—SINGLE FOLDING SHIELD, HINGELESS TYPE.

DOUBLE FOLDING.

Double folding shields, so far as their arrangements for folding along the horizontal centre line are concerned, may be of either of the two types mentioned above, but are usually of the hinge type.

In the double folding shield, Fig. 5, the lower edge of the lower half is hinged at or near the dash line, a piano type of hinge, extending the full width of the sheild, being customarily used. When the two halves are folded and secured together the whole thing is rotated forward and downward on this long hinge to a horizontal position over the dash. In order to allow of this motion, the two tubular sections of each stay rod telescope one within the other, and are locked together when in the desired position by an expansion nut or some equivalent device. If telescopic stay rods are not used there is a fitting attached to each side of the sash which slides on the stay rod, and is made fast at the desired position by means of some form of clamp.

In the sliding type of shield the upper half slides downwardly, just back of the lower half, exactly as do the two sashes of a window. Or the upper half is arranged to be removed bodily by releasing its fastenings, and is then placed back of the lower sash in appropriate guides, where it is securely held.

One point which has to be carefully attended to in all these folding shields is that of securing a watertight joint at the line of fold. Some kind of a lip is usually provided upon one sash or the other which effectually seals this joint.

FIXED SHIELDS.

There are on the market special tonneau shields of the non-folding type which are fixed to the rear of the front seat and protect the rear passengers. A coat rack can be made a part of the brass tubular frame of such a shield. A single folding shield is manufactured, the upper half of which may be either a brass wire screen or a plate of glass, the two frames being interchangeable. The former screens the passengers from flying insects or leaves, but allows a considerable circulation of air to pass.

Upon some of the fixed shields, especially those adapted to closed cars, a bracket is attached which holds a mirror, mounted upon a universal joint. This bracket is secured to the vertical portion of the shield frame, on the operator's side, and enables him to keep track of the traffic behind him. Some of the fixed shields provide ventilation by means of an adjustable door in the filler board, just above the dash, which may be kept open when desired. A folding shield may be bought for from $24 to $60, according to design and finish.

RESISTANCE TO MOTION.

As to the resistance to car motion offered by these glass fronts, it may be remarked that each square foot of projected area carried by a car meets an air resistance of approximately 1.2 pounds at 20 miles per hour, about 5 pounds at 40 miles per hour, and perhaps 11 pounds at 60 miles per hour. A shield 34 inches in height by 42 inches in width has an area of 1,428 square inches, or very nearly 10 square feet. The resistances offered by such a shield at the three speeds of 20, 40 and 60 miles per hour are thus 12 pounds, 50 pounds and 110 pounds, respectively.

The horse power absorbed in overcoming the air resistance upon such a shield at 20 miles per hour is 1.2; at 40 miles per hour, 5.3, and at 60 miles per hour, 17.5. It should be remembered that the installation of a shield of 10 square feet area does not, as a matter of fact, increase the projected area of the car by that entire amount. If the shield were not present the front seat back and the bodies of the passengers would offer considerable projected area, which should be subtracted from the projected area of the shield, in order fairly to estimate the power waste attributable to the shield itself. It may be that not more than one-half the total area of the shield is added projected area. In the case of a closed car the addition of a wind shield undoubtedly increases the total air resistance but comparatively little, as the total projected area of the car is not increased and the main loss of energy due to the presence of the shield is due to eddy currents around it.

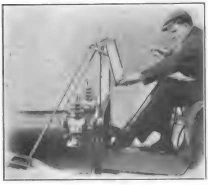


FIG. 4.—AN AUTOMATIC SINGLE FOLD SHIELD.

The same thing may be said of a touring car with the top fully down and the back curtains lowered.

In the case of a runabout or a touring car with the top down, the wind shield resistance plays a larger part in the total.

Fortunately at speeds of 20 miles an hour or less, at which most reasonable motorists habitually drive, the absorption of power by a wind shield is not at all a serious matter amounting perhaps to not more than three-quarter of a horse power.

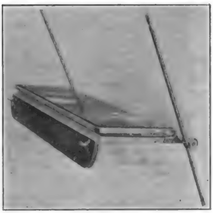


FIG. 5.—DOUBLE FOLDING SHIELD IN HORIZONTAL POSITION OVER BONNET.

Hints and Suggestions on Woodruff Keys.

BY GEO. E. GODDARD.

There is probably not one draughting room out of twenty-five in the motor car industry which has not used the "Woodruff" patent system of keying in at least several places. The writer has used it universally for several years, and has adopted the acompanying table for the use of the "layers out," and, in fact, all draughtsmen whose work requires the use of a Woodruff key. Each key as it is used is considered a part of the car, and therefore is given a serial number. No key is numbered, however, until it is a specified component of the car.

The selection of the proper key depends on many things. In fact it is not practical to give any special formula which will apply in all cases. For example, a No. 6 key, which is 3/32x5/8 inch, is considered ample to drive a high tension magneto whose shaft is 20 mm. in diameter (approximately 25/32 inch), while a six cylinder cam shaft of seven-eighth inch diameter, driven by a gear of 3½ inches or more radius, requires an "A" key, which is seen from the table to be ¼x7/8 inch. This particular cam shaft is part of a six cylinder engine having the valves all on one side (Napier type), and therefore the key is subjected to a shock every one-sixth of a revolution of the engine. When it is considered that the engine runs at an average speed of 1,000 r. p. m. it will be seen that this particular key is subjected to 3,000 separate and distinct shocks per minute. Hence the necessity of the larger key.

The following cases illustrate common practice: A No. 3 key, 1/8x½ inch, is used to drive the timer, which has a one-half inch diameter shaft; a No. 9 key, 3/16x¾ inch, is used for the cams, while a No. 15 key, ¼x1 inch, is used on the crank shaft pinion. An "A" key was considered correct to drive a water pump of the gear type. More than the mere driving of the pump was considered here, however. It has been found that, no matter how much pains may be taken to flush a radiator before putting it on a car pieces of solder loosen from time to time and eventually get to the pump. The key was therefore selected with a greater factor of safety to allow for any shearing strains due to one of the particles of solder temporarily clogging the gears in the pump.

In the construction of certain styles of crank shafts using annular ball bearings it is necessary to make the flywheel flange separable. The accompanying illustration, Fig. 1, shows the method ordinarily employed. It will be seen that the flange has a hub with a tapered hole, and that

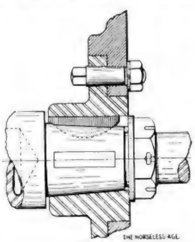


FIG. 1.

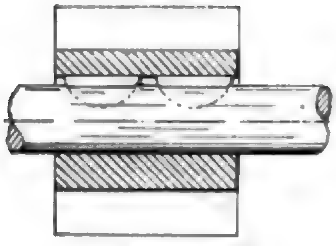

THE HORSELESS AGE.

FIG. 2.

two keys are used, at right angles. This particular key was a No. 29, and was required to resist, from a sudden change in the velocity of the flywheel, a shear of over 3,000 pounds.

Where a key is of insufficient length for the hub to be keyed on, two keys in line may be used, as shown in Fig. 2. Two keys at 90 degrees may be used where the shearing area of one key is not sufficient without cutting away too much of the shaft. The writer once was confronted with the problem of suggesting a remedy in a case where a key has been specified that "fell down." A change in the size of the key, or the use of two keys at right angles, meant the sacrifice of interchangeability. The key was case hardened, and no more was heard from it. The expedient proved entirely satisfactory. This, however, was a peculiar combination of crushing and shearing strains.

The depth to which the key is sunk into the piece or hub is taken as one-half the thickness, as with common square keys. It will be noticed that from .002 inch to .005 inch has been allowed over the total width of the key. This serves two purposes, of which the more important is the avoidance of a tendency of the key to "rock" in its seat when pressing the piece on the shaft. This is more easily understood by reference to Fig. 3. The second reason is to do away with the odd decimals of an inch beyond the thousandths place, and to bring everything to steps of .005 inch. The other dimensions given in the table will be found to materially aid in "drawing in" the keys.

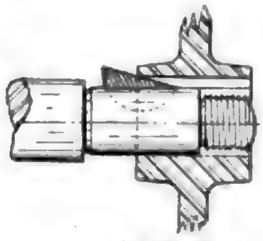

THE HORSELESS AGE

FIG. 3.

In Figs. 4 and 5 is shown a very good way of dimensioning shafts in connection with the use of Woodruff keys. Giving the dimension from the shoulder to the centre of the key enables the machinist to set his scale from the shoulder and sight to the tangent point of the cutter and shaft, a method which is sufficiently accurate for general purposes. He also sets his dial on his milling machine handle at zero at the same time, and proceeds to cut to the depth given (D).

For general use the following formulæ are applicable:

$$D = \frac{A}{3}, \quad T = \frac{A}{4}.$$

Where A = diameter of shaft in inches.

D = depth of keyway in shaft in inches.

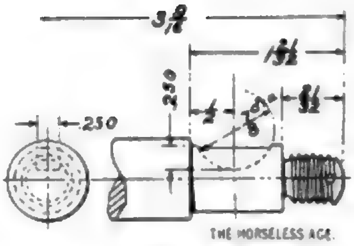
T = thickness of key or width of keyway.

The keys used to key the flywheel flange to the crank shaft in Fig. 1 were calculated from the formula:

$$T\,L_e = \frac{2\,F\,r}{A \times S_s} \quad \text{.......................} (1)$$

Where T = thickness of key.

Le = effective length used in figuring shearing area.



THE HORSELESS AGE.

FIG. 4.

F = actual force acting at radius of key.

S_s = allowable shearing stress per square inch.

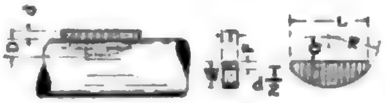
r = radius at which force F acts.

To obtain F, we use the well known formula

$$F\,r = \frac{H.\,P.}{N}\,63025.2 \quad \text{..................} (2)$$

Where H. P. = horse power transmitted.

N = number of revolutions per minute.



THE HORSELESS AGE

No. of Key.	Thickness. T.	Approx. Length. L.	Depth in Shaft. D.	Depth in Piece. d.	Whole Width of Key. W.	Radius of Key. R.	Complement of Radius. C.	Width of Flat. F.
1	1-16	1-2	.175	.030	13-64	1-4	3-64	...
2	3-32	1-2	.195	.050	13-64	1-4	3-64	...
3	1-8	1-2	.145	.060	13-64	1-4	3-64	...
4	3-32	5-8	.210	.050	1-4	5-16	1-16	...
5	1-8	5-8	.190	.060	1-4	5-16	1-16	...
6	5-32	5-8	.175	.080	1-4	5-16	1-16	...
7	1-8	3-4	.255	.060	5-16	3-8	1-16	...
8	5-32	3-4	.235	.080	5-16	3-8	1-16	...
9	3-16	3-4	.220	.095	5-16	3-8	1-16	...
10	5-32	7-8	.300	.080	3-8	7-16	1-16	...
11	3-16	7-8	.285	.095	3-8	7-16	1-16	...
12	7-32	7-8	.270	.110	3-8	7-16	1-16	...
A	1-4	7-8	.255	.125	3-8	7-16	1-16	...
13	3-16	1	.345	.095	7-16	1-2	1-16	...
14	7-32	1	.360	.080	7-16	1-2	1-16	...
15	1-4	1	.315	.125	7-16	1-2	1-16	...
B	5-16	1	.285	.155	7-16	1-2	1-16	...
16	3-16	1 1-8	.390	.095	31-64	9-16	5-64	...
17	7-32	1 1-8	.315	.110	31-64	9-16	5-64	...
18	1-4	1 1-8	.365	.125	31-64	9-16	5-64	...
C	5-16	1 1-8	.335	.155	31-64	9-16	5-64	...
19	3-16	1 1-4	.460	.095	35-64	5-8	5-64	...
20	7-32	1 1-4	.440	.110	35-64	5-8	5-64	...
21	1-4	1 1-4	.425	.125	35-64	5-8	5-64	...
D	5-16	1 1-4	.395	.160	35-64	5-8	5-64	...
E	3-8	1 1-4	.365	.185	35-64	5-8	5-64	...
22	1-4	1 3-8	.475	.125	19-32	11-16	3-32	...
23	5-16	1 3-8	.440	.155	19-32	11-16	3-32	...
F	3-8	1 3-8	.410	.185	19-32	11-16	3-32	...
24	1-4	1 1-2	.520	.125	41-64	3-4	7-64	...
25	5-16	1 1-2	.490	.155	41-64	3-4	7-64	...
G	3-8	1 1-2	.460	.185	41-64	3-4	7-64	...
26	3-16	1 23-32	.440	.095	17-32	1 1-16	17-32	3-32
27	1-4	1 23-32	.410	.125	17-32	1 1-16	17-32	3-32
28	5-16	1 23-32	.380	.155	17-32	1 1-16	17-32	3-32
29	3-8	1 23-32	.350	.185	17-32	1 1-16	17-32	3-32
R	1-4	2 5-16	.620	.125	3-4	1 3-8	5-8	1-8
S	5-16	2 5-16	.600	.155	3-4	1 3-8	5-8	1-8
T	3-8	2 5-16	.565	.185	3-4	1 3-8	5-8	1-8
U	7-16	2 5-16	.535	.220	3-4	1 3-8	5-8	1-8
V	1-2	2 5-16	.505	.250	3-4	1 3-8	5-8	1-8
30	3-8	2 7-8	.755	.185	15-16	1 3-4	13-16	3-16
31	7-16	2 7-8	.720	.220	15-16	1 3-4	13-16	3-16
32	1-2	2 7-8	.690	.250	15-16	1 3-4	13-16	3-16
33	9-16	2 7-8	.660	.280	15-16	1 3-4	13-16	3-16
34	5-8	2 7-8	.630	.315	15-16	1 3-4	13-16	3-16
35	11-16	2 7-8	.600	.345	15-16	1 3-4	13-16	3-16
36	3-4	2 7-8	.565	.375	15-16	1 3-4	13-16	3-16

The motor in question was of 57.6 horse power (A. L. A. M. rating), on the basis of 1,000 r. p. m. The diameter of the shaft at the large end of the taper is 1$\frac{13}{16}$ inches, and at the small end approximately 1$\frac{11}{16}$ inches. The key being in the centre, the mean radius of the shaft was taken as ⅞ inch. Then, substituting in (2) we have:

$$F\,r = \frac{57.6}{1000} 63025.2 \text{ or } F = \frac{3630.25}{.875}$$

and F = 4148.85 foot-pounds.

Now substituting in (1)

$$TL_e = \frac{2\,(4148.85)}{A \times S_s}$$

Taking the shearing stress of the steel of which the key is made to be 70,000 and assuming a factor of safety of 10, we have:

$$TL_e = \frac{4148.85}{1.75 \times 3500} = TL_e = .677 \text{ sq. in.}$$

The available or effective length of the key is 1½ inches, and the thickness M T = $\frac{.677}{1.5}$, or .451 inch, which is approximately $\frac{29}{64}$ inch. Instead of using one ½ inch key two ⅜ inch keys (No. 29) were used.

The above applies to engines having the flywheel at the rear of the motor and the clutch within it, according to the usual arrangement. Where the flywheel is located in front of the engine, as in unit power plants with three point support, the key must be able to resist strains due to the momentum of the flywheel rim, to a certain extent, dependent on the easy action of the disc clutch, which is always used in the above cases, for obvious reasons.

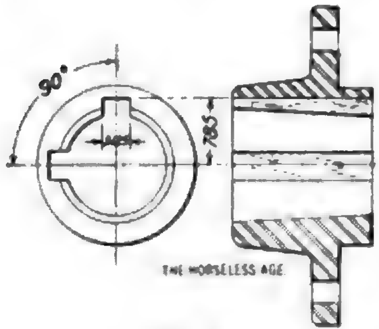


FIG. 5.

In another case which came under the writer's observation the key of the countershaft drive gear in the change speed gear shored off repeatedly. The driver of the car was in the habit of of coasting down hill, and not being a natural born mechanic he did not "feel" the difference in the action of the car when being driven by the power of the engine and when the motor was being driven by the momentum of the car. The cause of the shearing of the key can be readily understood from the above. One well known American car at least is provided with a means which obviates the possibility of such trouble, but it prevents the use of the motor as a brake. However, when a novice tries to use the motor for this purpose he may easily do the same damage.

The Use of Alcohol in Internal Combustion Motors.

By Lucien Perisse.

It involves perhaps a certain temerity to write of the use of alcohol in motors in the country where the production of gasoline is one of the great sources of wealth, and where, on the other hand, farmers have not yet taken up the culture of the vegetable best suited for purposes of distillation—I am referring specially to the sugar beet.

In the different European countries where the economic conditions are so different from those obtaining in the New World, the governments have found a considerable source of revenue in the constantly increasing taxes on potable alcohol, which is obtained from the distillation of fruits and saccharine plants, or from the transformation of grain. On the other hand, in order to permit the industrial use of this alcohol for lighting, heating and as a motor fuel, it became necessary to find the means of rendering it incapable of use for drinking purposes, without depriving it of its heating qualities.* These processes of transforming it are referred to as denaturation, because they have the effect of modifying the nature of the alcohol in such a manner that it cannot be drunk by even the hardiest topers.

Who knows but that some day the United States of America, foreseeing the period when the production of mineral oil will diminish in notable proportions, will find it advantageous to utilize some of the immense and fertile plains of the West for the production of saccharine plants for the supply of agricultural distilleries, with the object of manufacturing denatured alcohol? It was in France, in 1872, that the so called fuel alcohol (*alcool à bruler*) was first produced, and since that time most of the other nations have followed the example thus set. The denaturing agent, that is to say, the substance which serves as the base in all denaturing processes, is wood alcohol. The latter product is obtained by the distillation of wood, and the French market is largely supplied from the large forests in the Vosges mountains and from Germany. In order to serve as a denaturing agent under the French law, this alcohol must contain at least 25 per cent. of acetone and one-half per cent. of pyrogenous impurities, the repulsive odor of which is counted upon to prevent the consumption of denatured alcohol as a beverage. It is this wood alcohol mixture of a special composition to which has been given the name of methylene. In France alcohol is denatured by adding to 100 litres of 90 per cent. alcohol 10 litres of methylene and .5 litres of impure benzine. The density of this denatured alcohol is in general .832.

In Germany two kinds of denatured alcohol are provided for by the law, for industrial uses, as follows: First, fuel alcohol, containing 2 per cent of methylene and .5 per cent. of pyridine; its density is .819. Second, motor alcohol, which is denatured by 1 per cent. of methylene and .25 per cent. of pyridine, to which 2 per cent. of benzol is added. This liquid is colored a pale purple by means of a small quantity of violet color; its density is .825. Owing to a very powerful organization formed in Germany, the selling price of industrial alcohol remains substantially constant there, and in general does not exceed 25 to 28 marks per hectolitre.

The Austrian Government at the time of the international exposition held at Vienna in 1904 provided for three kinds of denatured alcohol. The composition of the denaturing agents has been kept secret, so that the government, which superintends the manufacture of denatured alcohol, may change them at will. In Austria we find, first, fuel alcohol of 90 per cent. The denaturing agent is composed of methylene, pyridine and a small quantity of phenol phthalein, or phthalic ether of petroleum; its density is .835, and it is almost colorless. Second, lamp alcohol, which is similar to the preceding grade as regards the denaturing agent used, but is of 95 per cent., and consequently its density is only .819. It is of a slightly darker color than the preceding grade. Third, motor alcohol, which must contain 80 per cent of absolute alcohol and 20 per cent. of benzol or gasoline; it is denatured by means of one-half per cent. of the general denaturing agent described above, and is colored by means of methyl violet; its density is .826. In Austria alcohol is sold by the government at a price about 30 crowns per hectolitre.

In England alcohol is denatured with 11 per cent. of wood alcohol, and in Holland a proportion up to 15 per cent. is used, which, in the writer's opinion, is excessive; the proportion of denaturing agent should be reduced to 10 per cent., if at all possible, in accordance with the French rule.

In Italy laws pertaining to the denaturing of alcohol have only recently been adopted. The composition of the denaturing agent is kept secret, but the agent contains an average proportion of impure wood alcohol, about one per cent. of pyridine and benzol. It is slightly colored by means of aniline violet. The Italian government sells the denaturing mixture at 1.27 francs per litre, and those who want to denature alcohol are required to use three litres of this compound to each hectolitre of pure alcohol.

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* The alcohol obtained by the distillation of saccharine or feculent plants is ethyl alcohol C_2H_5OH. The density of absolute or anhydrous alcohol is .086 at 0° C. and .795 at 15° C. It boils at 78.4° C. Its theoretical calorific power is 7,043 calories per kilogram. So called 90 per cent. alcohol contains 10 per cent. of water; it has a density of .833 at 15° C., and a theoretical calorific power of 5,710 calories per kilogram. Absolute wood alcohol, which has the formula CH_4O, has a density of .814 at 15° C., its theoretical calorific power is 4,451 calories per kilogram, and its boiling temperature is 56.5° C.

Switzerland also keeps the composition of its denaturing agent secret; it is known, however, that it contains wood alcohol, pyridine and about 2 per cent. of oil of acetone, which gives the mixture a disagreeable odor and a slightly yellow color; its density is .837.

Russia, which holds a monopoly of the sale of alcohol for drinking purposes, has also investigated the question of industrial alcohol. The tests which have been made were conducted with 10 per cent. of wood alcohol, to which was added 5 per cent. of acetone. The denaturing agent was completed by a small quantity of pyridine with a coloring agent consisting of the so called Hoffman violet; it is rated at 90 per cent., and its density is .836.

In the following table are compiled the data regarding the denaturing agents in the different countries which have made the composition of these agents public:

Per 100 Litres of 90 Per Cent. Alcohol.	France.	Germany. Ord.	Germany. Motor.	England.	Holland.
Methylene	10	2	1	11	15
Impure benzine	.5	..	..	..	..
Pyridine	..	.5	.25	..	..
Benzol	..	..	2	..	..
Violet coloring matter	..	.25	.25	..	..

It should be pointed out that aside from pure alcohol denatured alcohol mixed with an equal volume of benzol is extensively used in alcohol motors. Benzol is a hydrocarbon which is extracted from the tarry by-products of gas works and of coke furnaces. It is a by-product which may be produced in large quantities in all metallurgical installations, especially those using blast furnaces.

The technical committee of the Automobile Club of France, to whom the writer acts as secretary, has made an extensive series of tests with the object of determining the influence of the nature of the alcohol on the efficiency of explosion motors. The first tests were carried out with three different grades of alcohol which had not been subjected to the denaturing process. We used, first, the so called rectified spirits, which are of an agreeable odor; in other words, the alcohol as produced for current consumption. Second, the so called mauvais gout (bad taste) alcohol, which condenses on the plates and columns of the distilling apparatus at the beginning and toward the end of the distillation. This latter grade of alcohol is very frequently used for the manufacture of denatured alcohol, for the obvious reason that the rectified spirit is used more advantageously for the manufacture of liquors, and also for pharmaceutical purposes and for perfumes. We also tested what in France is known as the phlegm of agricultural distillation; in other words, the raw alcohol as it comes from the distilling plants installed at the point where the saccharine plants are raised. This alcohol is of 92 degrees and has a specific gravity of 827. It, therefore, is composed of a variable mixture of rectified spirits and mauvais gout alcohol.

Tests were also made on the motors of the laboratory with respect to the power obtainable from 90 degree wood alcohol. This test was made necessary by an incident which occurred in Belgium during one of the automobile races there a few years ago. M. Gobron, who manufactures automobiles fitted with a motor of a special type, had found that this motor developed a greater efficiency with alcohol than with gasoline. Having a number of vehicles entered in the Circuit des Ardennes Race, the party who was to supply him was prevented by the Belgian authorities from importing the fuel into that country, for the reason that Belgium at that time had not yet passed any laws with respect to the denaturation of alcohol for industrial purposes. As, on the other hand, the Belgian customs authorities did not make any objection to the importation of wood alcohol, M. Lepretre made a mixture of wood alcohol and benzol, which was taken into Belgium duty free and which gave excellent results, as M. Gobron's vehicles classed themselves in high positions. I would add that since that time a reactionary movement has set in in Belgium, headed by the University of Louvain, which is now terminating in the adoption of a more modern law.

The results obtained by M. Lumet, director of the laboratory of the A. C. of France, are as follows: The horse power obtained from a given motor when operated in succession with the different grades of alcohol, compared as follows with the horse power obtained from gasoline, the fuel consumption being substantially the same for all fuels, viz., .52 litre per horse power hour. With the mauvais gout alcohol there was a loss of 5 per cent.; with the rectified spirits, of 4 per cent., and with the phlegm of 2.5 per cent. In view of the very considerable difference between the heat values of the different fuels with an alcohol basis and that of mineral oil, the conclusion may be drawn that the efficiency of an explosion motor running on 90 degree phlegm is far superior to that of a motor running on gasoline.

It might be objected that this difference in efficiency was due to the fact that the carburetor of the motor was well adjusted for alcohol and poorly adjusted for gasoline, whereby the consumption of alcohol was favored. This objection does not hold, however, as the tests were made with two different carburetors, each one separately adjusted so as to give the highest efficiency, and by means of a three-way valve it was possible to change over instantly from one fuel to the other.

From the tests which we made in 1906 we arrived at the following three conclusions, which we succeeded in having officially approved by the International Congress of Applied Chemistry held in Rome:

1. It is advantageous to avoid as far as possible the so called mavais gout alcohol, and it seems preferable from every standpoint to use as a motor alcohol the unrectified phlegm as it comes from the agricultural distilleries which produce these phlegms of high percentage.

2. Wood alcohol, even when present in the proportion of 10 per cent., does not prejudicially affect the use of alcohol in motors, particularly if no impure benzine is added to this wood alcohol. If the introduction of some substance other than wood alcohol is insisted upon, it is advisable to use benzol of a good quality, but it is probable that the high proportion of wood alcohol alone offers a sufficient guarantee against fraud.

3. The alcoholmetric standard which seems to be most favorable for the use of alcohol in motors is 91-92 degrees.

In automobiles alcohol is generally employed mixed with an equal quantity of benzol for practical reasons. I might cite a large number of experiments on this subject which have been made in recent years, but I shall confine myself to indicating the most recent results obtained in two of the trials which have been completed this year. In the 1908 competition of military trucks the Brouhot truck, which carried a useful load of 1,600 kg. (3,520 pounds), with a total weight of 3,165 kg. (6,963 pounds), ran on Lepretre 50 per cent. alcohol, the price of which is 33.70 francs per hectolitre. The fuel consumption per gross ton kilometre was .064 litre, which makes the fuel cost 7 centimes per kilometre.

In connection with this trial of trucks there was also held a competition of motor cabs, which were operated during the entire time of the trial with a 50 per cent. alcohol mixture. The fuel consumption of the Doriot-Flandrin vehicle, which was the lightest of all, weighing 1,200 kg. (2,640 pounds), was 5.3 litres per 100 km.; the Brouhot car, which weighed 1,400 kg. (3,080 pounds), consumed 7.5 litres. The fuel cost for these two vehicles was therefore 18 and 25 centimes per kilometre, respectively, which results are certainly remarkable from the standpoint of economy.

The competition of light delivery wagons has furnished interesting figures, which permit of comparing the 50 per cent. alcohol mixture with gasoline. The Bayard-Clement cab consumed 9.4 litres of gasoline and 9.9 litres of alcohol mixture, respectively, for covering 122.6 km.; the Unic omnibus consumed for the same distance 10.9 litres of gasoline and 12.2 litres of alcohol mixture. On the other hand, the De Dion-Bouton car consumed 18.4 litres of gasoline and 16 litres of alcohol mixture.

The alcohol question is of such great importance to France that this year the Government appointed a parliamentary committee to take depositions from all persons who might be in position to shed any light on the subject. It results from these discussions that in a country like France, where an enormous tax is levied on alcohol, the cost of manufacture of 30 francs per hectolitre being augmented by 250 francs by the tax, it is absolutely necessary to have a denaturing agent giving the greatest security.

Why an Engine Cannot Be Perfectly Balanced When Fitted to a Car.

By P. Maisonneuve.

The balancing of engines is perhaps one of the most important and difficult problems in automobile motor construction. It can only be partly solved by mathematics, and successive trials after the engine is fixed to the car are necessary to solve it completely. The reason why this is so has only recently been pointed out. This theory, due to Prof. Albert Petot, of the Lille (France) School of Science, explains how an engine almost perfectly balanced when running on the testing block may impart vibrations to the car it propels, and that if this trouble is encountered it may be remedied by altering the original balancing of the engine.

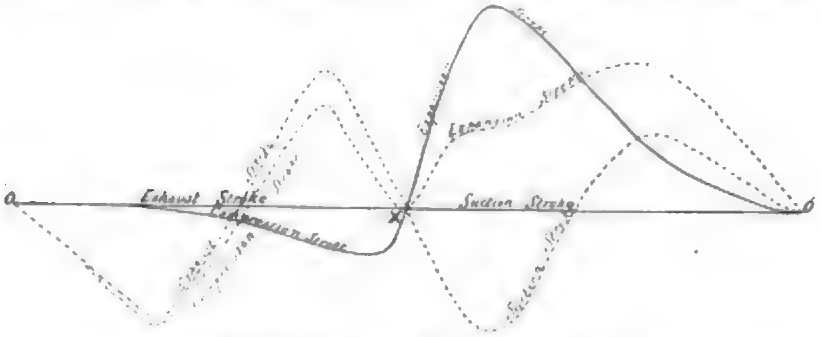


Fig. 1.—Variations of Forces Acting on Crank Pin.

Full line, tangential forces at low speed. Dotted lines, tangential forces at full speed.

The effect of the whole chassis on the balance of the engine is strongest when the engine has only one or two cylinders The balance of an engine of this type must be altered every time the motor is put on a new frame, or even when another body has been fitted to the latter In fact vibrations due to motor operation result either from a faulty balancing of revolving parts, such as crank pins, or poor balancing of reciprocating parts—pistons, and connecting rods. Another cause of vibrations is the periodical variation of the torque These periodical vibrations are more appreciable at low speeds of the motor (see Fig. 1), and if the whole transmission system, from engine to road wheels, had no backlash nor play of any kind, the effect of these variations in the torque would result in changes in spring deflection. This is so because, action and reaction being equal, the reaction of the engine power comes on the springs through the rigid frame, while the "action" takes effect on the driving wheels.

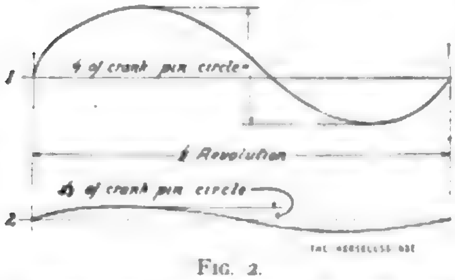


Fig. 2.

1, Variation of drive acceleration at lowest motor speed; 2, variation of drive acceleration at 300 r. p. m.

The periodical variations in the actual speed of the flywheel, due to the above causes, are noticeable only when the clutch is engaged; that is to say, when the motor power is applied to the driving wheels through the shafts and gears. Some of these parts are connected with the motor, some are connected with the driving wheels, and both mechanical groups are connected to each other by the side chains or Cardan shaft.

In the case of Cardan transmission and direct drive, power is applied directly and without alteration to the differential gear, and there is no supplementary reaction between the engine and the live axle. But if power is transmitted through toothed gears, the torque received by the Cardan shaft is greater than that delivered by the motor shaft. This multiplication of the torque results in an additional reaction on the frame:

Referring to Fig. 3 the couple transmitted by the crank shaft may be represented by $F \times r$. As a consequence, pinion I bears on gear II with a force F and reacts by pulling upward bearing I with a force $-F$, equal to F. The same force F produces in gear II a couple $-F \times R$ and bears on bearing II with a force $+F$. The effects of such a transmission of power on the various parts are as follows: The torque of shaft II will be multiplied in the ratio $R:r$. A torque equal to $F \times (R+r)$ will be impressed on the frame. The original couple $F \times r$ is the resultant of the following components: First.—The inertia of the pistons, which produces no reaction on the torque of the frame. Second.—The pressure of the gases on the piston head. As this pressure acts equally on the piston head and on the cylinder head, the effort the latter receives may be considered as a reaction acting on the frame and in the opposite direction.

The motor torque acting at the end of arm r may be expressed by $K \times r$, and the reaction applied to the chassis is $-K \times r$. So that after having been transmitted by gears, the frame is subjected to the couple $F \times (R+r) - K \times r$.

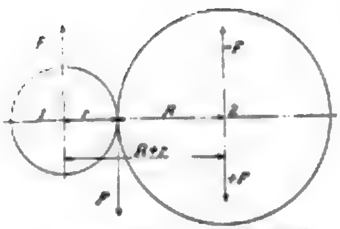


Fig. 3.

If $F = K + k$, the above expression becomes $F \times R + k \times r$.

The frame, therefore, receives the reaction due to the couple transmitted by the last member of the transmission, plus a constant reaction $K \times r$. If $S \times r$ is the couple transmitted by the Cardan shaft, the total reaction on the frame will be $-(S-k) \times r$. With the Cardan system of transmission, the reaction of these couples gives the frame a short and quick rolling motion. In cars with chain drive, the bevel gears driving the differential shaft change the direction of the couple and give the car a pitching motion. In both cases, the frame is submitted to polar motions the axis of which passes through the centre of gravity of the car (wheels and axle excepted).

This is the reason why vibration in cars does not depend solely upon balancing of the engine, but also on the complete chassis and on the change speed gear. The only remedy against undue vibration is to lighten the reciprocating parts of the engine, pistons and connecting rods, and to insert into the transmission a yielding member such as illustrated in Fig. 4. Such a device will absorb both speed fluctuations and sudden shocks, and it will thus tend to preserve all transmitting parts.

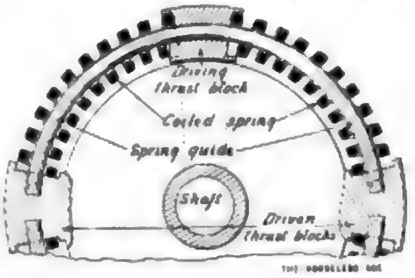


Fig. 4.—Transmission Shock Absorber.

In a recent consular report from India an air propellor gasoline motor car is referred to, which is said to have passed beyond the experimental stage, and to be about to be placed on the market. One of the main advantages claimed is that the car is very easy on tires, as its motion is absolutely smooth. A speed of 15 miles per hour is said to have been obtained on city streets, with a 5 horse power engine. As the air propellor is such an inefficient device we do not look for any extensive application of this principle of propulsion to road vehicles.

Principles and Experience Constants in Change Gear Design.

By S. Gerster.

In recent years the design of change speed gears has been systematized according to the various applications and the work to be performed. The classical change speed gear of early years is represented in Fig. 1. It is still used for heavy commercial vehicles. The reduction of speed is easily accomplished; it is not necessary to run the secondary shaft at the speed of the primary or motor shaft, which permits of obtaining a speed reduction between these two sets. This design comprises a minimum of parts, and they are easy to machine and are therefore not very expensive, but, on the other hand, the shafts are very long and they vibrate and cause shattering of the gear teeth. Parallel bearings have now been abandoned in change gears for pleasure vehicles, and partly also in the case of trucks. Chain transmission is also on the decline, and is now used extensively only for commercial vehicles, and there because it lends itself readily to a high demultiplication.

The above mentioned change gear is controlled by means of a single hand lever which when moved to its extreme rearward position gives the reverse and when moved to the extreme forward position the high speed forward, which is the most logical arrangement. The controlling linkage is of a very simple character, but the change gear box is very long and heavy.

In Fig. 2 is shown a change speed here widely used for vehicles weighing, loaded, less than 4,400 pounds. This gear is known as the progressive type with direct drive; it gives three forward speeds, and in the ordinary designs the first driving pinion is constantly in mesh with its gear on the secondary shaft, which shaft in turn is constantly in mesh with the reverse pinion. By leaving these gears constantly in mesh, the length of the change gear box is reduced. Care should be taken to reduce the speed of revolution of the secondary shaft as much as possible, by using the smallest possible driving pinion, so the secondary shaft will run at the lowest speed, and it will not produce a ringing noise when the car is being operated on the direct drive. The secondary shaft always runs at the same speed, whatever gear may be in mesh. The reversing pinion is geared down from the secondary shaft, and therefore operates under the best possible conditions. The illustration shows the overhanging driving pinion mounted on two bearings; this is not a very good construction, and the arrangement shown in Fig. 4 is much preferable.

The squared shaft is carried in front on a ball bearing placed inside the driving pinion. In the writer's opinion, this arrangement is very wasteful of space, and in this particular case a parallel bearing would be better, the load on this bearing being slight. The rear end of the squared shaft is carried in two ball bearings, an arrangement which is adopted by very few designers, owing to the fact that even the best of ball bearings always have slight imperfections and a pair of such bearings side by side never run perfectly concentric with each other; in consequence, the whole load will be taken by one, and it will even happen that one will be damaged by the other.

The transmission brake, mounted at the rear of the gear box, is of the contracting type. This type is rather out of date now, and has been replaced by the internal expanding brake, of such design as to be interchangeable with the rear wheel brakes. This change gear is controlled by means of a single lever, which gives the reverse speed in its forward position and the high forward speed in its rearward position—an illogical arrangement.

In order to so arrange matters that a forward motion of the lever will give the successive forward speeds, and vice versa, some designers operate the shifting fork in the gear box by means of a device similar to the one shown in Fig. 3, which is placed inside the gear box. The forks operating the sliding gears slide on two fixed bars.

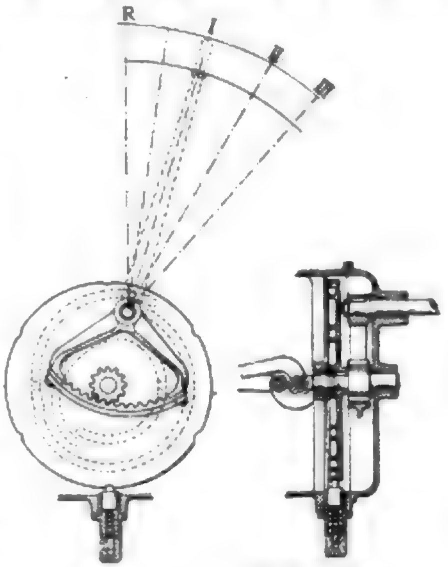


Fig. 3.

(In other constructions the bars are arranged so as to slide in bearings integral with the wall of the casing, the forks being fixed to the bars. This arrangement is more expensive.) Fingers carrying rollers slide in circular slots formed on a cam plate; this plate, carried on a pinion shaft, is actuated by a sector keyed to the shaft of the hand lever. A latch pin engaging into slots on the periphery determines the positions of the various speeds. This device, as illustrated, is provided with two circular slots adapted for operating two sliding gear sets, as indicated in Fig. 4.

In order to obtain a shorter change gear, and consequently a lighter one, designers have found it preferable to employ two sliding sets, instead of a single one. One

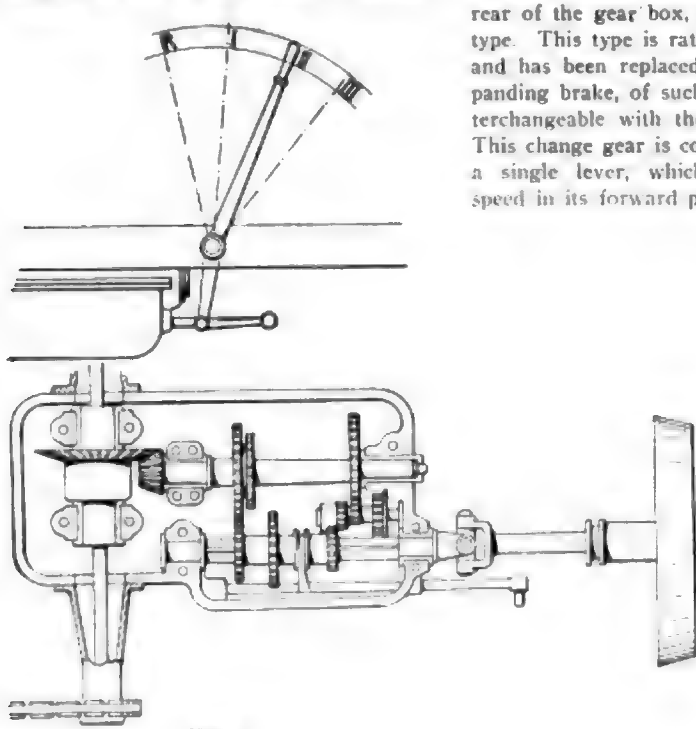


Fig. 1.

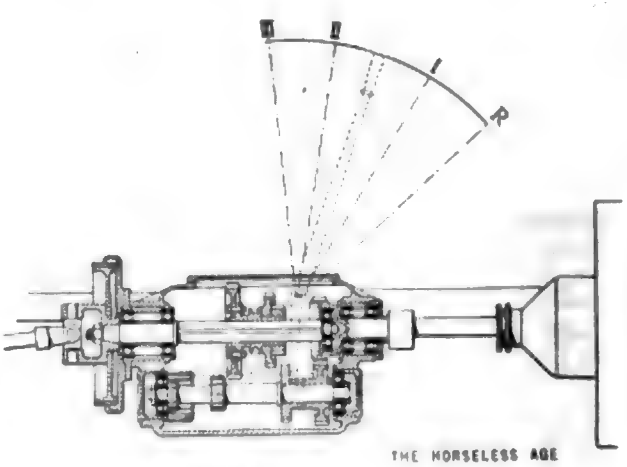


Fig. 2.

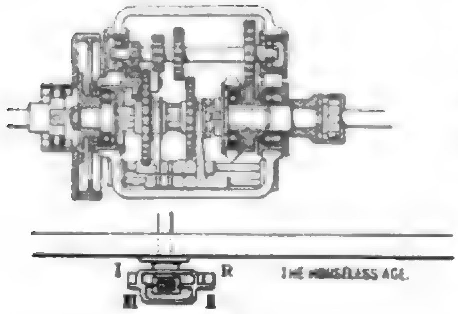


Fig. 4.

objection to this latter type of change gear is that the sliding sets have only a relatively short bearing on the fluted shaft, but this disadvantage is negligible in comparison with the advantages this design offers. Such a change gear is represented in Fig. 4. The driving pinion is mounted in the most rational manner between two ball bearings. The operation of the secondary gear set is effected in the same advantageous manner as in the case described above. The reversing pinion, which is constantly in mesh, is more advantageously arranged than in the previous case, there being less waste of space. The sleeve to which the universal joint is secured, which carries the brake drum, is keyed to a cone; it serves at the same time as the rear bearing for the primary shaft. This arrangement is rather delicate, and its only advantage is that it saves a few millimeters of length. The sliding pinions are provided with hubs which project at each end. In determining the design of these gears difficulties are encountered in providing space for the extension of the hub at each end. If the hub is not thus extended the overhanging gear will produce an inordinate pressure on the fluted shaft and wear same at a rapid rate.

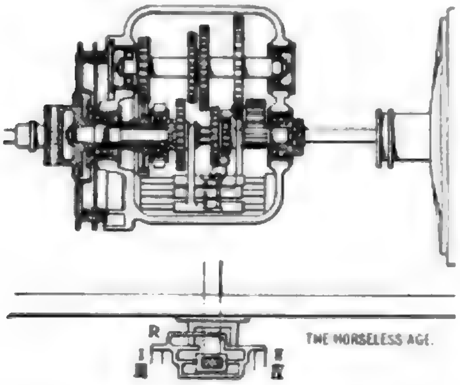


Fig. 5

In the illustration the two slider forks are operated by a linkage and a hand lever which moves in an H sector, spring pressed V bolts holding the forks in place. The various positions of the lever correspond to the following gear combinations:

Inside, forward—reverse gear.
Inside, rearward—first speed.
Outside, forward—second speed.
Outside, rearward—third speed.

This arrangement is illogical, in the sense that the reverse speed is obtained by a forward motion of the lever and the high forward speed by a rear motion of the lever. Owing to the complication of the device above described, which permits of obtaining all the speed with a single lever, this arrangement is often employed, however.

For large touring cars four speed gears are much used, generally of the construction illustrated in Fig. 5. This change gear is more complicated than the preceding ones, but it offers great advantages, and the only objection that may be made to it is that when the direct drive is used the secondary shaft turns at a higher speed of revolution than the primary shaft. For this reason it is necessary to unclutch the reversing pinions.

The primary shaft carries the two sliding sets, which in their turn operate the secondary shaft. The final gear is keyed between two bearings to the shaft carrying the clutch claws. The rear bearing is located as far back as possible, so as to avoid any overhanging of the brake drum. The brake drum is provided with ribs to facilitate the radiation of heat, and is built into the rear part of the change gear box, which protects the brake blocks against dust. The sliding gears and the reverse pinion are actuated by forks sliding on rods. The fork for the reversing pinion operates the latter through the intermediary of a balance lever, so as to obtain the reverse speed for a rearward position of the control lever. The lowest speed is obtained for a rearward position of the lever and the highest speed for a forward position, a rational arrangement.

The linkage of the control mechanism is represented in Fig. 6. The sliding forks are held in position by means of a "dog" placed underneath, and the range of motion is limited by stops on the rods. A locking arrangement for the fork of the first and second speed is necessary, as in engaging the reverse gear it may happen that the "dog" for the first and second speed fork does not engage, which would result in the engagement of the second forward speed and the reverse gear at the same time. This has actually occurred, and the two shafts of the change gear were then twisted, and complete dismounting of the gear box was necessary.

Different locking arrangements are in use, and I will describe a few of the simplest and most practical ones. The lever which actuates the forks slides in a transverse slot of the locking device, which by a lateral motion permits of the engagement of one or the other fork.

Fig. 7 shows a suitable position of the hand lever with respect to the seat of the driver. It is good practice to place this lever quite a distance from the frame side member, so the lever will not interfere with the body work. The brake lever is generally located at the side of the change gear lever. The shaft of this lever passes through the frame side member, an arrangement which is desirable from the standpoint of ready mounting of the body. Some designers place the lever shaft above the frame. This arrangement is desirable from the standpoint of the driver, but it considerably diminishes the strength of the body. In Fig. 2 the shaft at the control levers is placed two inches in front of the seat; it should never be placed further forward, and it is better to place it further to the rear, and to give the hand lever a forward inclination. By passing the shaft into the change gear box, the necessity for a special casing for the selecting mechanism is obviated.

After having thus described the principal arrangements for operating the change gears, we will now pass to a consideration of the factors and co-efficients to be employed in determining the proper dimensions of the shafts and gears. Before laying out his design the designer should ascertain the principal dimensions of the gears, shafts and bearings. The operating mechanism, the castings, cages and other accessories are laid out according to the dictates of practical experience. It is of course necessary to keep in view all the exigencies of foundry and machine shop work, and the claims of existing patents must be avoided.

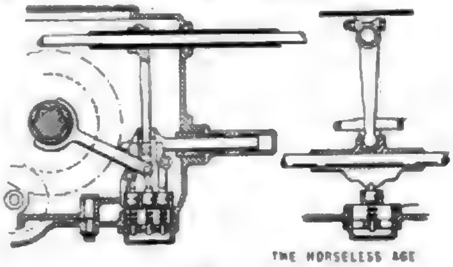


Fig. 6.

The proportions of the speeds must be determined in accordance with the weight of the whole vehicle, the power of the motor and the use for which the vehicle is intended. For light cars equipped with a powerful motor it is permissible to bring the speeds closer together, and the same holds good for vehicles provided with smooth acting clutches. In order to determine these factors it is advisable to lay out a sketch similar to Fig. 8. The pitch line pressures are determined from the motor turning moment P × R and the distance e, after having first determined the different gear ratios and the number of teeth. The pitch line pressures P_1, P_2, P_3, P_4 are calculated from the radii r_1, r_2, r_3, r_4. The

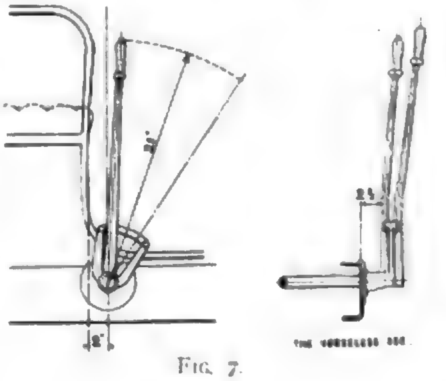


Fig. 7.

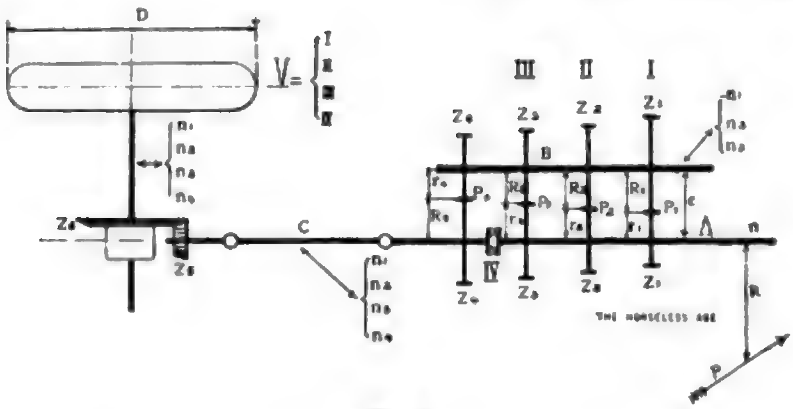


FIG. 8.

speeds of revolution n_1, n_2, etc., should be inscribed on the sketch for each shaft, they serving, together with the diameter of the driving wheels D, to calculate the speed V of the car in kilometers or miles per hour.

In the case of a three speed change gear the speeds are usually in the following proportions:

First speed, ⅓-¼ of the third speed.
Second speed, ⅔-½ of the third speed.
Third speed, equal to motor speed.

In the case of a change speed gear with four forward speeds, the proportion of the four speeds are generally as follows:

First speed, $^{9}/_{30}$-¼ of the fourth speed.
Second speed, $^{19}/_{30}$-½ of the fourth speed.
Third speed, $^{22}/_{30}$-¾ of the fourth speed.
Fourth speed, direct drive.

Some firms prefer to have the second and third speeds closer together.

The speed of the vehicle has an influence on the design of the change gear; thus, for instance, in the case of a change gear for racing cars the materials are worked under greater stresses. The tooth pressures are determined from the maximum turning moment M which the motor delivers under test on the testing stand. The pressure P on the pitch line is:

$$P = \frac{M}{r} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

The pressures P_1, P_2, P_3, P_4 are determined according to the torque transmitted by the secondary shaft and the pitch radii R and r. The further the two shafts are placed apart the smaller the pressure P becomes and the greater the pitch line velocities. The distance between the centres of the shafts vary from 80 to 155 mm. (3.2-6.2 inches) in gears for transmitting from 5 to 100 horse power. The following are the usual distandes of the gears for cars of different powers:

For 5 horse power at 2,000 r.p.m., 3.2 inch.
For 15 horse power, at 1,600 r.p.m., 4 inch.
For 30 horse power, at 1,300 r.p.m., 5 inch.
For 45 horse power, at 1,150 r.p.m., 5.6 inch.
Above 45 horse power, at 1,000 r.p.m., 6 inch.

These distances are, of course, only approximate, the exact distance depending upon the pitch decided upon.

There are three different classes of steel which may be used for the construction of change speed gears, as follows:

First, nature hard steel not quenched.
Second, case hardened steel.
Third, nature hard steel quenched.

The steels of the first class require the fewest operations, but have the one defect of rapidly wearing the cutting tools. Gears made from such steel wear rapidly, owing to the fact that the tooth contact surface is not hard enough. Steels of the second class are in great favor. The surfaces of case hardened gears are much harder than those of high carbon steel not hardened. The interior of the gears remains soft after quenching, and the metal preserves its original elasticity. These steels are greatly improved by the addition of from 2 to 6 per cent. of nickel. Nickel steel is used for change gears which shows an elastic limit of 70 kg. p. sq. mm., a tensile strength of 80 kg. p. sq. mm. and an elongation of 12 per cent. Gears made from these high tensile steels require great care in their cementation and quenching. It is necessary to let the parts cool slowly with the carbonizing box, and, if possible, with the furnace, in order to avoid warping of the parts.

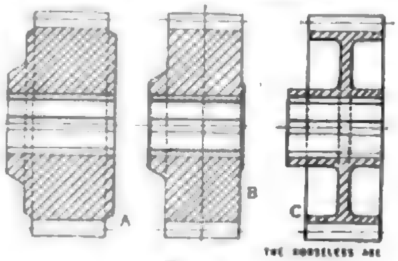


FIG. 9.

In order to avoid having brittle portions within the body of the material it is necessary to quench twice in succession, first at the temperature of recalescence of the steel and then at the temperature which gives the desired hardness of the surface. The steel is preferably quenched in a lead bath in which is inserted the end of a pyrometer. The best method of manufacturing gears, that is, the one which minimizes warping effects, is as follows:

In the first operation the gear is roughed out as shown at A, Fig. 9. Then the teeth are finished, as well as the bore and the keyways, if the gear is to be provided with such. On those parts which do not need to be hard, a thickness of metal of 4 mm. (0.160 inch) is left, which is removed after the cementation process, as shown at B, Fig. 9. The part is then quenched, with the greater part of the material near its hub. After hardening the gear is cut down to its final shape, as shown at C, Fig. 9.

If the gear has formed keyways in its bore only the bore is finished after the hardening process, and the bore is counted upon to centre the gear on the shaft. In the case of large gears it is preferable not to use any thinner sections than 5 mm. (0.200 inch), and in order to prevent the gear from giving out a ringing noise a number of large holes are formed in the web.

Alloy steels, hardened, are used more extensively in the United States than in Europe. This class comprises chrome nickel steel, vanadium steel and silicon steel. Gears made from these steels are completely finished before being hardened. Special treatments are employed for each grade of steel. These gears, owing to their very reduced dimensions, become easily deformed during the hardening process, and it is sometimes necessary to re-cut them after hardening. The parts which are fixed to the shaft must be finished by grinding.

Gears, and particularly those of high tensile steel, increase in size or become oval during the hardening process. For refinishing gears that have thus warped out of shape special tooth grinding machines are used, the grinder being in the form of a rack. This operation is very expensive, and a machine for grinding the gears in with emery flour is used in preference.

For testing the correct shape of the teeth, the device shown in Fig. 10 is used. It is fitted with a standard gear A mounted on an eccentric shaft. The gear B, which is to be tested, is mounted on a fixed shaft and a bushing corresponding to its bore. For testing the same gear after the different operations, sleeves or bushings of different diameters and different shapes are used. The eccentric shaft of the standard gear A carries a sector upon which a scale is inscribed. When the zero mark on the scale is opposite the mark on the base the

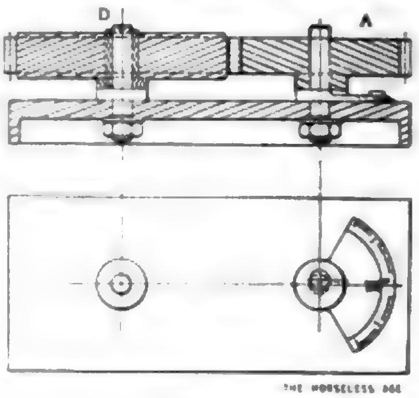


FIG. 10.

shafts are the exact distance apart, and the other positions of the scale show variations in this distance. The gears are generally cut to the exact depth, while the shafts of a change gear are set apart 0.2 mm. (0.008 inch) more than the theoretical distance, this slight extra distance allowing for any swelling that may occur during the hardening process. In some instances the pitch diameter of the wheels is decreased by grinding or recutting after hardening.

The shafts of change speed gears are made either of low carbon steel or of high carbon steel having a tensile strength of 70 to 80 kg. p. sq. mm. In the writer's opinion it is advisable to make them of the latter grade of steel. The secondary shafts are made in several different ways. The most general practice is to provide them with integral flanges and to bolt the gears to these. Some manufacturers make the shaft fluted, the same as the primary shaft, and then force the gears over the shaft by means of a nut at the end. The primary shafts are made with either four or six integral keys (up to some years ago these shafts were generally made with a square section). There are special machine tools on the market for milling the integral keys on the shafts and also for cutting the keyways in the pinions. For the primary shaft nickel steel with a high percentage of nickel and very hard is generally employed. These shafts are calculated to withstand the greatest torsional and flexing stresses combined. The material is worked at about one-tenth its elastic limit.

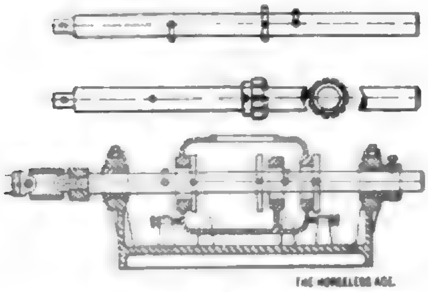


FIG. 11.

The change gear cases are generally made of aluminum, especially for pleasure vehicles. For trucks with cast steel wheels they are generally made of cast steel, a material which will stand the strongest vibration. For small cars selling at low prices these cases are often made of cast iron, which is cheaper than any other and which absorbs noise.

The boring of the bearings in the casing is accomplished by means of the fixture shown in Fig. 11. The casing as it comes from the foundry is adjusted on the fixture by means of set screws. In order to facilitate the machining it is advisable to so design the casing that all the bores are of the same diameter, at least all those which are concentric with each other. This rule is not always observed. The different operations of boring and facing are preferably accomplished by means of three cutter bars, as shown in Fig. 11. The cutting tools are not taken off the bars. When it is desired to change the bars, the upper half of the casting and the caps of the fixture bearings are removed. The best method of machining is to first rough out the bores with bar No. 1 to within 2 mm. of the finished dimension, and to finish with a hollow reamer mounted on bar No. 2. This reamer is cylindrical, the teeth cutting only at the ends, and a tool of this kind gives an absolutely correct bore.

This arrangement gives excellent results for machining aluminum gear casings. For casings in steel or cast iron it is necessary to use hollow reamers with ground flutes. For facing off the ends of the bearings, a third bar is used, which is provided with as many cutting tools as there are surfaces to be faced, and with two stops which limit the width of the parts. The cutter bars must be made of the greatest possible diameter, about three inches. These bars are driven through a shaft with two universal joints. In this manner, any want of alignment of the fixture with the machine tool does not affect the correctness of the work.

Piston Side Thrust as Affected by the Location of the Wrist Pin and Offsetting of the Cylinders.

By David Landau and Asher Golden.

The cause of the side thrust of the piston is due to the obliquity of the connecting rod; if we could have an infinitely long rod its obliquity would be zero and there would be no component of the pressure on the piston perpendicular to the axis of the cylinder.

Two methods have been adopted to minimize the effects of side thrust. One of these is to locate the piston pin in such a position that the side thrust shall be uniformly distributed over the entire surface of the piston. Engineers are fully agreed that the location of the piston pin does seriously affect the side thrust, and consequently the wear of the cylinder liner and piston, and that for any given piston dimensions a position may be found for the piston pin, such that the pressure on any one part of the piston will be the same as on any other part. The second method is to relatively displace the axes of the cylinder and the crank shaft, so that these axes shall not be in the same plane. In regard to the advantages of this method there seems to be some uncertainty, perhaps not so much so far as the method itself is concerned as there is in knowing what offset to employ. That this is probably the case may be seen from the fact that some engineers employ an offset as small as one-eighth of the crank length, while in one case, that of the Ramsey engine, the offset is equal to the crank length—that is, the axis of the cylinder is tangent to the crank pin circle. (See Fig. 2.)

There may be another object in employing extreme offsets, such, for example, as the desire to get a quick return motion. However, the consideration of this is foreign to the purposes of this article, and the matter will not be treated here.

We find from Lucke, "Gas Engine Design," page 204, that the maximum side thrust on the cylindrical surface of the piston is given by the maximum value of

$$P_m \tan \phi, \ldots\ldots (1)$$

where ϕ is the angle between the connecting rod and the axis of the cylinder, the P_m is the maximum pressure on the piston—that is, the explosion pressure.

Now, in any triangle (Fig. 1), $\frac{l}{\sin \theta} = \frac{r}{\sin \phi}$

from which $\sin \phi = \frac{r}{l} \sin \theta$, and

$$\phi = \sin^{-1} \left(\frac{r}{l} \sin \theta \right).$$

Evidently ϕ is a maximum when θ is 90°; that is, $\phi_{max} = \sin^{-1} \frac{r}{l}$.

Substituting this value of ϕ in (1) we find the maximum total side thrust to be

$$\frac{\pi d^2}{4} P_m \tan \left(\sin^{-1} \frac{r}{l} \right) \ldots\ldots (2)$$

where d is the diameter of the piston. If we call L the length of the piston and P_s the side thrust per unit projected area of the piston, then

$$P_s = \frac{\pi d^2 P_m \tan \left(\sin^{-1} \frac{r}{l} \right)}{4 d L} \ldots\ldots (3)$$

Equation (3) would give the maximum value of the side thrust if the maximum pressure P_m in the cylinder were constant throughout the entire stroke. This, however, is very far from being the actual con-

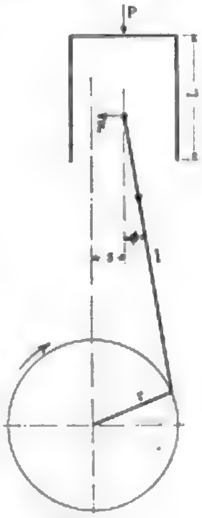


FIG. 1.

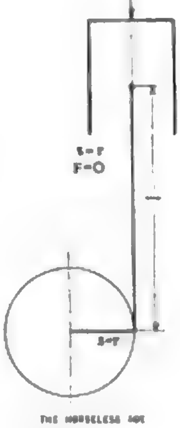


FIG. 2.

dition. The maximum pressure exists for a very short time at or near the instant of the explosion. At this instant the angle ϕ is at or near its minimum value. At the instant when ϕ has its maximum value, that is, when the crank angle is 90 degrees, the pressure in the cylinder has died down to a value expressed by the relation

$$P = \frac{C}{V^n} \qquad \text{.....(4)}$$

where C is a constant for a particular engine,

V is the volume of gas in the cylinder at the instant when ϕ is a maximum,

n is the ratio of the specific heat of the gas at constant pressure to the specific heat at constant volume.

Now, when ϕ has reached its maximum, the piston has swept over a distance from the top of the stroke equal to

$$r + \frac{r^2}{2l}$$

and the volume of gas in the cylinder is now

$$V = K + \frac{\pi r d^2 (2l + r)}{8l} \qquad \text{.....(5)}$$

where K is the volume of the combustion chamber.

Substituting this value of V in equation (4), we have

$$P = \frac{C}{K + \frac{\pi r d^2}{8l}(2l + r)^n} \qquad \text{.....(6)}$$

and finally, substituting the value of P from (6), we have

$$P^n = \frac{1}{4dL}\left[\frac{\pi d^2 C}{K + \frac{\pi}{8l}[r d^2 (2l + r)]^n}\right] \tan\left(\sin^{-1}\frac{r}{l}\right) \qquad \text{.....(7)}$$

It will now be of interest to determine the side thrusts as given by equations (3) and (7). This can best be done by a numerical application. The following figures will be assumed as representing an actual case:

d = 4.5 inches
r = 2.5 inches
l 10. inches
L = 6. inches
Compression, 75 pounds per square inch
Combustion chamber volume, K, 26.51 cubic inches
Explosion pressure, P_m, 300 pounds per square inch
n = 1.3 (approximately)

Then C is found to have the value 5635.

Now, making the necessary substitutions, we find

From equation (3) P_n = 45.7 pounds per square inch, and

From equation (7) P_n = 3.32 pounds per square inch.

It will be seen from these results that at the instant when the angle ϕ is a maximum the side thrust is very far from having its maximum value. The maximum value of the side thrust does not occur either at the instant of maximum pressure or at the instant of maximum connecting rod angle, but at some point between these two. To those who may be desirous of determining the maximum side thrust the following method is suggested:

We know that at any instant the maximum side thrust (pressure on the cylindrical surface of the piston per square inch of projected area) is

$$P_n = \frac{\pi d^2 P \tan\phi}{4dL} \qquad \text{.....(8)}$$

where P is the pressure on the piston at the instant considered.

We have here three variables, namely, P_n, P and ϕ. We can replace P and ϕ by a single variable by expressing them both in terms of θ.

We have seen above that $\sin\phi = \frac{r}{l}\sin\theta$; also

$$\cos\phi = \sqrt{1 - \sin^2\varphi} = \frac{1}{l}\sqrt{l^2 - r^2\sin^2\theta}$$

We then have

$$\tan\phi = \frac{\sin\phi}{\cos\phi} = \frac{r\sin\theta}{\sqrt{l^2 - l^2\sin^2\varphi}} \qquad \text{.....(9)}$$

We have also seen above that $P = \frac{C}{V^n}$.

The volume V at any instant is the product of the area of the piston into the distance which the piston has moved up to the instant under consideration, to which must be added the volume K of the combustion chamber. The distance which the piston has moved is

$$S = r(1 - \cos\theta) + \frac{r^2}{2l}\sin^2\theta,$$

and the volume V is then

$$V = K + \frac{\pi d^2 S}{4}$$

Substituting this value in equation (4), we have

$$P = \frac{C}{\left(K + \frac{\pi d^2 S}{4}\right)^n} \qquad \text{.....(10)}$$

If, now, we substitute in equation (8) the value of P from (10) and the value of tan ϕ from (9), we can write P_n in the following form:

$$P^n = \frac{\pi d C r \sin\theta}{4L\left[K + \frac{\pi d^2}{4}\left(r(1 - \cos\theta) + \frac{r^2}{2l}\sin^2\theta\right)\right]^n \sqrt{l^2 - r^2\sin^2\theta}} \qquad \text{.....(11)}$$

The value of θ, which makes P_n a maximum, may now be found by differentiation and the corresponding value of ϕ from the relation

$$\sin\phi = \frac{r}{l}\sin\theta.$$

This gives us the side thrust expressed as a function of the obliquity of the connecting rod. The uniform distribution of the side thrust over the piston surface will depend on the location of the wrist pin and the number and disposition of the piston rings.

For any given stroke and any position of the piston the longer the connecting rod used the lower will be the side thrust; in other words, the side thrust will be less the nearer we place the wrist pin to the head of the piston. It is clearly seen that if we place the wrist pin at the piston head the connecting rod angle is less than for any other position of the wrist pin. An arrangement of this kind, however, gives us a side thrust which is distributed near the head of the piston so that this part will wear most. On the other hand, if we locate the wrist pin at the bottom of the piston the angularity of the connecting rod is a maximum. The side thrust for all positions of the piston is now greater than for the other extreme case, and the thrust is distributed near the bottom of the piston. Between these two extremes a position may be found for any given case where the side thrust is practically uniformly distributed over the entire surface of the piston.

OFFSETTING OF CYLINDERS.

It will now be of interest to discuss the matter of offsetting the cylinders and to see how this affects the side thrust.

Let r = length of the crank arm
l = length of the connecting rod
s = offset
(See Fig. 1.)

As before, the side thrust F = P tan ϕ.

where P is given by the relation $P = \frac{C}{V^n}$ and

$$\tan\phi = \frac{r\sin\theta - s}{\sqrt{l^2 - (r\sin\theta - s)^2}} \qquad \text{.....(13)}$$

The volume $V = K + \frac{\pi d^2}{4} s_1$

where

$$S_1 = \sqrt{(l + r)^2 - s^2} - \sqrt{l^2 - (r\sin\theta - s)^2} - r\cos\theta$$

Substituting this in equation (4), we have

$$P = \frac{C}{\left[K + \frac{\pi d^2}{4}\left(\sqrt{(l + r)^2 - s^2} - \sqrt{l^2 - (r\sin\theta - s)^2} - r\cos\theta\right)\right]^n} \qquad \text{.....(14)}$$

We can now substitute in equation (12) the values of tan ϕ and P given in equations (13) and (14); we then find the maximum side thrust to be

$$P_n = \frac{\pi d C (r\sin\theta - s)}{4L\left(\left[K + \frac{\pi d^2}{4}\left(\sqrt{(l+r)^2 - s^2} - \sqrt{l^2 - (r\sin\theta - s)^2} - r\cos\theta\right)\right]^n \sqrt{l^2 - (r\sin\theta - s)^2}\right)} \qquad \text{.....(15)}$$

As before, the value of θ, which makes P_n a maximum, may be found by equating $\frac{dP_n}{d\theta}$ to zero and substituting the value of Θ in $\frac{d^2 P_n}{d\theta^2}$, which will make this derivative negative.

The value of P_n given in equation (11) may be obtained from that given in equation (15) by making s zero.

We will now apply the formulas (11) and (15) for the purpose of comparing the side thrust under both conditions of offset and non-offset. For this purpose the following dimensions and figures will be assumed:

d = 4.5 inches
L = 6. inches
l = 10. inches
r = 2.5 inches
Compression = 75. pounds per sq. in.
K = 26.5 cubic inches
n = 1.3
C = 5635
θ = 60. degrees
s = 1.25 inches

Substituting these values in equation (11), we find P_n to be 46.66 pounds per square inch. Substituting the corresponding values in equation (15), we find P_n to be 2.07 pounds per square inch. The extreme contrast between these two conditions should leave no doubt as to the advantage of offsetting.

Were we to employ an offset equal to the crank length, it is seen that when Θ became 90 degrees, the side thrust would be zero, for the numerator of equation (15) would then be

$$\pi\ d\ C\ (r - r) = 0.$$

(See Fig. 2.)

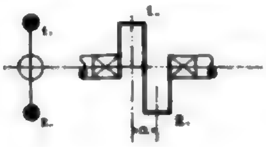
This does not prove by any means that such an extreme offset is the most advantageous. As was pointed out by F. E. Watts in the last Engineering Number of THE HORSELESS AGE, the best offset must be determined by the conditions of any particular case.

It must be here remarked that while offsetting the cylinders does reduce side thrust, the piston pin must be properly located in order to distribute the side thrust uniformly.

Comparison of Vibration in Two and Four Cycle Engines.

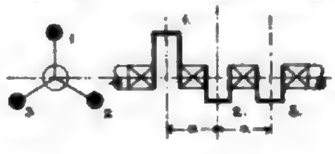
By T. M. Phetteplace, Assistant Professor Mechanical Engineering, Brown University.

Great activity in study and experiment regarding the two cycle engine characterizes the present time, and the possibility of simplicity and greater power in the two cycle type attracts everyone. So a comparison of the highly perfected four cycle with the neglected two cycle is always interesting, and numerous such comparisons have appeared, but none discussing the forces causing vibration. Since the subject of vibration is very important, especially in automobile construction, the author feels that this paper should be of some interest.



Two Cylinders.

Fig. 1.



Three Cylinders.

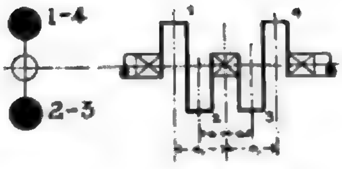
Fig. 2.

The forces causing vibration in a gas engine may be grouped into three systems: (1) those due to revolving masses; (2) those due to reciprocating masses; (3) those due to the gas pressures and inertia forces of the reciprocating parts combined, causing a pressure on the side of the cylinder and a turning force always tangent to the crank pin circle.

REVOLVING MASSES.

In the four cycle type there are usually two or three systems of revolving masses, those about the crank shaft and those about each cam shaft, in case there are more than one. The revolving masses about the crank shaft which might not be balanced would be the crank pin, the cranks and that part of the connecting rod which is considered as revolving. The weight of these parts may be reduced to equivalent weights at the crank radius, and this is usually done. The centrifugal forces due to these weights have both horizontal and vertical components, and those components in the case of more than one cylinder introduce moments about horizontal and vertical centre lines. The vertical components cause a jumping up and down, and the horizontal components cause a movement of the engine to and fro sideways in a horizontal direction perpendicular to the centre line of the crank shaft.

The moments due to the vertical components would cause a tilting up and down of first one end of the engine and then of the other, like a seesaw. The moments due to the horizontal components would cause an oscillation in a horizontal plane about a vertical axis, like the needle of a compass. In a single cylinder engine of either four cycle or two cycle type these forces, due to the revolving weights, would be the same and could be balanced by counterweights placed opposite the cranks, as is the usual way, and there would be no moments.



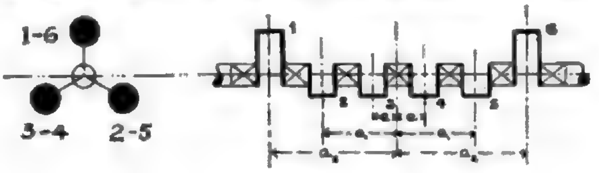
Four Cylinders - Four Cycle.

Fig. 3B.

In a two cylinder engine, with the cranks at 180 degrees, these forces would be balanced in both types, but not in the same plane, so there would be a moment or couple, the arm being equal to the distance between the centres of the cylinders. (Fig. 1.)

In the case of a three cylinder engine with cranks at 120 degrees the forces would be balanced, but not in the same plane, so that moments would result the same for both types. (Fig. 2.)

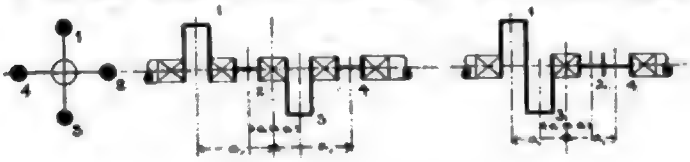
When there are four vertical cylinders we have a different arrangement of cranks for the two cycle from that for the four cycle, because there are four impulses per revolution with the two cycle, and the cranks are set at 90 degrees, to get a better turning effort, while the usual arrangement for the four cycle is to have the cranks set at 180 degrees, all being in the same plane, the two outer ones up while the inner ones are down. (Fig. 3.) For either type the forces are balanced, while for the four cycle the moments are balanced and for the two cycle they are not. Two crank arrangements are shown in Fig. 3 for the two cycle type.



Six Cylinders - Four Cycle.

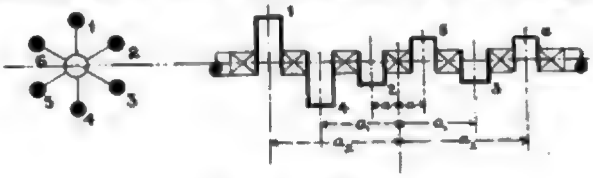
Fig. 4A.

If the engine is a six cylinder one, again there would be a difference in the arrangement of the cranks. The four cycle would have them set at 120 degrees and arranged symmetrically about the centre. (Fig. 4.) In this case the forces and moments would both be balanced. In the case of the two cycle the cranks would be set at 60 degrees



Four Cylinders - Two Cycle.

Fig. 3A.



Six Cylinders - Two Cycle.

Fig. 4B.

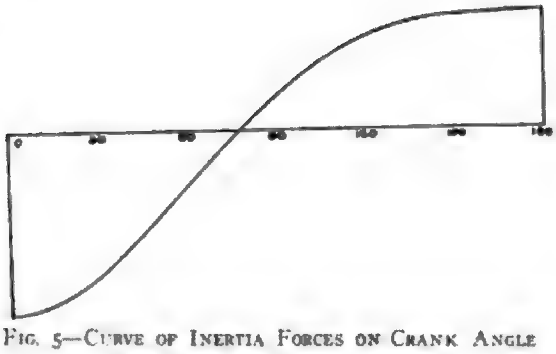


FIG. 5—CURVE OF INERTIA FORCES ON CRANK ANGLE BASE TOWARD CRANK SHAFT.

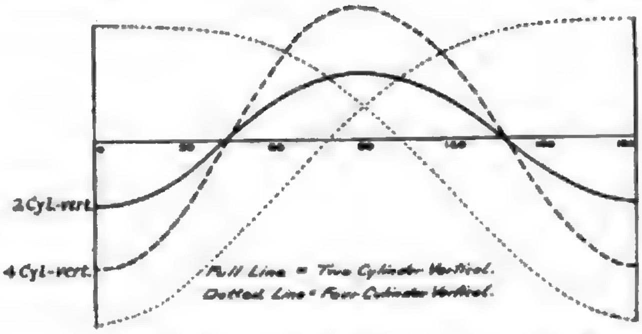


FIG. 6—CURVES OF UNBALANCED INERTIA FORCES.

and the forces would be balanced and the moments would not. However, in all of these cases the forces and moments could be balanced by adding weights to the flywheel, or by using counterweights on the cranks.

Now, in considering the other systems of revolving masses there may be one or two cam shafts in the case of the four cycle type and none in the two cycle. The ordinary three port two cycle engine is referred to in this paper; those types having mechanically operated valves or auxiliary air pumps are left out. Hence there will be no vibration from this source in the two cycle type, while there may be a small amount from the four cycle. The part that would be unbalanced would be the cam, which is light in weight, not far removed from the axis and revolves at one-half the speed of the crank shaft, so that its effect would be very slight.

The effect of these unbalanced forces and moments, of course, is slight, but is in favor of the two cycle engine.

RECIPROCATING MASSES.

The second system comprises the reciprocating masses. There may be two or three groups of these weights in the four cycle type. The first group, common to both types, would be the piston, piston pin, and that part of the connecting rod not considered as revolving. The inertia forces resulting from these weights may be calculated from the formula: $F/A = .00034\ W/A\ N^2R$ $(\cos\theta + r/l \cos 2\theta)$, which is given in THE HORSELESS AGE, October 14, 1908, page 536.

CYLINDER ARRANGEMENT.	REVOLVING.				RECIPROCATING.				Turning Effort. Number of Impulses.	
	Forces		Couples.		Forces.		Couples.			
	Four Cycle.	Two Cycle.	Four Cycle	Two Cycle.	Four Cycle.	Two Cycle.	Four Cycle.	Two Cycle.	Four Cycle.	Two Cycle.
1 Vertical	Unbal.	Unbal.	None.	None.	Unbal.	Unbal.	None.	None.	1	2
2 Vertical	Bal.	Bal.	Unbal.	Unbal.	Unbal.	Unbal.	Unbal.	Unbal.	2	4
2 Opposed	Bal.	Bal.	Unbal.	Unbal.	Bal.	Bal.	Unbal.	Unbal.	2	4
3 Vertical	Bal.	Bal.	Unbal.	Unbal.	Bal.	Bal.	Unbal.	Unbal.	3	6
4 Vertical	Bal.	Bal.	Bal.	Unbal.	Unbal.	Bal.	Bal.	Unbal.	4	8
6 Vertical.......	Bal.	Bal.	Bal.	Unbal.	Bal.	Bal.	Bal.	Unbal.	6	12

There are two ways in which the inertia forces may be discussed, by substituting the proper values for angle θ, and noting whether the expression in brackets reduces to zero or not, or by constructing the curves of inertia forces and then combining these curves, arranging them according to the proper crank angle phase. Both methods will be illustrated.

For comparison choose engine dimensions as follows:

Crank Radius = R = 2¼ inches
Bore = 4¾ inches
R. P. M. = 1000
W/A = .6 pound
$.00034\ W/A\ N^2R = 41.4$

Fig. 5 shows the free unbalanced inertia forces for any crank angle for a single cylinder engine. The curve is the reverse for the return stroke. These forces act along the centre line of the cylinder and cause a jumping up and down of the engine, and cannot be wholly balanced by adding revolving weights. Hence in a single cylinder the forces cannot be completely balanced. Where there is more than one cylinder these forces introduce couples or moments which cause a tilting the same as unbalanced revolving forces. In a two cylinder vertical arrangement with cranks at 180 degrees the forces would be unbalanced, as shown in Fig. 6, the curves of inertia forces being added together, and there would be a couple with one arm equal to the distance between the centre of the cylinders which would not be balanced.

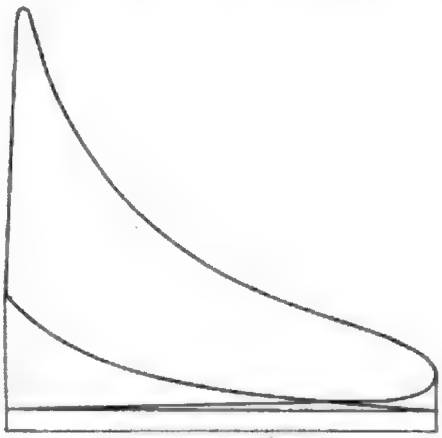
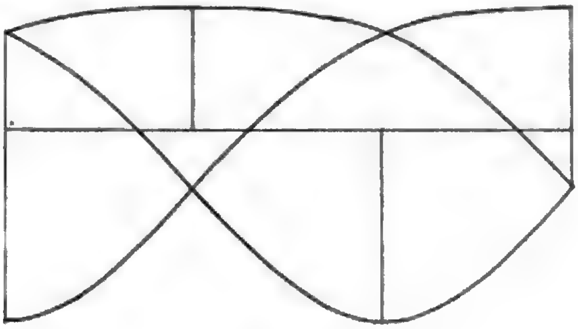


FIG. 8.



Added together these curves reduce to zero.
FIG. 7.

Furthermore, in this case, substituting in the brackets in the formula for the inertia force for ths angle θ, θ and $(\theta + 180)$ and adding, $\cos\theta + \cos(\theta + 180) + R/L \cos 2\theta + R/L \cos 2(\theta + 180)$ is the value of the bracket. This reduces as follows: $\cos\theta + \cos\theta \cos 180 - \sin\theta \sin 180 + r/l \cos 2\theta + r/l \cos 2\theta \cos 360 - r/l \sin 2\theta \sin 360 = \cos\theta - \cos\theta - 0 + r/l \cos 2\theta + r/l \cos 2\theta - 0 = 2\ r/l \cos 2\theta$ showing that the forces are not balanced.

In a three cylinder vertical engine the forces would be balanced and the moments would not in both types.

Putting for θ, its values θ, $(\theta + 120)$ $(\theta + 240)$ $\cos\theta + \cos(\theta + 120) + \cos(\theta + 240) + r/l \cos 2\theta + r/l \cos 2(\theta + 120) + r/l \cos 2(\theta + 240) = \cos\theta + \cos\theta \cos 120 - \sin\theta$

sin 120 + cos θ cos 240 — sin θ sin 240 + r/l cos 2 θ + r/l cos 2θ cos 240 — r/l sin 2 θ sin 240 + r/l cos 2θ cos 480 — r/l sin 2θ sin 480 = cos θ — ½ cos θ — ½ 3 sin θ — ½ cos θ + ½ 3 sin θ r/l cos 2θ — ½ cos 2θ + r/l ½ 3 sin 2 θ — ½ r/l cos 2θ — r/l ½ 3 sin 2θ = 0, showing that the three cylinder inertia forces are balanced.

The inertia curves are also combined in Fig. 7, and when added reduce to zero, showing that the forces are balanced.

In a four cylinder, vertical of the four cycle type the forces would not be balanced, and the free forces would be twice those for a two cylinder vertical engine (Fig. 6). The moments would be balanced. With the two cycle type the forces would be balanced, but the moments would not be. In the case of a six cylinder the four cycle type would be balanced as to forces and moments, while in the two cycle type the forces are balanced and the moments are not.

COMBINED GAS PRESSURE AND INERTIA FORCE.

The third system of forces is due to the combined inertia forces and gas pressures. The gas pressures were assumed as in the following indicator cards (Figs. 8 and 9). The first is a four cycle card and the second is a simliar card modified for the two cycle type. Combining the inertia force with the gas pressure gives the wrist pin pressure, of which a small part acts as a side pressure of the piston on the cylinder walls, and the greater part acts along the connecting rod, causing a turning force on the crank pin. The side pressure varies in amount and changes sides, and would tend to cause the upper part of the cylinder to rock about the crank shaft. This pressure is small in amount, and in the two cycle type would be wholly in one direction during the down stroke and in the opposite direction during the up stroke, changing at the ends of the strokes, while for the four cycle type, during the exhaust and suction strokes it would change at the ends of the stroke and also near the middle, so that during two revolutions there would be four changes of direction in the two cycle and six in the four cycle. Multiplying the piston pin force by the tangential factor, the turning effort results and the turning effort curve may be plotted. (Fig. 10.) This force tends to twist the whole engine about the crank shaft as if the crank shaft were stationary and the engine revolving, and the effect is very noticeable when the cylinders miss or do not get equal charges.

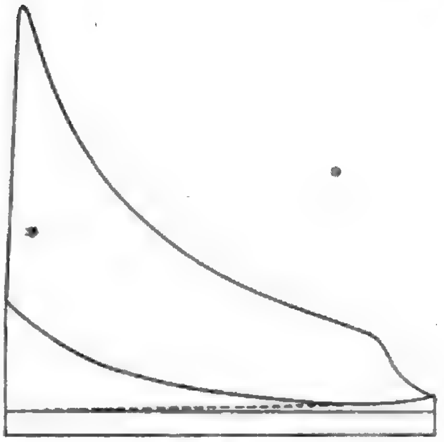


FIG. 9.

TURNING EFFORT CURVES FOR TWO AND FOUR CYCLE ENGINES FOR VARIOUS CYLINDER ARRANGEMENTS.

FULL LINES - FOUR CYCLE. MIXED LINES - TWO CYCLE.

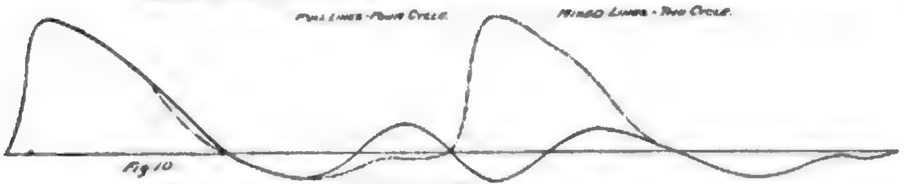


Fig 10 SINGLE CYLINDER.

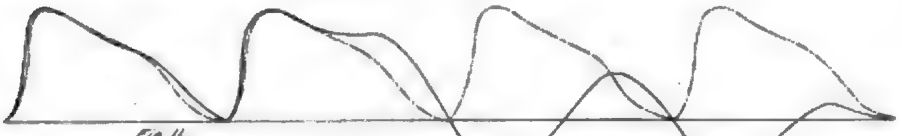


Fig 11. TWO CYLINDER

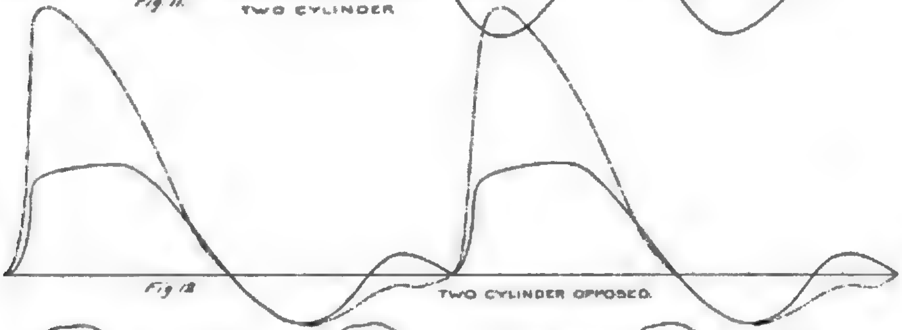


Fig 12 TWO CYLINDER OPPOSED.

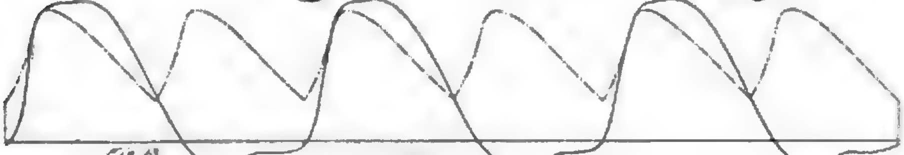


Fig. 13. THREE CYLINDER

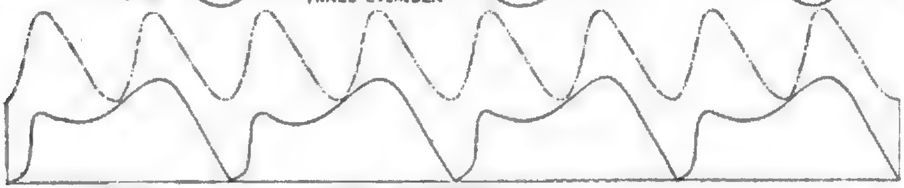


Fig 14 FOUR CYLINDER

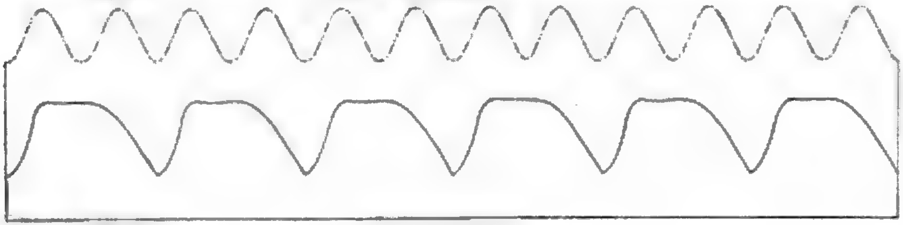


Fig 15 SIX CYLINDER.

Fig. 10 shows the comparison of the turning effort curves for a single cylinder engine. The full lines represent the four cycle type, and the mixed lines the two cycle. Fig. 11 shows the same for a two cylinder vertical; Fig. 12, two cylinder opposed; Fig. 13, three cylinder vertical; Fig. 14, four cylinder vertical, and Fig. 15, a six cylinder vertical. A careful examination of these curves shows the great advantages of the two cycle type over the four cycle type as regards uniform turning effort. To be sure, a properly designed flywheel would even up the turning effort curve and would reduce the vibration due to this source somewhat, but since most flywheels on automobiles are light, the inertia of the machine itself being depended on to take the place of part of the flywheel, vibration from this source is felt, and the advantage of a smooth, continuous turning effort may be easily noticed.

Our conclusion would be that in general the four cycle type would be freer from vibration, due to the revolving and reciprocating masses, than the two cycle, but would be much inferior as regards turning effort. However, engines of one, two or three cylinders of the two cycle type would be freer from vibration from all sources than similar ones of the four cycle, and the six cylinder, four cycle would be better than the six cylinder, two cycle. In the four cylinder case the inertia forces of the four cycle type and the moments of the two cycle type would be unbalanced, while the turning effort of the two cycle would be better than for the four cycle, so it would seem that they were about even.

The Wood Sill.

By F. E. Watts.

Although wood is one of the most common materials and is used in a wide variety of constructions, most of us have only a general knowledge of its properties. Its very commonness causes us to take but little notice of it, and we have here another illustration of the old adage that "familiarity breeds contempt."

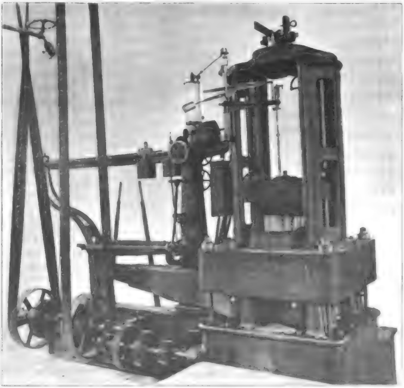
Unfortunately much of the wood we commonly see is of poor quality, is cross grained, knotty, and often partially decayed. So we unconsciously form the opinion that wood rots easily, warps, sags under load and is generally unreliable. All of these strictures are more or less true of the wood we commonly encounter, but they do not apply to carefully selected, seasoned and preserved specimens.

In the field of automobile manufacture wood has largely been disregarded as a material of construction, except for bodies. Until recently the only place where it had been used under any considerable stress was in frames, but a little over a year ago it was adopted for the axles of a small car designed to run upon solid tires. As frames and axles of this material are giving good satisfaction, it will no doubt be of interest to discuss some of its qualities and the conditions which must be complied with in its use to get satisfactory results.

The structure of wood is entirely different from that of metals. The latter, being inorganic bodies, are somewhat homogeneous in their structure, while wood, being organic, is made up of cells of varying size and shape. From the method of growth of trees, adding a layer just inside the bark every year, the trunk is made up of annular rings of these cells. As a matter of fact, the name cells applied to these structures is not very descriptive, as they are more in the nature of capillary tubes with their sides cohering together. The annular rings made up of these tubes are bound together by radial sheets of cellular tissue, called the medullary rays, which are very prominent in the sections of such trees as the oak. At and near the middle of the tree these tubes are choked with matter of a more or less resinous nature; this part is called the heart wood. The surrounding sap wood is lighter and its tubes are filled with liquid sap.

The whole structure of wood is very complex and has been the subject of a considerable amount of microscopic study for the past twenty years. At the present time the Forestry Department is making extensive researches along these lines.

Seasoning of wood consists principally in drying the liquid from the tubes. The final strength of the wood depends quite largely upon the manner and thoroughness in which this is done. If too much water is extracted the wood is apt to be brittle; if too much is left in the pores, not only is the wood weaker, but it is much more apt to decay. So, proper seasoning, like the heat treating of metals, is a process which requires considerable study and skill.



Method of Testing Franklin Wood Sill in Riehle Testing Machine

Regarding the increase in the strength of wood from proper seasoning, Thurston says: "The increase of strength is very variable; pine gains about 10 per cent., elm 10-15 per cent., oak 5-25 per cent., while ash and beech often gain 40 per cent.

"Dryness is the best preventive of decay. Wood kept perfectly dry will last several centuries, still it finally becomes brittle and weakened and may ultimately give way under a light load.

"Alternate moisture and dryness produce rapid decay. This takes place partly by solution and removal of a portion of the substance at each moistening, and partly by the action of oxygen dissolved in the water, a fresh supply of dissolved oxygen being furnished at each repetition of the moistening."

Dry rot is usually produced by want of circulation of air, or by high temperatures, where the wood has not been well seasoned.

It will be seen from the foregoing that the strength of wood varies greatly with its treatment. But there are further wide variations even in well seasoned, straight grained wood of the same kind. These are caused by differences in age at which the trees are cut, differences in locality, differences in soil, and many other considerations. For these reasons most of the tables of the strength of woods are unreliable and not suitable for use where exact knowledge is required. There are also considerable differences in the values given in various tables. Many of the early tables were based upon tests of small specimens, and later tests upon full size columns and beams have given values about one-third lower, owing to knots and other imperfections. Such tabular values are of course not large enough for selected wood, such as is used in automobile construction. To find the strength of such wood we must refer to the results of actual tests.

The following diagrams are from tests made by the H. H. Franklin Company, and as they are probably the largest users of the wood sill, the tests made in their laboratory are of interest to the trade. Furthermore, these tests were made upon quite large pieces and upon the quality of wood actually used. The curves were selected during a recent visit to their factory, from among a large number which they have on file. If my memory serves me correctly they have made some two thousand tests of wood for frames.

Fig. 1 shows the test of a piece of ash 2x4 inches in section. The values given are to the total load in pounds, load in pounds for each unit of weight of the test piece, greatest fibre stress in pounds per square inch, and the deflection, in decimal fractions of an inch, caused by these loads. All test pieces were 30 inches long, so the

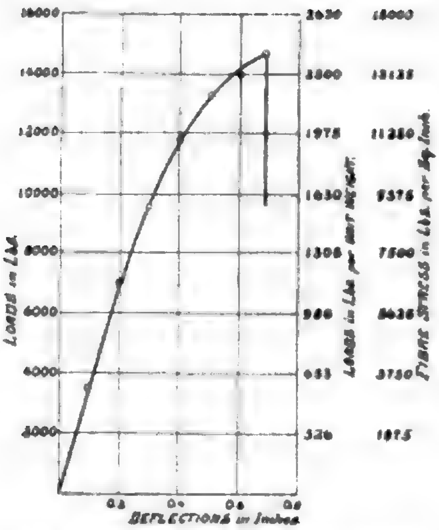


FIG. 1—ASH SILL, SOLID PIECE, 2x4x30 INCHES. WEIGHT = 6.125 POUNDS.

stresses per unit of their weight are comparable.

It will be seen that this beam broke under a load of a little less than 15,000 pounds, with a deflection between .6 and .7 inch.

Fig. 2 is for an ash beam built up of three strips. The result of this test is about the same as the foregoing. It appears from this that the principal advantages gained from a built up sill lie in the fact that the composite piece is perfectly uniform. It is practically impossible to get wood in anything like commercial quantities with every piece having a perfect grain for spans of eight to ten feet, as required in automobile frames. Possibly also, slightly better seasoning may be secured by using the thin strips.

The question of weight for a given strength is an important one in automobile construction. So the comparison of the test of a steel channel with the foregoing may be of interest. The test of the channel shown in Fig. 3 was carried out in the same manner as those for the wooden beams; except that the regular knife edge was used in the middle, and that a steel block one-half inch wide was fitted inside the channel at each knife edge, to keep it from collapsing.

This channel was 4½ inches deep, with 1$\frac{11}{16}$ inch flanges, made from stock 0.2 inch thick. The material was chrome nickel steel, heat treated.

By comparing curves 1 and 3 it will be seen that the ash deflects .2 inch under a load of 7,000 pounds, while a similar deflection for the channel is produced by a load of 13,000 pounds. But it will be seen that the channel is just twice as heavy as the ash, so its deflection per unit of its weight is the greater. Comparing the ultimate strengths upon this basis, that of the channel is 1,550 pounds per unit of its weight, that of the ash is about 2,400 pounds. So the wood is .08 stiffer and .54 stronger than the channel.

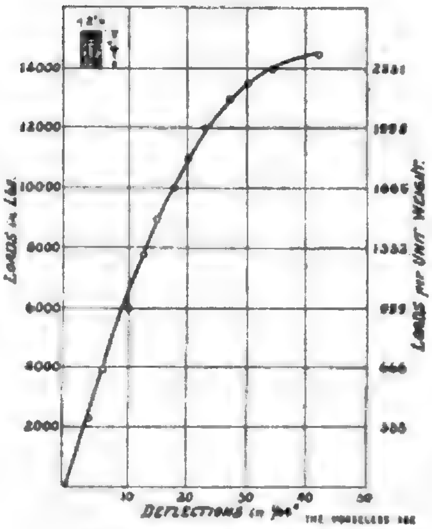


FIG. 2.—ASH SILL—NOT ARMORED, THREE PIECES GLUED TOGETHER.

The question will at once occur to the reader: Why is the ash beam stronger and stiffer for the same weight than the channel which is made from material of much greater tensile strength? The answer will be found in the specific weights of the two materials. Ash is given as .0396 pound per cubic inch in tables, and from the specimen is .0255 pound per cubic inch, while the weight of steel is .283 pound per cubic inch. So the ratio of specific weights is 1 to 11. Hence an ash beam has eleven times the section of a steel beam of equal weight, and eleven times as much material to distribute a given stress through. Although this material cannot be disposed to the same advantage as in the steel beam, owing to the fact that the wood is used with a rectangular section, giving as much material at the neutral axis as the lines of greatest stress, while in the channel nearly half of the total material is near the highly stressed portions, nevertheless the far lower specific weight of the wood gives it the advantage. The conditions may be understood by comparing the sections of equal weight, Fig. 8. By comparing the fibre stresses in Figs. 1 and 3 it will be seen that for the wood it is under 14,000 pounds, while for the steel it runs over 65,000 pounds.

Tests of open hearth channels gave such low figures for the loads per unit of weight as to be worthless for purposes of comparison with ash.

In Fig. 4 is shown the test of a maple sill. At first sight it may seem that this is both stronger and stiffer than the ash, but as its section is an eighth inch narrower, with the same depth, the two materials are about equal in their properties. Moreover, this test was made on an extraordinarily good piece of maple, while the ash tested was of about average quality.

The test of Oregon fir, shown in Fig. 5, is also quite satisfactory. While this wood breaks at a smaller load per unit of its weight than the ash, it is somewhat stiffer for smaller loads.

A piece of basswood was also tested, and the results are shown in Fig. 6. As this test did not give very high values, a piece of the same material was armored with $\frac{1}{16}$ inch ash and tested. The results, shown in Fig. 7, do not exhibit any marked increase in the ultimate strength per unit of its weight, although the piece is considerably stiffer.

Wood has no well defined limit of elasticity, but treatises upon the strength of materials usually advise taking from one-third to one-quarter of the breaking load. From these test curves it would appear that nearly one-half the breaking weight may be used for selected specimens. In the test for basswood there is no sign of any

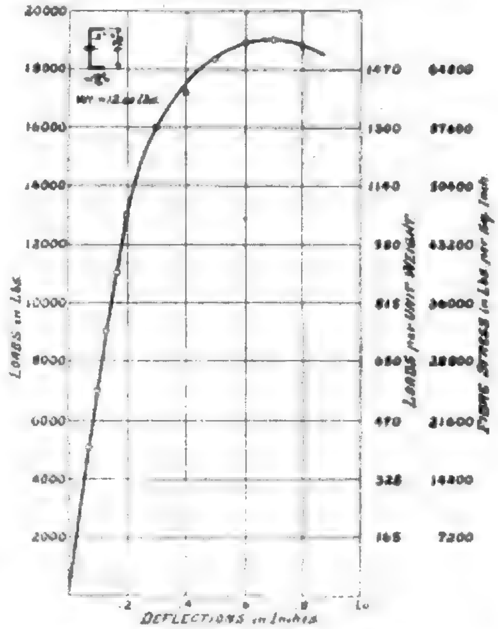


FIG. 3—TRANSVERSE TEST OF HEAT TREATED CHROME-NICKEL CHANNEL.

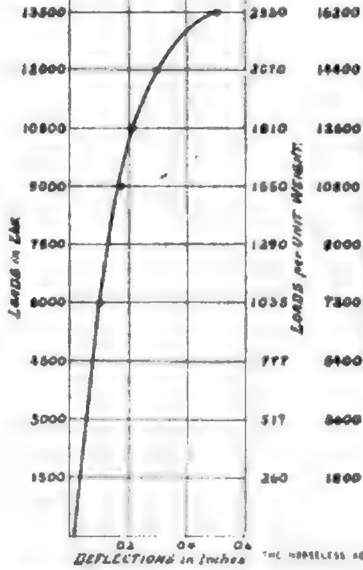


FIG. 4—TEST OF MAPLE (1⅞x4x30 INCHES). WEIGHT, 5.8 POUNDS.

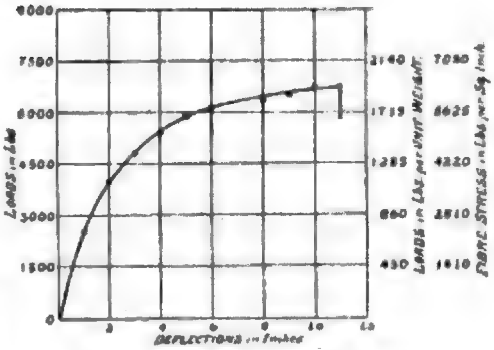


FIG. 6—THREE PLY PIECE OF BASSWOOD, 2x4x30 INCHES. WEIGHT = 3.5 POUNDS.

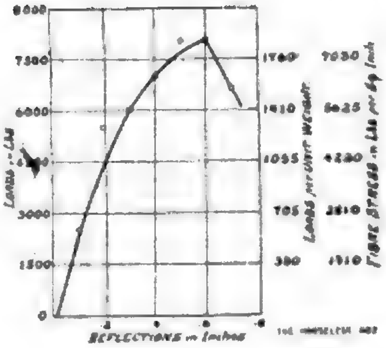


FIG. 7—THREE PLY BASSWOOD SHEATHED WITH THREE-SIXTEENTHS INCH ASH. 2x4x30 INCHES. WEIGHT = 4.25 POUNDS.

elastic limit, but this was caused by the apparent deflection exceeding the real, owing to the blocks sinking into the wood.

There are probably other kinds of wood which would show up favorably in tests of this character. Hickory is a wonderful wood, when selected specimens are considered. I saw a marvelously good specimen which had been tested in torsion at Purdue University a short time ago. It was stated to have shown a tensile strength of 40,000 pounds. But good straight grained hickory, in lengths suitable for automobile frames, is rapidly becoming a thing of the past. On the whole, I think it is safe to say that ash is the best wood we have at present, for frames at least.

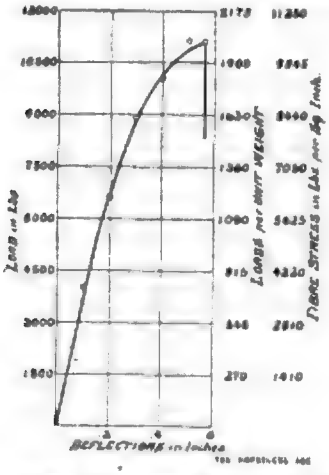


FIG. 5—TEST OF WOOD SILL, SOLID PIECE, OREGON FIR, KILN DRIED, 2x4x30 INCHES. WEIGHT = 5.5 POUNDS.

Before using wood in automobile construction it would seem natural to ask the following questions concerning it: What effects have moisture, age, vibration and temperature upon its strength? What tendency is there for it to sag?

All the tests were made in a Riehlé machine by placing the specimens upon supports 24 inches apart from centre to centre, and applying the load in the middle. To prevent the load from cutting into the wood the knife edge was replaced by a metal block one-half inch wide. But even with this precaution it is, of course, impossible to get tests of deflection which are as precise as those with steel. In fact, wood is a difficult material to test accurately in any manner.

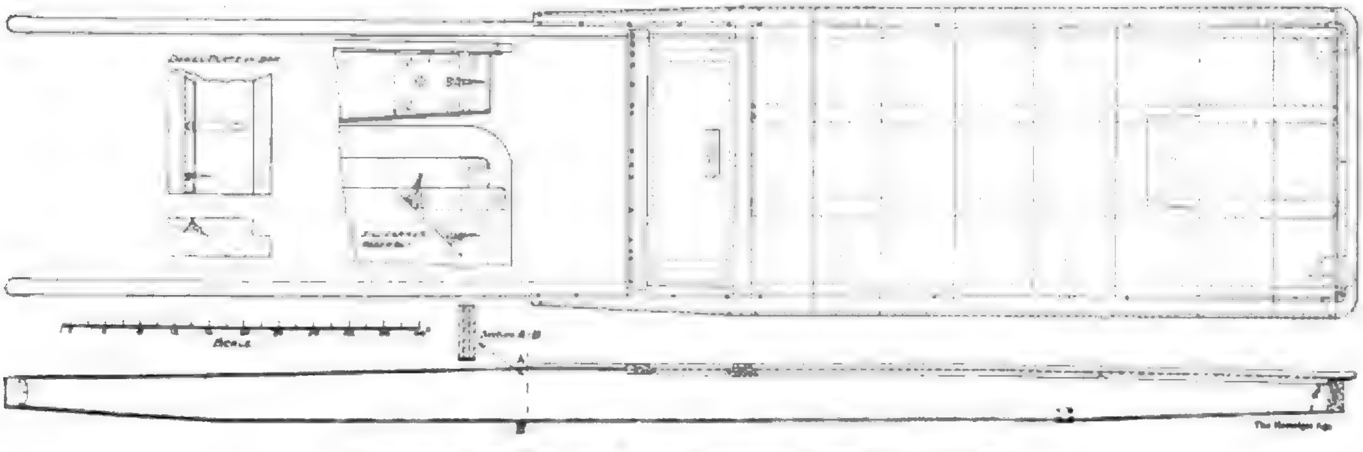
We have already spoken of the effects of moisture. It is evident that the interior of the wood must be kept dry. If it is originally thoroughly seasoned, and then well painted and varnished, it will last for a long time. But if it is not well seasoned to start with paint and varnish only hasten decay. Wood is also preserved by a more or less thorough saturation with any one of a variety of metallic salts, with petroleum products, or with boiled linseed oil. Many of these treatments increase the weight of the wood, and some of them reduce its strength and stiffness; but some preservative may be found desirable for cars to be used in tropical countries, where wood is especially liable to attack by insects.

Not long ago I saw a mummy case, which was put together in Egypt about the time of Abraham. The planks still appeared sound, and though they did not look good enough for an automobile frame, I should judge them stronger than many of our plank sidewalks. If this wood lasted for several thousand years with no other preservative than the dry air of Egypt, it would seem that well seasoned, painted ash would last as long as most automobiles are likely to be in service. To be sure, the wood of the case was soft, and its structure somewhat like that of pine or cedar, which are excellent woods for standing the weather, but ash has the reputation of keeping well if dry, although it decays rapidly when wet.

Any changes in temperature due to atmospheric causes have little effect upon the strength of kiln dried wood.

As to the tendency of wood to sag, we have the following evidence from tests made by J. E. Denton at the Stevens Institute of Technology. The wood was yellow pine, selected stock, air seasoned. Bars 1 inch square, placed upon supports 40 inches apart, sustained an average breaking load at their middle of 375 pounds. Moderate kiln drying was found to raise the modulus of elasticity a little over 10 per cent. and the modulus of rupture 20 per cent. Three bars were loaded with 95 per cent. of this average breaking weight; they broke within thirteen and one-half hours, thirty and one-half hours and forty-three hours, respectively, after the load was applied. A second set were loaded to about 75 per cent. of their breaking weight. Two of these sustained this load for three and one-half and five days, respectively. The other held out for about a month.

The third set, weighted with 60 per cent. of their probable breaking load, lasted much longer. They had an initial deflection of about one inch, which slowly and steadily increased till the time of rupture. The most flexible piece broke in 6,000



ASSEMBLY AND DETAILS OF THE FRANKLIN WOOD SILL FRAMES.

hours. The second piece to give way lasted 9,000 hours, about a year. While the stiffest piece broke after sustaining the load for 11,100 hours, or fifteen months.

For the rupture tests the deflection of this wood averaged about 1.8 inches. Under the 95 per cent. time test load it was 2.4 inches. For the 75 per cent. load it was 3 inches; while for the 60 per cent. loads it was slightly less.

From a careful examination of the results of these tests Thurston concludes: "A, that the factor of safety for sustained loads should be 4 to 5. B, that the factor of safety for live loads should be from 8 to 10."

Lanza, in his "Applied Mechanics," states: "The deflection of wooden beams under long continued loads is two or more times that at first. So to compute it we should use for the modulus of elasticity not more than half the value for quick tests."

It is a question in the mind of the writer whether the beams under these long tests did not absorb water from the air which caused their strength and stiffness to grow less and the deflection to increase. So for varnished beams lightly loaded there may be little increase in deflection.

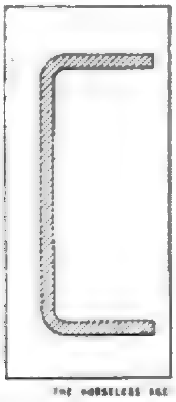


FIG. 8—SECTION OF ASH BEAM AND STEEL CHANNEL FOR EQUAL WEIGHTS.

Regarding the effects of vibration upon wood I can find no testimony. Apparently no such tests have been made. Indeed, it would probably be very difficult to make them with any degree of accuracy. Whether wood is affected by fatigue or not is a question yet to be solved. It would seem that its cellular, fibrous structure might have the effect of cushioning shocks and that the effect of vibration would be much less serious than with steel. Very probably wood and every other substance with reasonable rigidity have a fatigue limit, but for wood the effect may be of no practical consequence.

It may be of interest to describe how the Franklin Company make their wood frame. The material is second growth white ash, the pieces being selected by an expert in the employ of the company who travels through the country looking up good lumber. This is carefully air seasoned and kiln dried in the plank. Three pieces are glued and screwed together to form a side member, they being selected so that the grain in each piece runs at a slightly different angle. The composite piece is kiln dried, at a somewhat lower temperature than before. Then it is shaped to the exact size required. Thin strips are now glued along the top and bottom edges, to cover the joints in the main portion of the sill. Two side sills are placed in their proper relation to each other and connected by the rear crosspiece, and the wood flooring which covers the rear portion of the frame. The rear corners are metal bound and have four inch gusset blocks. The attachment of small parts, painting and varnishing completes the construction. Great care is taken to prevent the entrance of moisture.

My conclusions from the foregoing are that a lighter and stronger sill can be made from selected wood than from most grades of steel. The material has other desirable properties for this purpose, such as absorbing vibration and deadening sound. It is perhaps more difficult to join securely and to attach parts to than steel, but to all appearances these difficulties have been overcome. Owing to the increasing scarcity of good wood, and the amount of work required to put up a good composite frame, I do not expect to see the use of wood become general for this purpose.

Those who may be sufficiently interested in the properties of wood to wish to look into the matter further I would refer to a paper by G. Lanza, which may be found on page 87 of Part F of Vol. 54 of the Transactions of the American Society of Civil Engineers. It contains a bibliography of the principal tests of wood from the year 1709 to 1904.

Slip of Driving Wheels.

From the results of some experiments carried out by S. F. Edge on the Brooklands Automobile Track, London, Henry Souther has computed the following table, which gives the percentages of slip at various speeds on a hard, smooth, level track, with plain round tread tires, inflated to the usual pressure:

0.3 per cent.	at 40 m. p. h.
0.6 per cent.	at 50 m. p. h.
1.1 per cent.	at 60 m. p. h.
1.8 per cent.	at 70 m. p. h.
3.7 per cent.	at 80 m. p. h.
5.4 per cent.	at 90 m. p. h.

In addition it appears that the driving wheel on the inside, running around a curved track, slips a very little more than the outer wheel. This is clearly accounted for by the fact that the centrifugal force going around curves reduces the weight on the inner wheel, permitting it to slip more readily than the outer wheel. The above figures show that the slip at ordinary speeds on dry level roads is negligible. They also give a good idea of the enormous strains on the tires at high speeds.

Self Starting Devices.

By J. V. S. BICKFORD.

Whatever remarks I have to make on this subject are offered from the point of view of the user, not the maker. I drive upward of 12,000 miles a year, and in the course of my business I am continually stopping to pay calls, so that a self starting device is a convenience.

I may say at once, however, that I should most certainly not be prepared to put on a device which cost $100, nor should I be willing to add more than 25 pounds to the weight of my car for the luxury of self starting. I believe that these sentiments will be found to pervade the buying world to a great extent. Among the many men I have spoken with there does not seem to be a great demand for self starting devices. In the case of the wealthy owner a self starting device only saves his mechanic trouble, not himself. The one class of users to which it does appeal is the medical man. Even here, however, I always notice that it is one of the last points to be considered, and the provision of such a device would not, I am fairly sure, other things being absolutely equal, induce the doctor to pay $100 more for the car.

On the whole, therefore, I am strongly of the opinion that anything in the nature of a self starting "device" will be a commercial failure; but, on the other hand, the man who can design his engine as well in other respects as the next man and can in addition to make it that it will start nineteen times out of twenty on the switch, will have the advantage of his rival. This starting on the switch is most curious, and is not, in my opinion, at all well understood. Among the cars which I have driven are the following English makes, which I will designate by letters only:

Eighteen horse power S. This car will start nineteen times out of twenty on the switch, being fitted with double ignition. It is a four cylinder engine of 4 inch bore by 4½ inch stroke, fitted with a fairly common type of carburetor, without apparently any special points about it. It has pump circulation. It will, as a rule, start up on the switch after three hours' standing.

Fourteen horse power, same make. For all practical purposes this never starts on the switch, though the tremblers buzz on switching on. Will sometimes go away after a stop of ten or fifteen seconds, but not longer. It has 3½ inch bore and 4 inch stroke, thermo-syphon circulation and the same type of carburetor as the last.

Eighteen horse power A. Four cylinders, 4⅛ inch bore, 5 inch stroke; pump circulation. Usually starts on the switch up to half an hour.

Forty horse power D. Engine about 5 inch bore; pump circulation. Starts every time, and even after standing all night.

One very curious fact about the 14 horse power S., mentioned above, is that though it would never start on the switch it would almost always start on the first pull over.

Now the first pull over means the firing stroke of that cylinder which is standing on the compression stroke. This cylinder is full of gas already in the engine, so that it is not a case of having to suck fresh mixture from the carburetor, but that already in the engine will do the work. Of course, there is the difference that the gas in the cylinder which is in the firing position is not compressed; that in the first cylinder pulled over is about half compressed (because the piston, stopping about half stroke, will allow half the charge to leak out).

All things considered, I am strongly of the opinion that self starting devices which are special pieces of apparatus will not be a commercial success, but those which take the form of making the engine start up on the switch will be well worth introducing for a "talking point," if nothing else.

It should be noted in this connection that one big magneto maker has just put a self starting device on the market, to be used in conjunction with his high tension magnetos. It consists of a single plain coil and one dry cell with a bell push on the coil. The high tension of this coil is wired to the magneto high tension distributor, and on pressing the button a single spark is sent through this to that cylinder of which the high tension wire is on contact. I have not tried this, but one user who has it on a 40 horse power Austin tells me that it works very well and starts the car without fail up to one hour's standing.

I have for some time meant to carry out some experiments to ascertain, if possible, the reason for the different behavior of different engines in this respect. I can hardly see that it can have anything to do with anything but the carburetor, and I should try the following experiment. Take, for instance, the above engine which would never start on the switch. First, I should work on the assumption that the mixture at stopping was too weak, and I should arrange a piece of metal with which I could partly close the carburetor suction pipe. Then on switching off to stop the engine I should arrange my damper and allow the engine to stop. This damper would, of course, increase the suction in the carburetor, and therefore enrich the mixture If this succeeded we should know where we were, and a self starting device which simply consisted of a little shutter to slip over the induction pipe by a handle on the dash would certainly be tolerated. If that failed I should try a small tap in the induction pipe between the engine and the carburetor by which pure air could be admitted to the induction pipe, and try this at various points of set when switching off. If this succeeded we should again be in a position to correct the throuble. It may be worth mentioning that the above car which would never start on the switch was always troublesome to start, and required the carburetor to be heavily flooded, and when quite cold gasoline had to be injected before a start could be made at all.

Remarks on Fuel Feed Systems.

By Pearsol Sargeant.

In modern automobiles fuel is fed from the tank to the carburetor by gravity, pressure or by a combination of both gravity and pressure. In this country gravity feed is more generally used, while in Europe pressure feed is used to a great extent, although gravity feed is well represented. The combination systems are not much used, but will be treated here as well as the two other systems.

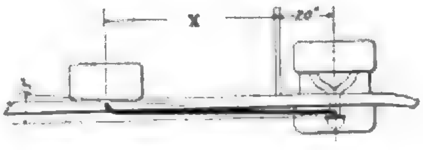


Fig. 1.

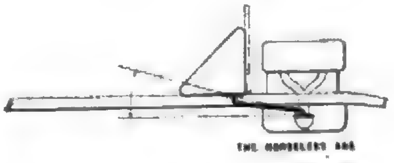


Fig. 2.

In the gravity feed system the "head" of fuel is depended upon to feed the fuel to the carburetor. There are two general positions for the fuel tanks, viz., on the frame, Fig. 1, and on the dashboard. In American practice the usual frame position for the tank is under the driver's seat, although a recent and very popular location is directly behind the driver's seat, the tank being placed in a cradle and elevated somewhat above the frame to give a greater "head." This arrangement was copied from foreign racing cars and is seen only on runabouts. European practice also puts the tank under the driver's seat, but feeds from all tanks on the frame by pressure, except in the case of the Delaunay-Belleville (Fig. 2), where the tank forms the dash and footboards in addition to containing the fuel. Placing the tanks upon the dashboard is not done to any extent to-day except in the case of combination systems, which will be referred to later.

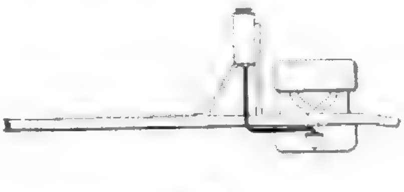


Fig. 3.

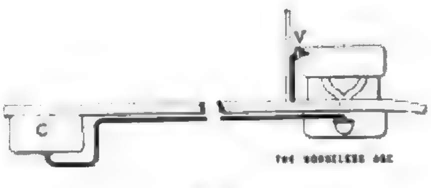


Fig. 4.

Former practice suspended the fuel tank on the rear of the dash, and usually combined it with the oil tank in the same outer casing. Cars having the motor under the seats, instead of under the bonnet, have their tanks placed either on the front of the dash or on the frame itself under the bonnet. Where an extreme "head" is desired, or where the fuel in the tank has to be used to the last drop (as in competitions), the tank is placed as in Fig. 3.

The general arrangement of a pressure feed system is shown in Fig. 4. A pipe leading from the exhaust goes to a pressure valve V, which regulates the pressure on the fuel in a tank C located at the rear of the car, as a rule. This pressure forces the fuel to the carburetor. A hand pump with suitable piping (not shown) is also fitted, by means of which pressure may be put on the fuel for starting up or for assisting the regular pressure system in case more pressure is needed, etc. This might be said to be almost universal European practice in fuel feeding. Quite a number of American cars use this pressure system, but these are of the more expensive types and are usually close copies of some European model.

If we were dealing with a flat country with well kept roads, the difference between the two systems would be merely a question of cost. This difference being due to the extra piping, the pressure valve and the hand pump in the case of the pressure system. Unfortunately, however, we are in a country of very irregular surfaces and with a large proportion of poor roads. Therefore, while the difference in cost is still to be considered, the vital question is which system will give the best service under all conditions of road, etc.

Taking up the gravity system first, in the case where the tank is resting on the frame under the driver's seat, and the fuel inlet of the carburetor is in its average position with reference to the side member of the frame, i. e., 10 inches below the top of the member and 20 inches ahead of the dash, we find that with the minimum possible distance between the centre of the fuel tank and the dash (*x*, Fig. 1), which is 20 inches, the extreme grade that a car fitted with a tank 14 inches deep can ascend without starving the carburetor will be one of 58 per cent. and this with the tank full. With the tank nearly empty only a 25 per cent. grade can be ascended. This means that the car could ascend any grade likely to be encountered in touring or on mountain roads. With the distance $x = 20$ inches, the front seat will be only 14 inches from the dash, which would be very uncomfortable for the driver. Taking another case, representing the opposite extreme, where $x = 45$ inches, the tank being placed behind the driver's seat on a well known runabout, we find that with the tank full a 35 per cent. grade could barely be ascended, and with the tank nearly empty a 15 per cent. grade could just be taken. It can be readily figured that, with a gravity feed tank placed in its usual position under the seat, the extreme grade which the car can ascend without starving the carburetor is 50 per cent. with full tank and 22½ per cent. with the tank nearly empty, which meets practically all requirements. It is evident that if extreme grades are encountered, the carburetor must be lowered, or the tank placed further forward, in which case the logical position would be on the dash, or forming the dash, as in Fig. 2. In the latter case no grade would ever be encountered steep enough to prevent the flow of fuel to the carburetor whether the tank is full or nearly empty. Cars having the motor under the seat and the tanks in front should be fine for hill climbing from this viewpoint, as the greater the grade the greater will be the "head" of the fuel.

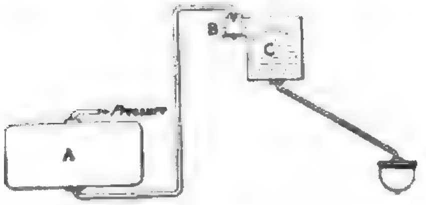


FIG. 5.

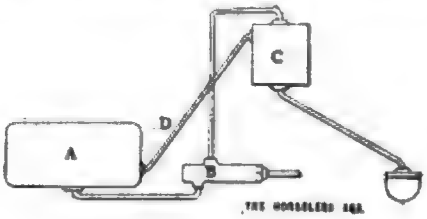


FIG. 6.

The tank under the seat is most excellently protected from puncture, fire, etc., by the body framework, but as usually constructed it is not very accessible. To fill the tank it is necessary to remove the seat cushion and the seat board, and then remove the filler cap, the operations being reversed when the tank has been filled. Filler-tube arrangements projecting through the body panels have been brought out by foreign constructors, but these have never been taken up here, our American manufacturers clinging to the filler under the seat. Further, it is necessary to dismount the front seat in order to remove the fuel tank when repairs are needed, which takes time. With the tank on the frame, behind the driver's seat, in runabouts, for example, no protection is given by the body work, and in case of an upset or collision the chances are that the tank will suffer a puncture or break. The tank, however, is much more accessible and can be made to hold a greater quantity than one placed under the seat, where space is limited.

With the dash tank access thereto is easy, but in case of accident its proximity to the motor renders the chances of fire greater than in any other possible position except on top of the motor itself. It is well protected by the gunstocks, the false dash and the footboards, however, and with a safety device for closing the fuel top should a fire occur it would doubtless be safe enough. Several users of cars with tanks so fitted have lagged the lower sides of the tank with asbestos as a fire preventive. The tank shown in Fig. 3 has not been used to any great extent, but is given here as example. An English car, the Riley, incorporates the fuel tank in the upper part of the dash, giving the same effect as that in Fig. 3.

With regard to the pressure system, the grade has no effect upon the feed of the fuel. The tank is very much exposed to puncture from rear end collision, for example. That this is recognized is indicated by the placing of a slatted wooden guard around the tank by a number of constructors. Better protection could be secured by placing the tank within the frame, when the cross member and longitudinals would take any shock of collision. In case of rupture of the fuel line the chances of fire are greater than with the gravity system, as the fuel is forced out rapidly and a considerable quantity escapes before the flow can be stopped. Tanks placed on the frame behind the driver's seat are protected from collision, and are much more accessible for filling, repairs, etc., although all pressure tanks are provided with extension fillers so that fuel may be put in without the removal of footboards, etc.

From the standpoint of care required in maintaining the system, gravity feed system will continue in service for a greater length of time than will the pressure feed system. There are no valves to carbonize nor springs to lose their temper; no strainers to clean nor hand pump to operate. In other words, there is nothing to take care of. By judicious care and frequent inspection no trouble whatsoever need be encountered in the various parts of a pressure feed system, and the driver has the satisfaction of being sure that the fuel is getting to the carburetor no matter how small the amount in the tank. Again, if there is a slight obstruction in the fuel line it will be blown into the strainer chamber and the flow will continue.

As to combination systems, they usually comprise a main pressure tank for fuel and an auxiliary tank, which feeds the fuel to the carburetor by gravity. Such a system is shown in Fig. 5, where A is the main tank and C the gravity tank. A pipe leading from A opens into a float chamber, B, on the tank C, the float being fitted with a needle valve similar to that of an ordinary carburetor. It is evident that a constant level of fuel will be maintained in C and a sufficient "head" retained at all times. The main tank would probably be situated at the rear of the car and the gravity tank on the dash. The system has all the disadvantages of the pressure systems, but also has the advantage of being capable of use as a gravity system, the tank C being provided with a filler for the purpose. There are a few other systems, but these are merely modifications of the above.

Another system, shown in Fig. 6, relies on a pump B to get the fuel from the main tank A to the gravity tank C. This pump is driven from the cam shaft, and works continuously, an overflow pipe, D, returning the fuel to the main tank when it has exceeded the required level. The float chamber is also dispensed with. The pump keeps up a constant circulation from the main tank A to the gravity tank C, and back through the overflow pipe D, at the same time maintaining a constant level in C. In this system the disadvantages of the pressure systems are absent, but the fuel pipes must necessarily be brought to or near the motor on account of the pump, so that if a rupture of the line occurs the fire risk is considerable. This risk is minimized in a design recently seen by the writer, where the pump and fuel pipes are carried inside the crank case, and where they are only to be reached by taking off the lower half of the case. Thus immunity from fire danger is secured at the expense of accessibility.

There has been considerable experimenting, particularly in the two cycle field, with direct fuel injection by means of pumps. The pump system has been in use for years in stationary work on both heavy oil and gasoline engines, and has met with success. High speeds were attempted, but the pumps could not suck and discharge rapidly enough, so that it was only applied to slow and medium speed engines. In automobile practice, similar conditions were found upon experiment. It has been estimated that the highest speed at which the pumps will deliver a working charge is 1,100 revolutions per minute, although one builder claims 1,500 revolutions per minute. Multicylinder pumps, such as are used on the Antoinette motors for aeroplanes, have also been tried, and will deliver working charges at somewhat higher speeds than the single pumps.

The pumps used for direct injection are of the variable stroke type, single action and spring return. The stroke may be varied by means of a variable lift cam, by means of a variable eccentric, or by linkage varying the length of contact of the plunger with a cam. The pump system is only seen in isolated cases on automobile motors, these being in the experimental shop or testing laboratory, for the most part. Fuel injection by pump has a number of advantages over the use of the carburetor.

Charge Distribution.

By P. S. Tice.

In a multicylinder gasoline engine maximum flexibility and fuel economy, together with smooth, noiseless and vibrationless running, can be secured only if each cylinder receives exactly the same charge as every other one. The problem of charge distribution is not encountered in connection with single cylinder engines, but since some 80 per cent. of the manufacturers of cars in this country four or five years ago took up the double cylinder opposed type this problem has confronted almost every designer.

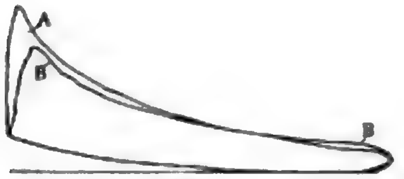


Fig. 1

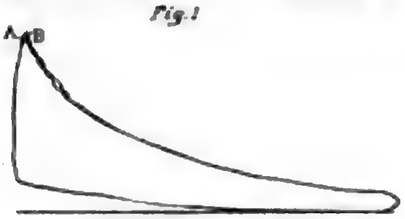


Fig. 2 THE HORSELESS AGE

In this type of engine one cylinder was almost invariably "weaker" than the other. This was probably in most instances due to constructional imperfections, resulting in unequal compression spaces, valve passages and valve timing. Within the last few years designs and the facilities for executing them have so improved that each engine cylinder now is an exact duplicate of the others, and such care is exercised in synchronizing the opening and closing of the different valves that attention can now be turned to what may be considered the minor parts.

Let us see what are the advantages of equal as compared with unequal distribution of charges, other conditions being the same.

The effects of unequal charge distribution are best illustrated by a practical example. In Fig. 1 A and B are two indicator cards, superposed, taken simultaneously from the two cylinders of a double cylinder opposed engine with 4¾x5½ inch cylinders at 656 r. p. m. with full throttle. The cylinders themselves were alike as regards volume of compression space, areas and shapes of passages, etc.; the valves were timed alike and the lifts were the same. Ignition was effected by a single coil (each high tension terminal being connected to a spark plug located over the intake valve, the plugs having equal gaps), a snap-off timer, which had been carefully synchronized, and a fully charged sixty hour, 6 volt storage battery. Great care was taken in preparing the engine for these tests, so that any differences in the actions of the two cylinders would be entirely attributable to differences in the quantities of charge admitted to the two, respectively, the idea being to determine by trial the exact effects produced by a series of different designs of manifolds and by various mixture characteristics. Later another series of runs were made with a four cylinder engine with the same object in view, but nothing additional was learned from this last series.

The indicator cards (which were traced for making the cut (Fig. 1) showed mean effective pressures of 97.3 and 83.4 pounds per square inch for A and B, respectively. At the time of taking these cards the engine was developing 12.76 b. h. p. At this speed and with these m. e. ps. the total i. h. p. was 14.56, thus showing a mechanical efficiency of slightly over 87 per cent. It follows from the above data that cylinder A was developing 7.84 i. h. p., while B was developing only 6.72 i. h. p. The difference in outputs is 1.12 i. h. p., or .97 b. h. p. If the m. e. p. of cylinder B had been equal to that of cylinder A about 8 per cent. more power would have been generated.

It will be noted in Fig. 1 that the pressure in the cylinder at the time the exhaust valve began to open was considerably higher for cylinder B than for A. The result of this was that the exhaust of B was noisier than that of A and there was a disagreeable rhythm of sound which it was impossible to effectively muffle without causing undue back pressure.

Upon substituting another manifold, but employing the same carburetor with adjustments unchanged, the cards Fig 2 were obtained at a speed of 652 r. p. m. The m. e. ps. shown by these two cards are 108.1 and 109.6 pounds per square inch for A and B, respectively. The engine was developing 15.1 horse power on the brake at the time these cards were taken. The latter m. e. ps. show that the total i. h. p. was 17.54, which indicates a mechanical efficiency of about 86 per cent. The small difference between the two m. e. ps. (only 1.5 pounds), together with the close agreement of the card outlines, shows clearly that the cylinders received substantially equal charges.

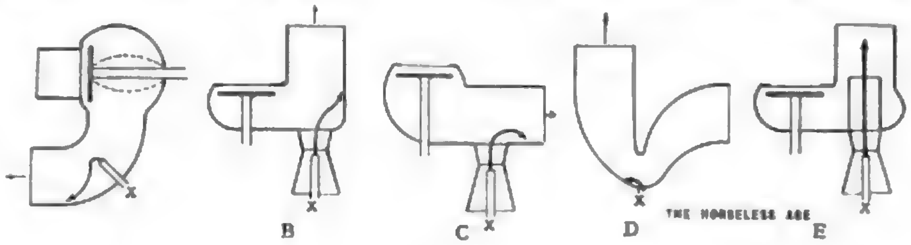


Fig. 4.

In this case the equalization of the charges led to a gain of 2.34 b. h. p. at the same speed and with the same fuel consumption, which represents a gain in flexibility and economy; it eliminated one of the formerly existing causes of vibration; it made possible effective muffling of the exhaust without choking the engine, and generally added much to the engine's sweetness of running.

In considering charge distribution and its effects it must be remembered that two charges may differ in three different respects as follows: (*a*) as to quality or proportion of constituents; (*b*) as to quantity, and (*c*) as to both quality and quantity. While nearly all actual cases come under head *c* the effects of differences in quantity and quality, respectively, must be discussed separately.

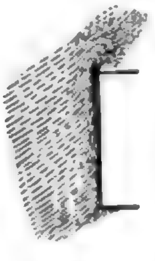


Fig. 3.

It is safe to make the assertion that with all carburetors a considerable portion of the fuel supplied is entrained as liquid particles which are carried along by the friction between themselves and the air. Granting this, the history of the fuel from the time it leaves the carburetor nozzle until it enters the cylinders can be readily determined, provided the passage and velocity conditions are known.

Before passing to a discussion of the effect of quality differences, the writer wishes to call attention to a well known phenomenon. When rain drops, under the influence of a strong wind, impinge at an angle against the side of a building, the wind is deflected, but each rain drop is broken up and a portion of each rebounds into the wind current in the form of smaller drops, which become entrained in the deflected air current and fail to again contact with the wall. That part of each drop which fails to rebound adheres to the wall and moves along it in the direction of the deflected wind until reaching the edge. At this point it is carried away from the wall by air friction and presents the appearance of a fringe, the surface tension of the liquid causing the drops forming the fringe to be of greater size than the originals. The analogy between this example, depicted in Fig. 3, and the action which takes place in the mixture supply system of a multi-cylinder engine is quite striking, as will be seen later.

In Fig. 4 are shown diagrams of the courses followed by the fuel after leaving the nozzle, for several different arrangements of passages and parts. The heavy, arrowed line leading from the nozzle X shows the path of flow of the carburetted initial air and its entrained liquid, or of the liquid stream itself, as controlled by the air currents through the device. These diagrams are self explanatory, with the possible exception of E, which shows that the liquid globules are precipitated against some portions of the mixing chamber wall almost immediately after leaving the nozzle. This tends to disturb the homogeneity of the mixture, and requires that provisions be made for correcting this effect in the remaining portions of the passage.

However, the throttle valve forms another and in some cases more powerful deflector and separator, and the throwing of the fuel against a particular part of the wall is a matter of secondary importance. The throttle valve is given the first of several instances where the above cited example of the wind-driven rain may be applied in studying the action of the mixture components.

All of the throttle valve forms now employed in carburetors act as separators, and many so deflect the liquid content of the mixture that even qualitative distribution is very difficult, if not impossible.

Several designs of throttle valves are shown in a partially open position in Fig. 5, where the effects of separation and deflection of the liquid globules are depicted for each case. It is here assumed that on approaching the throttle the liquid is evenly distributed over the cross section of the mixture column. While this assumption is very seldom borne out in practice, as reference to Fig. 4 will show, any deviation from this assumed initial condition will tend to result in an aggravation of the effects illustrated in Fig. 5. It will be seen that all these throttles act as separators when only partially open; A, B, C and D also throw the liquid upon the walls, unevenly. E and F, while evenly distributing the liquid over the walls, are most energetic separators, nearly as bad as D. It is a noticeable fact that throttles of type D are rarely found in later designs. Probably all who have had any experience with this type of throttle remember that a drain cock is always inserted at X, Fig. 5, D. With the throttle fully open, A, C and F are about equally efficient—both separator and deflector action being almost entirely absent. Forms B, D and E act both as separators and deflectors for all degrees of opening.

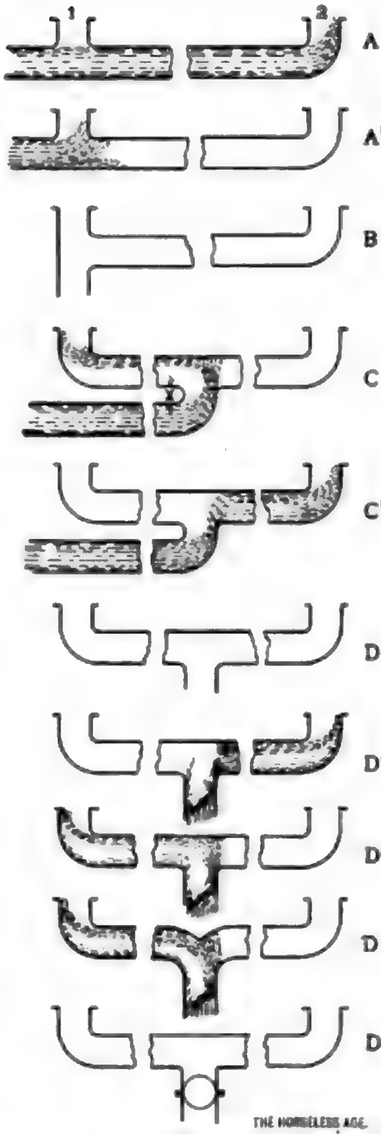


FIG. 6.

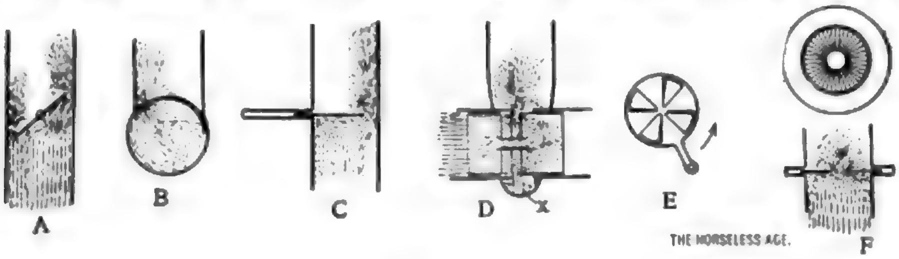


FIG. 5.

The manifolds for two cylinder opposed engines are the simplest forms which involve distribution difficulties, they being generally simple Ts or Ys. In Fig. 6 are shown some of the T forms which have been and are still employed. In cars in which this type of engine is placed longitudinally under the body the carburetor is usually located well forward under the front floor boards. The three most popular piping arrangements for this case are shown as A, B and C, in Fig. 6. A has unequal lengths of pipe, with an equal number of bends per cylinder; B has unequal lengths and unequal numbers of bends, and C equal lengths and equal numbers of presumably equal bends. Aside from possible throttle effects, qualitative distribution is effected in each of these pipes by the deflecting action of the bends alone.

Take the case of the simple elbow bend leading from the long, horizontal pipe to cylinder 2, at A, Fig. 6. Any unvaporized liquid carried in the air moving from left to right will tend, by virtue of its momentum, to concentrate along the extreme outer wall of the bend, as shown. The truth of this assertion is most simply demonstrated by blowing through a piece of copper or other tubing which has been bent quite near the outer end, when the moisture carried by the breath will be discharged as small drops on the outer side. A similar course is followed by the entrained liquid when cylinder 1 is aspirating its charge through the vertical stem of the T, A', Fig. 6.

In order to obtain a clear idea of the magnitude of the disturbance at A', the writer, having at hand a four-cylinder, 4⅝x 5 inch engine, with a T manifold, as shown at A, Fig. 7, sawed off the end wall, X, and, after counterboring and threading, as at B, made four tubes, C. These tubes were ½, 1, 1½ and 2 inches in length, respectively, and were threaded and faced at their outer ends so that a disc of glass could be drawn down on a ring gasket by a large ring nut. This change in the manifold provided an observation window of the full passage diameter, which could be placed successively at any one of four different distances, ⅝, 1⅛, 1⅝ and 2⅛ inches, respectively, from the outer edge of the branch leading to the front cylinder. The device was used to roughly determine the distance through which the liquid globules would be projected beyond the branch, for any mean gas velocity through the manifold.

In making these tests, the throttle was fully opened during each run, and the engine, which was mounted on a testing block, was controlled as to speed by varying its load. In this way the approximate mean gas velocity through the manifold was made to vary directly as the piston speed. The pieces C, Fig. 7, were successively adjusted to the manifold, and the approximate mean gas velocities — piston area × piston speed ÷ cross sectional area of manifold passage—at which the glass window showed wetting of its inner surface were noted. This wetting could be very easily observed because as each globule struck the glass it caused a sort of scintillation of the reflected and refracted light. The following table indicates the lowest mean gas velocities,

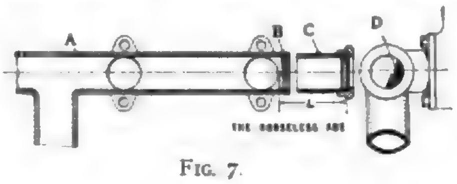


FIG. 7.

V ft. per min., referred to the several values of L, Fig. 7, at which the glass showed the presence of liquid:

L	⅝ in.	1⅛ in.	1⅝ in.	2⅛ in.
V	2,534	4,484	6,752	8,953

By decreasing the load, and thereby increasing the value of V, it was found that, for the two lower values of L, the separation of liquid and air could be so increased that the glass appeared to be sprayed upon by an innumerable number of small streams. However, with L = 1⅝ inches, no such uniform spraying was produced at any speed within the range of the motor. Likewise, with L = 2⅛ inches the uniformity with which the surface was wetted was further decreased. The cross-hatched portion of the glass, at D, Fig. 7, shows the form and location of the wetted area with L = 2⅛ inches, the motor turning at 1,366 r. p. m.—which is equivalent to a mean gas velocity of 10,240 feet per minute by the above formula.

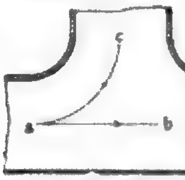


FIG. 8.

The reason for this separation is quite apparent. Suppose a globule of weight W and surface area A to be entrained and moving with velocity V in an air column which is moving with a velocity V_a. The globule has an energy = $WV^2/2g$. Let this quantity be represented by the line *a-b*, Fig. 8. At the T, A′, Fig. 6, the frictional force acting on the globule changes direction, as shown by the curved lines *a-c*.

The force F_1 acting along *a-c* is proportional to the product of the surface area of the globule A, the velocity V_a and a coefficient of friction *f*. From this it appears that, with a given value for V, the force along *a-b* varies with W; while that along *a-c* varies with A, V_a remaining constant. But W varies with the volume of the globule, which varies as the cube of its diameter D, while A varies as the square of the same dimensions. Thus, while large globules give higher values for both *a-b* and *a-c* than do smaller ones, the ratio of volume to surface area, and therefore the ratio of *a-b* to *a-c*, increases rapidly as D is increased. The smaller the globules or the more nearly the fuel is to complete vaporization, the more nearly will the resultant of F and F_1 take the direction of *a-c*, and the less will be the separating effect.

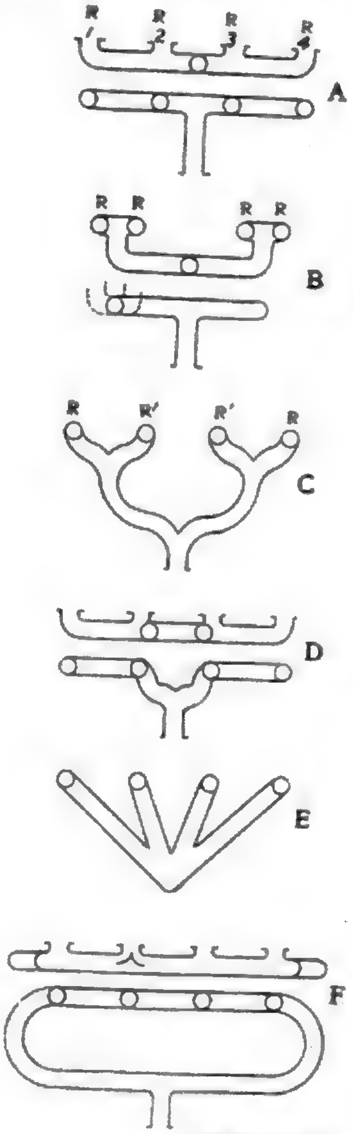
At the T in A′, Fig. 6, many globules cross the paths of and unite by collision with others. This increases the value of W and tends to cause a resultant more nearly in the initial direction *a-b*. The general effect is depicted by the dotted lines within the T at A′, Fig. 6. Since there is no flow of air toward the T, opposite to the initial flow, any fuel which passes the T, as at A′, will remain in the passage until cylinder 2 again aspirates, at which time it will be carried along in the mixture, as at A, Fig. 6. That is, with a given fuel content C in the initial mixture, the content in the mixture aspirated by cylinder 1 will be C—*x*, and the content in that aspirated by cylinder 2 will be C + *x*, the value of *x* being determined for a given case by the relative values of W, V and V_a.

The two branched manifold B, Fig. 6, simply reverses the qualitative distribution of A. In many cases the qualitative distribution difficulties encountered with forms A and B have led to the adoption of form C, under the assumption that even distribution was prevented by the inequality of the passage lengths per cylinder. Passage length equality was secured by the insertion of a centrally located T and L, either pipe fittings or a casting, and a long pipe, common to both cylinders, which lead forward to the carburetor. While this arrangement is superior to either that of A or B, and thus gives some relief, it is still quite imperfect. Its fault is that the axes of the T and L both lie in the same plane. All of the mixture is here required to pass the L before distribution. A similar separating or localizing action must here take place as in the simple L at cylinder 2, A, Fig. 6, in consequence of which cylinder 2 will aspirate the richer charges, C and C′, Fig. 6. The simplest remedy is to attach the carburetor to the stem of the T without intervening bends, as at D. If this is done, the qualitative distribution of the charge will be equal, provided that the time intervals between the aspirations 1 and 2, and 2 and 1, are equal and that the entrained fuel is uniformly distributed over the cross section of the air column upon its entrance to the T.

However, such uniformity of entrainment is rare. When the long common branch, as at C and C′, Figs. 4 and 5, is omitted, space limitations usually make a close connection between the T and the carburetor imperative. D′ and D″ show the effect of thus closely connecting the carburetor with a butterfly throttle, the plane of the disc being perpendicular to the plane of the axes of the T when it is in the fully opened position. If the throttle opens clockwise, cylinder 1 will receive the richer charges, while if it opens counterclockwise, cylinder 2 will receive them.

If a Y displaces the T in D′ and D″, it is seen in D‴ that the value of *x*, the loss and gain respectively of fuel in the charges, is increased. One of the very worst cases of unequal qualitative distribution that has come under the writer's observation was due entirely to the combination D‴ fitted to a two cylinder opposed engine. Both cylinders could never be made to fire regularly with the throttle less than about one-quarter open; with the throttle opened farther regular firing could be obtained with very careful carburetor adjustment. The engine worked best when the throttle was fully open, since then the disc ceased to deflect toward one branch. But even with the throttle fully open the engine did not deliver its full power, owing to disadvantageous carburetor adjustment. If the carburetor was so adjusted that, with the throttle partially closed, cylinder 1 received the proper amount of fuel for maximum power, cylinder 2 would receive a sufficient excess to cause sootiness and missing; and if the adjustment were so made that cylinder 2 worked with the best possible mixture, cylinder 1 would back fire because of the much impoverished charge aspirated. Upon turning the axis of the throttle stem through 90°, as in D″″, so that the plane of the disc when fully opened coincided with the plane of the axes of the Y, as it here does with the axes of the T, all distribution difficulties were ended. Just here it may be mentioned that the indicator cards in Fig. 1 were obtained with a manifold like C and C′, Fig. 6, and those shown in Fig. 2 with the arrangement D″″.

Figs. 9 and 10 show several four and six cylinder manifold forms. The cylinders are numbered and also lettered to in-



THE HORSELESS AGE.

FIG. 9.

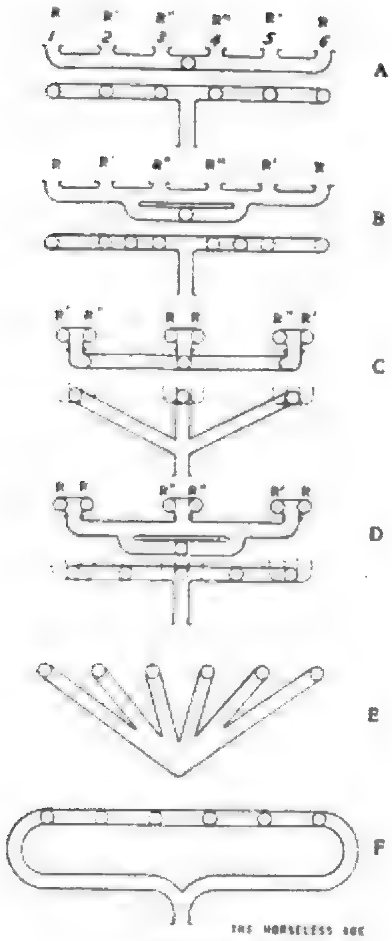


FIG. 10.

dicate the comparative values of the fuel content aspirated by each; R indicates the cylinder or cylinders receiving the richest mixtures, R' indicates those receiving less rich mixtures, R" still weaker mixtures, etc. It will be noted that the firing order does not affect the qualitative distribution.

A, B and C, Fig. 9, are those forms most commonly fitted to four cylinder engines. D, so far as the writer knows, is employed on only one engine, but a very popular one. Its general form permits of a quite close approximation to equal distribution. E gives equal distribution when the common branch leading from the carburetor enters the distributing chamber at right angles to the axes of the tubes leading to the cylinders. F gives equal qualitative distribution by virtue of the characteristics of flow shown for it in the sectional plan of its straight portion. When the flow is from this straight, common passage into any one of the several cylinder branches, there are two initial flows exactly opposed to each other. This provides the counter-flow which is lacking in A', Fig. 6, and entirely prevents the projection of globules beyond the stem of the T.

Quantitative differences between the charges aspirated by the several cylinders are always due to differences between the efficiencies of flow through the several passages or combinations of passages. It is very desirable that the flow through the several parts of the system be as free as possible, and also that the flow to any one cylinder be as free as that to any other. Briefly, the elements which reduce gas flow efficiency are sharp edged openings, lack of approach to passage contractions, eddies, bends and roughness of passage surfaces.

Sharp edged openings are mostly found in the carburetor proper at the points of entrance of the initial and auxiliary air. The initial air port is usually a free opening, unobstructed by a valve, of such a form as at A, Fig. 11. At B is another form possessing the same area at its most contracted part. Call these two equal areas X. With a given pressure difference P_d at the opening, due to motor suction, the air will flow into each of these two openings with a velocity V; but at A the area over which the velocity V is effective is less than X. Because of its abrupt entrance to the passage, the air forms a vein of smaller effective diameter than the actual diameter of the orifice. Let the area of this contracted vein equal Y, then Y = .6 to .84 X, according to the distance the orifice area is projected beyond the orifice to form a passage. At B an easily curved (parabolic) approach is provided. There is here no appreciable contraction of the air vein beyond the orifice, and the effective area Y = .95 to .99 X. Since V is the same for equal values of P_d and X, from 11 to 39 per cent. more air will be aspirated than with A.

With a valve closed auxiliary air port, A, Fig. 11, the effective annular area Y never exceeds .85 X, X being the measured area of the valve opening. Some reliable empirical data in the writer's possession shows that, for a flat seat valve of 1.5 inches clear diameter, as at A, Fig. 11, with a lift of .05 inch, Y = .79 X, and that with fourfold increases in P_d and X, the lift now being .20 inch, Y = .54 X. It is characteristic of all such orifices that the efficiency falls off rapidly with increases in X and P_d. However, with a conoidal approach and valve shaped as in B, Y becomes equal to .9 to .96 X for all lifts and values of P_d, a gain of 11 to 42 per cent. It should, of course, be noted that as the flow efficiency is increased the valve will open to a lesser extent for a given P_d, so that so long as the engine is under throttle there is no gain in output; but with the throttle fully opened and the engine running at considerable speed, there will be notable gains in power and flexibility.

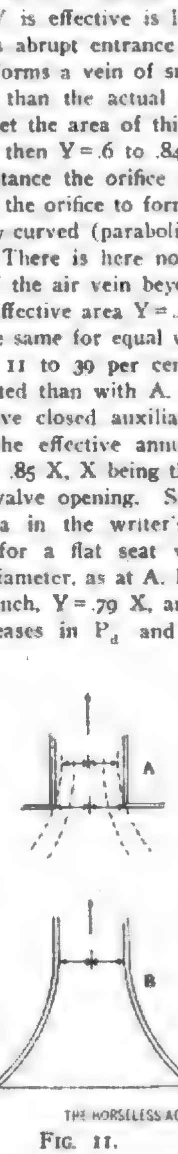


FIG. 11.

The effect of lack of approach to passage area constrictions is best illustrated by the example of the cylindrical gate throttle valve, B, Fig. 5. In this case we have the orifice characteristics of A, Fig. 11, in combination with a con-circular bend, a very inefficient arrangement.

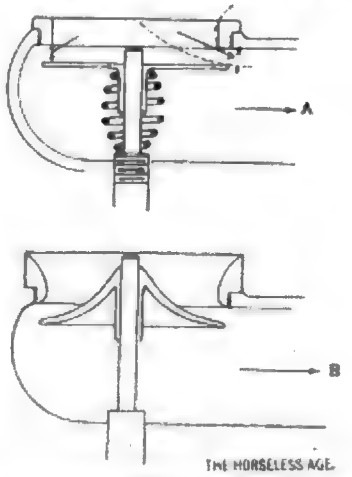


FIG. 12.

While the foregoing causes of losses in flow efficiency are quite easy of elimination, the losses due to bends are not so readily overcome, for the simple reason that bends cannot be eliminated. Nevertheless, if more thought were given to the throttling effect of short radius bends in the intake piping there would be fewer of the present tortuous forms. The throttling effect of bends on the freedom of the exhaust is familiar, because it is so easily demonstrated by removal of the manifold and piping; but very few have witnessed a demonstration of the same throttling effect in the intake piping.

In Kent, page 488, under the general heading of air losses in pipes, is given a table showing the effect of 90° bends of various radii. This table, reproduced as Table II, contains empirical values found by the Norwalk Iron Works Company. The fact that fluid friction is independent of pressure makes them very approximately applicable to the case in hand, as will be shown. If D equals the diameter of the passage and R equals the mean radius of the 90° bend expressed in terms of D, then L, also expressed in terms of D, equals the length of straight passage which introduces the same resistance as the bend:

TABLE II.

R	.5	.75	1	1.25	1.5	2	3	5
L	121.2	35.09	17.51	12.72	10.36	9.03	8.24	7.85

Thus it appears that if D = 1 inch, a bend of mean radius R = .75 D, Fig. 13, imposes the same resistance to the passage of the charge as does 35.09 inches of straight one inch pipe; if D = 1.25 inches, L = 43.68 inches; and if D = 1.5 inches, L = 52.63 inches. The proportion R = .75 D is average practice in intake manifold bends, and is found in Fig. 14, which is one of the several manifolds used by the writer with a four cylinder engine having individually cast cylinders of 4.5 inches bore and 5 inches stroke. The actual mean length of the passage from the carburetor flange to any one of the valves was 16.68 inches. There being five 90° bends in the line to each cylinder, the equivalent length L = 5x35x1.5 = 263.2 inches. Adding to this the straight length per cylinder, 12.25 + 263.2 = 275.45 inches = 22.95 feet. It can be mathematically shown that, neglecting the air density factor, there will be a pressure drop of some 6 ounces per square inch between the points *x* and *y*, Fig. 14, with a mean charge velocity of 7,000 feet per minute.

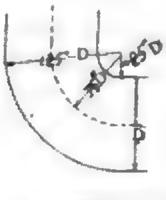
In experimental determinations the points *x* were connected together by a manifold made of small copper tubing and provided with an air cock, as shown; a similar cock was inserted at *y*, as near to the flange as possible; then these two cocks were connected by rubber tubing with the two legs of a water manometer. The openings of the cocks could be so adjusted that, no matter what the engine speed or throttle opening, the water columns gave dead-beat readings, the difference between their heights being a measure of the mean pressure drop due to the manifold. Representative readings of pressure difference P_d, taken with open throttle and referred to mean gas velocity V_m through the manifold Fig. 14, computed as in the foregoing, are given opposite A in the following table:

TABLE III.

	No.	R. P. M.	V_m	In. H_2O	P_d Lbs.
A	1	558	4184	4.8	.173
	2	912	6838	13.5	.486
	3	1246	9342	26.9	.968
B	1	552	4139	.5	.018
	2	908	6808	1.3	.047
	3	1252	9388	2.4	.086

Corresponding readings taken at approximately the same speeds with the same engine and carburetor, but with the manifold Fig. 15 are given opposite B in the above table. Manifold Fig. 15 possessed an actual mean passage length of 60.28 inches and an equivalent length per cylinder, computed from Table II, of 113 inches or 9.41 feet. For the bends at the cylinder ports R = .75 D, but for the other bends in the manifold R = 2 D. Both Figs. 14 and 15 are drawn to scale.

Reference to A and B, Table III, shows that while the equivalent lengths are to each other as 2.43 : 1, the pressure drop losses are more nearly as 10 : 1. This is accounted for by the fact that, though the diameters of the passages were the same in each manifold, the velocity through the main branches of that in Fig. 15 was approximately only .5 of that through Fig. 14, or one-half of the V_m values given for it in Table III.



THE HORSELESS AGE.

FIG. 13.

The point which it is desired to bring out by the above example is that, aside from the actual velocity difference in the two cases, experimental results from engine manifolds approximately bear out the results collated in Table II, and that actual losses due to the manifold are proportional to the equivalent lengths as determined thereby. In both the above cases the increase in friction loss between the air and the passage walls is proportional to the square of the velocity ratio. Taking the case of Fig. 14, and calling any one of the velocities through it unity, its friction loss is at that velocity proportional to its length—16.68 inches. For Fig. 15 it will be seen that the gas divides upon its entrance to the manifold and traverses its whole length before passing to a cylinder. This length is, therefore, the total length of the manifold = 60.28 inches. Since V_m is here only one-half that for the other manifold, by the laws of fluid friction the relative friction loss is proportional to the product of $.5^2$, and the actual length = $.5^2 \times 60.28 = 15.07$; thus the friction loss for manifold Fig. 14 is to the friction loss in manifold Fig. 15 as 16.68 : 15.07, or as 1.106 : 1. But the actual loss ratio is approximately 10 : 1; therefore there are other losses which for these two cases bear the relationship of 9.014 : 1, and which cannot be accounted for as friction. This loss is that caused by the bends alone, and is due to the eddy currents induced by them in the flowing gas. From the P_d values in Table III it is seen that while the loss due to friction increases as V^2, the losses due to eddies in A, where they are prominent because of the shortness of the bends, increase as $V_m^{2.2}$ to $V_m^{3.0}$ as V_m itself increases.

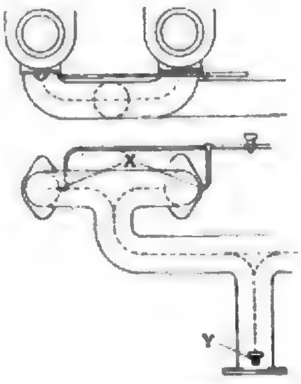


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FIG. 14.

The net result shown by the foregoing is that the same engine, with the same carburetor, suffered a loss in terminal suction pressure, at a speed of 1,250 revolutions per minute, which was .88 pounds per square inch greater with manifold Fig. 14 than with Fig. 15. This meant a loss of from 9 to 11 pounds per square inch in compression pressure in this particular engine. It would be interesting to know the experimental values of P_d for a manifold like D, Fig. 10. The writer has heard, indirectly, that in a well known six cylinder engine the manifold pressure drop reached a value of 6.8 pounds at the rated speed of the engine.

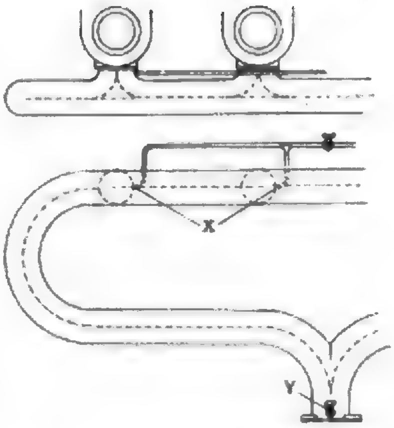

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FIG. 15.

Since any retardation of the flow due to the carburetor, its orifice and passage forms, is common to all cylinders, it is obvious that the distribution will not be disturbed by these factors, and the manifold itself is the only possible disturbing factor. The two-cylinder manifold A, Fig. 6, can be made to distribute equally if the cylinder ports 1 and 2 are just far enough part to introduce a resistance in the straight pipe between them which is equal to the difference between the resistances of the T and the L. Eddy losses, being primarily due to gas inertia, are much greater when the flow is through the cross legs of a T, in the direction of A′, Fig. 6, than when it is through a simple L.

A and B, Fig. 16, illustrate the relative eddy losses, as shown by photographs of air flow through glass walled passages. Fine columns of smoke, emitted from a series of small nozzles set along the vertical diameter of the passage, were entrained, and by their fraying out and interference gave visual indications of the eddies. Inertia effects are well shown by the overrunning of the smoke columns beyond the stem of the T. This overrunning introduces eddies of apparently equal violence at two points instead of one, as in the L. Since eddies dissipate the energy of the gas column, it may be assumed that the loss in the T is twice that in the L. Therefore, it is probable that distribution will be quantitatively equal with A, Fig. 6, if the straight pipe introduces a resistance equal to that at the L. Obviously, it cannot be so with B, Fig. 6, since all the resistance due to the manifold is in the line leading to cylinder 2.

In D″ ″, Fig. 6, the losses are equal, and it therefore distributes equally; and C may be taken as doing so if the distance X = 2 D or more. With the throttle located, as in D' and D" there are somewhat unequal eddy resistances, favoring cylinder 1, depending upon the extent of the throttle opening. The Y, D"', Fig. 6, with the throttle as in D"", will give equal resistances, but the eddy losses are as great, if not greater, than in the T (See C, Fig. 16). With the throttle as in D"' these losses are greatly unbalanced, favoring cylinder 2.

It is commonly accepted that a Y-pipe branch gives easier flow and minimizes losses. This is true if the flow is from the two branches into the common stem of the Y; but where the direction of flow is selectively from the stem through one or other of the branches D"', Fig. 6, and C, Fig. 9, the eddy loss due to gas inertia is at least as great as it is with selective flow from the stem through the branches of a T, as in the centre of A, Fig. 9. Selective stem to branch flow in a Y is almost as inefficient as branch to stem flow for a T, A and B, Fig. 6. Of course, if the flow is not selective, as in F, Figs. 9 and 10, and Fig. 15, the efficiency of the Y is much higher than that of the T. This, in all probability, partially accounts for the low P_d values obtained with the manifold, Fig. 15. Eddy losses at the lower Y must have been almost nil because of the absence of selective flow to the branches. Also, like losses could not have been great at the entrances to the cylinder branches because of the favorable directions of the initial flows—simultaneously from each branch into the stems of the Ts.

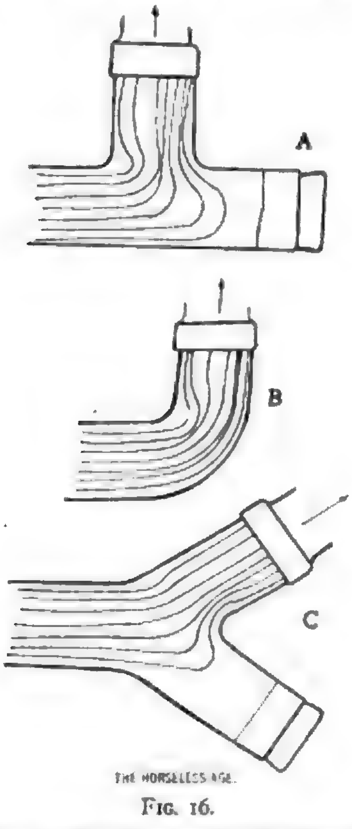

FIG. 16.

It is extremely poor practice to join an L to the stem of a T in the same plane, as in C, Fig. 6, unless the distance X = 2 D or more.

The Theory of Case Hardening.*

By Leon Guillet, D. Sc.

Case hardening is a metallurgical operation of the greatest importance in the manufacture of automobile parts. It has, moreover, been the cause of a great deal of trouble, owing to parts being too brittle, not sufficiently hard, etc.

As in all metallurgical operations, very important progress has recently been made in case hardening, owing to modern theories and scientific investigations, which show that this process may be applied methodically and may furnish uniform results. It is these means of obtaining uniform results which we will consider in this article.

DEFINITION AND PRINCIPLE.

The object of the case hardening process is to obtain a part with a soft, non-breakable core and an extremely hard outer surface. In order to secure this object the following principle is made use of: A steel containing a small proportion of carbon is not hardened by quenching, while a steel containing a considerable proportion of carbon (.900 per cent.) when quenched at a suitable temperature is rendered extremely hard. On the other hand, experience shows that if a steel is carried to a high temperature in the presence of a material susceptible of giving up its carbon to it, the carbon will dissolve little by little into the steel, the surface layer of which thereby becomes a high carbon steel, while the core retains its original content of carbon.

If, therefore, we take a very low carbon steel and case harden it, that is to say, raise it to a high temperature in the presence of a carbonizing material, we obtain a piece which, after being quenched at a suitable temperature, presents a very high surface hardness, while the core or interior portion remains soft and is not at all brittle—at least not if the process has been properly carried out.

The process of case hardening is generally referred to in France as "cementation." This term comes from the English word "cement," which is synonymous with powder. In the application of the process, a carbonizing powder is usually employed. (We shall see further on that various gases may also be used.)

In every case hardening process there are two distinct operations, as follows:

1.—The carbonization or cementation.

2.—The quenching or hardening.

We will first consider the carbonizing process and then pass on to the quenching of the parts which have been carbonized.

FACTORS AFFECTING THE CARBONIZATION.

On the whole the carbonizing process consists in dissolving carbon in the steel. It will be at once apparent that there are four factors in this connection, as follows:

1.—The solvent (the steel).

2.—The material to be dissolved, the carbon which may be in different forms (charcoal, cyanide, hydrocarbon, etc.)

3.—The temperature at which the carbonization takes place.

4.—The time during which the carbonizing action takes place; that is to say, the duration of contact between the cement and the metal.

INFLUENCE OF THE COMPOSITION ON THE STEEL.

The influence of the composition on the steel must be considered from two different points of view, viz., that of the rapidity of the carbonization and that of the mechanical properties of the piece after the process is completed. As regards the rapidity of carbonization, the tests which the writer has published (Society of Civil Engineers of France, February, 1904) show that the carbon content has no influence, at least not if it ranges between .05 and .50 per cent., the trials not having been extended beyond the higher limit.

But steel always contains impurities, such as manganese, silicon, sulphur and phosphorus. What influence have these impurities? There is only one of these, manganese, which has an extremely detrimental effect, which we shall discuss further presently; we will here point out that manganese increases the speed of penetration, and that silicon diminishes it. The ordinary commercial case hardening steels having always a very low content of manganese and silicon, the influence of these elements may be neglected, and this applies even more strongly to phosphorus and sulphur, whose percentages are always extremely small. In short, it is not necessary to take account of variations in the composition of commercial case hardening steel as regards the rapidity of penetration.

Unfortunately the same does not hold true if we examine the qualities of the case hardened part. What should these qualities be? The surface of the part should be hard and the core should not be brittle. Let us see what is necessary in order to obtain this result. The surface must be extremely hard after quenching, and we have seen that this necessitates a carbon content of .850 per cent. in the surface layer. The component of carbon in the surface layer will depend upon the temperature of the carbonizing furnace, the time and the nature of the cement, as we shall see, but not on the composition of the steel.

Let us now consider the core, which must not be brittle. It is known that when a steel is carried to a temperature beyond its point of transformation and then slowly cooled, it becomes the more brittle the higher the temperature to which it has been carried, the longer it has been exposed to the heat and the greater its carbon content.

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* This will be followed by an article on "The Practice of Case Hardening," by the same author, in a later issue.

We will first consider this latter point, viz., that the higher the carbon content the more readily the steel becomes brittle during the annealing. During the process of carbonization the core—granting that it is not subjected to any chemical action, which has not been proven—is submitted to an extended annealing process at the temperature of carbonization, and lasting as long as the latter process, sometimes fifteen to twenty hours. In order that this annealing may have the least possible effect on the part the carbon content must be the very smallest possible.

On the other hand, it is necessary that the mechanical properties of the core should not be detrimentally affected by the quenching or quenchings which always follow the carbonization. It is particularly essential that it should harden upon quenching, without which its brittleness would increase (we are, of course, here referring to ordinary steels only). This is another reason why the carbon content of case hardening steel should be low, and steels of the very lowest carbon content are, therefore, always employed.

This condition imposes another difficulty, and that is that very low carbon steels, containing .05 to .10 per cent. of carbon, are very difficult to work, these metals "cramming" the tool, as the shop term goes; that is to say, the chips refuse to disengage. If one adopts a steel containing more than .25 per cent. of carbon the annealing has a very strong influence on the brittleness. Steels with between .100 and .200 per cent. of carbon are suitable for case hardening, and a carbon content of .150 may be considered the best. The writer knows, however, of manufacturers who prefer above all a metal which is easily worked in machine tools, and who gladly sacrifice something in the qualities of case hardened parts; these use steel with a carbon content of .200 per cent. In the writer's opinion this a very bad mistake. But the fact is so well known that several large French steel mills have been obliged to furnish two grades of case hardening steel, one a very low carbon and the other a low carbon steel, the former having a tensile strength of 36-39 kg., and sometimes even as high as 45 kg. per square mm.

Another steel maker has introduced a very important modification in the composition of ordinary case hardening steel (let me repeat that I am not now referring to special case hardening steels, such as nickel steel). This modification consists in the introduction of a higher percentage of phosphorus than is found in high grade steels (I am unable to state the actual percentage, not having had a sample of this steel). It is sufficient to appreciably improve the machining qualities, but is not sufficient to seriously affect the mechanical qualities of the metal, especially its resistance to shock.

From what has been said it may be concluded that ordinary case hardening steel should have a low carbon content, at most .200 per cent. In the writer's opinion, it is also essential that it should contain a considerable proportion of manganese. It often happens that after careful carbonization and a very excellent heat treatment a case hardened part shows great brittleness in the core, while another piece, made from steel of the same carbon content and subjected to the identical treatment, shows remarkable resistance to shock. This difference has been a cause of much mystery.

From numerous samples which the writer has tested, he believes that this phenomenon in the majority of cases may be ascribed to a difference in the manganese content. If we consider two steels of low carbon content, one containing little manganese, .200 per cent., for instance, and the other .500 per cent., the latter is much more sensitive to prolonged annealing at high temperature, and becomes brittle much more easily than the steel containing .200 per cent. of manganese, other things being equal. It seems that the maximum manganese content which may be tolerated in case hardening steel is .300 per cent. The writer has never found among case hardening steels such large contents of silicon, sulphur or phosphorus as would have been troublesome.

We may thus resume the requirements of a good case hardening steel by saying that the carbon content should not exceed .200 per cent. and the manganese content should not exceed .300 per cent.

As it is a much easier matter to verify compliance with these conditions by means of mechanical tests than by a chemical analysis, the best specifications which may be adopted for case hardening steel seem to be the following:

1. Tensile tests on a test bar 138 millimetres in diameter and 100 millimetres between knife edges, annealed at 900° Cent. and cooled slowly. Breaking strength, 36-39 kg.; elongation, 30-32 per cent. (higher tensile strength not tolerated).

2. Chemical analysis. Maximum manganese content, .300 per cent. (It is well to specify the analytical method to be made use of, so as to avoid any misunderstanding with the steel maker.)

THE CEMENT.

How may the value of a cement be determined? A cement is the better (1) the more readily it penetrates, without, however, introducing the carbon too violently; (2) the more slowly it becomes exhausted; that is to say, the more constant the results it gives throughout a number of successive operations. An ideal cement would evidently be one which could be used continuously, always giving the same effect. The third condition which a cement must fulfill is that it must be easy to correct. As we have seen, there is no cement which gives absolutely constant results, and it is therefore necessary to correct the composition from time to time. It must be comparatively easy to thus correct the cement, and this operation must not involve any complicated analyses.

Special emphasis should be placed on the first requirement, that the cement must produce rapid cementation, yet not introduce the carbon too violently. What is meant by this requires, perhaps, further explanation. We have already seen that the object of the process under discussion is to obtain a surface carbon content of .850 per cent. If the carbon content is greater the surface will be brittle and will easily chip off under the influence of repeated shocks. If a cement is used which introduces carbon violently, if the surface carbon content is .850 per cent., the thickness of the surface layer will be small—too small for a great number of applications. If such a cement is used one has the choice of two alternatives: One may either have a very thin carbonized layer, or an outer surface which is too rich in carbon.

One of these conditions is as dangerous as the other, and it is, therefore, necesssary to avoid every violent cement.

The rapidity of cementation may be defined by the depth to which the carbon penetrates during a given time. On the other hand, by varying the time the corresponding variations in the depth of the carbonized layer permit of determining the value of the cement. For measuring the depth of the carbonized layer there is only a single method, viz., by means of the microscope. By interposing a micrometer between the steel sample and the lens of the microscope one may readily measure the distance from the edge of the steel to the point where the pearlite becomes more compact than at the interior of the part.

A cement must be considered from four different standpoints, viz., rapidity of cementation, mode of introduction of the carbon, exhaustion and possible correction.

INFLUENCE OF THE NATURE OF THE CEMENT.

Let us then see which substances may logically be used as cements. Whatever cement is used it must contain carbon, as it is this element that is to be introduced into the steel. The first substance that suggests itself is carbon itself. Experiments have been made to determine whether pure carbon would act as a cement. The results have been contradictory. In any case, it is certain that pure carbon, as, for instance, burnt sugar, treated by a current of chlorine, carbonizes steel extremely slowly, if it does so at all.

The next question that arises is, How do the industrial carbons behave? It is found that wood charcoal, as is used for many purposes, after having first been pulverized, produces very much slower cementation than is obtained with other products, but its effect is, nevertheless, quite appreciable. We shall explain this phenomenon presently, in connection with cyanide cements, in which wood charcoal may be embodied. It may be stated at once that the use of this substance alone is of little interest, for the reasons that its cementation is less rapid than that produced by other substances, and that it loses its strength rapidly.

The most important class of cements is that which acts through the cyanogen radical, having the chemical formula CN. This compound substance sometimes acts like a simple element, resembling chlorine, and for this reason it is sometimes designated by a single symbol Cy, as though it was an element. It gives rise to the well known salt potassium cyanide, KCN, which is similar to potassium chloride, KC_1, but it also gives rise to complex salts, such as potassium ferro-cyanide, $K_4Fe(CN)_6$, which is not a double cyanide of iron and potassium, but rather the potassium salt of a new acid, ferro-cyanhydric acid, which is only very distantly related to cyanhydric acid.

The cements which act through the cyanogen group seem to produce cementation in the following manner: They are rapid cements and some of them are violent, some of them become exhausted because they are volatile, and some among them are easily corrected.

The cements acting through cyanogen may be divided into two large classes, viz., (1) those which actually contain cyanogen, and (2) those which do not contain it, but are capable of furnishing it at the desired moment.

In order to carbonize a part of any kind it is enclosed in a box, a layer of cement being interposed between it and the walls of the box. All cements which are solid are in the form of a fine powder. If this powder is placed in the box the intervening spaces are necessarily filled with air, and consequently with nitrogen. Now, by heating certain carbonates, like those of potassium, sodium, ammonium and barium, in the presence of nitrogen and carbon, we produce the cyanide of the corresponding metal, according to the following reaction:

$$4C + CO_3K_2 + 2N = 2CNK + 3CO$$

Carbon + potassium carbonate + nitrogen = potassium cyanide + carbon monoxide.

$$4C + CO_3Ba + 2N = (CN)_2Ba + 3CO$$

Carbon + barium carbonate + nitrogen = barium cyanide + carbon monoxide

It is therefore possible to use mixtures of carbon and certain carbonates as a cement. It is to be noted that the nitrogen which takes part in the reaction forms the vehicle between the metal and the powder which surrounds it. The principal cements which act through cyanogen are the cyanides of potassium, sodium and ammonium. The first is most widely used. All of the cyaniden are very dangerous to handle, they being poisonous and very volatile, and causing the most serious accident. Ferro-cyanide of potassium is one of the most widely used cements, and is especially used for rapidly imparting surface hardness to tools.

The disadvantages of these cements reside particularly in their "brutal" action and their rapid exhaustion. In fact, they introduce the carbon very rapidly, and promptly produce those needles of cementite which must be avoided. Their rapid weakening is due to the fact that the alkaline cyanides are very volatile. Attempts have therefore been made to improve them. It was first proposed to apply practical expedients, such as painting of the parts, and we will consider these methods when discussing the practice of cementation. It has also been tried to diminish their violence by mixing them with inert substances.

It was then proposed and attempted to use cements composed of cyanides or a ferro-cyanide, mixed with bricks, or even with chemical products, such as bichromate of potassium. The latter, it must be recognized, is not an absolutely inert body, producing an oxidizing action and transforming the cyanide into a cyanate.

The principal cements which act through cyanogen which they produce by a reaction with the nitrogen of the air in the carbonizing box are carbon and carbonate of barium. The use of the latter substance as a cement was first suggested by Captain Caron, of the French Artillery. It gives excellent results, a proportion of 60 parts of carbon and 40 parts of barium carbonate seeming to work best. This cement offers the following great advantages: (1) Rapid penetration; (2) constant action; (3) remarkably slow exhaustion; (4) great ease of correction.

According to Captain Caron these qualities are due to the fact that barium cyanide is not volatile, in which respect it is the exact opposite of potassium cyanide. Moreover, it is easy to correct, for in order to determine the amount of barium carbonate present it is sufficient to treat the cement with diluted hydrochloric acid and to then wash it: only carbon remains, and by the loss of weight, as determined after drying, one may determine the quantity of barium carbonate present, and consequently the addition required. The carbon-barium carbonate cement used in practice is the so called "whiterite," a product found in nature, which is carefully ground. It would be possible to use a mixture of carbon and of the carbonates of potassium, sodium and ammonium, but these mixtures become rapidly exhausted owing to the volatility of the alkaline cyanides.

A cement which seems to belong to this class, and which gives good results, consists of a mixture of carbon and chloride of sodium (about 6 per cent. of the latter substance). Finally, there also belong to this class of cements acting through cyanogen, which they produce themselves, carbon and all nitrogenized substances (crushed beans, powdered horn, old shoes, leather) and ammoniacal salts. The carbons act through the cinders which they contain, and their carbon content giving rise to cyanides, as explained above. The ammonias also favor this formation, but in that case one has to deal with a very volatile cyanide of ammonium. Urea acts in the same way.

As to the powders intended for the instantaneous cementation of steel, and which are particularly used for hardening tools by sprinkling them with the cement, then heating them in the forge, and finally quenching them, these cements all have a potassium ferro-cyanide base, which, as we have seen, is open to the objection that it is violent in its action.

A third class of cements is constituted by carbonic oxide. It is known that when carbon is burned in the presence of a limited quantity of air carbon monoxide (CO) is formed, which acts as a cement according to the following formula:

$$2CO = C + CO_2$$

Carbon monoxide = carbon + carbonic acid.

The action is extremely slow, however. It is for this reason that very pure carbon, such as burnt sugar, for instance, and washed animal black, which contains no salts, may give cyanides which act very slowly. In fact, these substances act because, being in contact with only a limited quantity of air, they produce carbon monoxide. Other bodies, certain carbonates, may become dissociated at the temperature of cementation, and in the presence of carbon may produce carbon monoxide, which has a cementing effect. But these products are not used commercially, as their action is too slow.

There is also a fourth class of cement, which is constituted by hydro-carbons, which, in decomposing in the presence of air, give rise to carbide and hydrogen. Among the cements of this class should be mentioned illuminating gas and acetylene. If a part which has been cemented by means of illuminating gas is examined at the moment it is withdrawn from the carbonizing medium, a quite heavy layer of graphite is found.

Of the three classes of cement which are used commercially the first and second class, which act through the cyanogen they contain, and through cyanogen which they produce, respectively, are most widely used. In the writer's opinion preference should be given to those of the second class, and among these to the mixture of carbon and carbonate of barium, as it is regular in its action, easy to regenerate and not noxious.

Evidently the investigations on cements are not yet terminated, and it is to be hoped that some day a cement will be found which will more closely approximate the ideal than those now used. The ideal cement would be a liquid, into which the part to be cemented could be plunged, so as to acquire rapidly the richly carbonized surface layer desired. The salts which seem to lend themselves to this process are volatile, and invariably give off noxious vapors. In waiting for the ideal cement to be discovered let us be satisfied with the carbon and barium carbonate mixture, and let us banish from our shops all those strange products which should no longer have any place within the realm of modern metallurgy.

INFLUENCE OF TEMPERATURE.

This influence must be studied from two different points of view, viz., first, as regards the rapidity of penetration, and, second, as regards the qualities of the finished part. We have already observed that cementation, being a solution process, the increase of temperature should favor the solution. This view is confirmed by experience. Following are the results of tests which the writer made, and which have already been published (Civil Engineers' Society of France). The cementation was continued for eight hours from the time that the temperature indicated in the table was attained. The cement consisted of 60 parts of carbon and 40 parts of barium carbonate.

Temperature.	Penetration in Tenths of a Millimetre.	Temperature.	Penetration in Tenths of a Millimetre.
700° C.	0	950° C.	28
800° C.	5	975° C.	32
850° C.	10	1,000° C.	42
900° C.	16	1,025° C.	48
925° C.	20	1,050° C.	52

These experiments show in a striking manner the influence of a variation in temperature. Thus, for instance, after maintaining the part of 900 degrees for eight hours, the carbonization has penetrated to a depth of 1.6 mm., while, if it is maintained at 1,000 degrees, all other conditions being the same, the depth of carbonization attains 4.2 mm., or nearly three times as much. From these results the following conclusion may be drawn for practical application: If it is desired to obtain a carbonized layer of a certain depth, which is a matter of great importance, as we shall see later on, it is absolutely essential to know the exact temperature at which the process is being carried out.

It was pointed out in connection with the tests which gave the results recorded in the above table that the time of heating was counted only from the moment that the part attained the final temperature. This is a rather delicate point, which we will discuss in greater detail in connection with the practice of case hardening later on. It is necessary to take into account the time required by the assemblage of box and parts to be carbonized in reaching the desired temperature. Only practice permits of determining this time for different conditions, but it is necessary that this practice be based on methods which do not lend themselves to ambiguity.

Let us now examine the influence of the temperature on the qualities of the finished part. The higher the temperature the more brittle the core of the part after cementation. The obvious conclusion is that the cementation process should be conducted at the lowest temperature possible; in other words, the cementation must be carried out slowly, as at low temperature the carbon penetrates slowly into the steel. But what is of the greatest importance is not the brittleness of the parts directly after cementation, but, rather, their brittleness in the state in which they are used; that is, after quenching.

In discussing the details of these quenchings we shall see that a judicious treatment will entirely eliminate the brittleness of the core of a carbonized part, provided that this brittleness is not a consequence of the composition of the case hardening steel. This enables us to carbonize steel at a high temperature.

INFLUENCE OF TIME.

The time of cementation has the same influence as the temperature, both from the standpoint of speed of penetration and of qualities of the finished part. The longer the cementation is continued the deeper the carbonized surface layer and the more brittle the metal. Following are some tests regarding the influence of time on the thickness of the carbonized layer. These tests were carried out at a temperature of 1,000° C., and the time was counted from the moment when the box was introduced into the furnace. The cement consisted of 60 parts carbon and 40 degrees carbonate of barium:

Time.	Penetration in Tenths of a Millimetre.	Time.	Penetration in Tenths of a Millimetre.
¼ hour.	0	4 hours.	13
½ hour.	0.5	6 hours.	20
1 hour.	8	8 hours.	30
2 hours.	10		

In the experiments already mentioned almost a half hour elapsed before the cementation became noticeable. This factor may evidently become of great importance, if the part is large. The writer experimented only on samples of 20 mm. diameter and 60 mm. in length, placed in a box of 80 mm. inner diameter.

From what has already been said it follows that the higher the temperature the shorter should be the time of cementation. It seems thus that the two factors compensate each other, and that up to a certain point one may carry out the cementation either at low temperature extended over a long time, or at high temperature for a short time, without affecting the result. This, however, is not correct, and for the following reason: A prolonged annealing induces in the steel a certain brittleness, which may be regarded as a limited brittleness, being acquired after a certain period of heating, which is the shorter the higher the temperature. This point must not be exceeded. But this limited brittleness increases rapidly with the temperature. According to experiments made by the writer this limited brittleness amounts to 10-12 kgm. at 800 degrees, and to 0-2 kgm. at 1,000 degrees. It depends to quite an extent to the manganese content, as has already been pointed out.

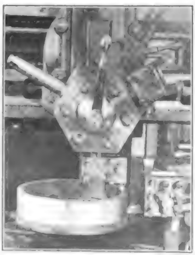
It results from the above that the influence of the temperature on the qualities of the case hardened part is even more important than the influence of the time. This would be correct if the heat treatment which follows the cementation did not in some way wipe out the effects of the temperature.

A Method of Machining Flywheels.

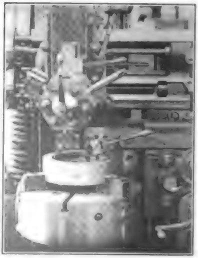
"Progress in transportation has been a machine shop problem in every step beyond horses" (to quote a recent editorial remark in the *American Machinist*), and is a truism borne out completely by the leaps and bounds which have characterized the recent development in the automobile field.

The low priced car of to-day is low in price because of the careful attention and study given to the making of every component part. Cars are no longer built; they are manufactured, and this very fact opens up possibilities in the way of equipment expenditures, positively prohibitive under the former method, which are unquestionably the highest economy. Special machinery for cylinder boring and grinding, large milling and drilling machines for crank cases, etc., are a necessity on account of the number of integral parts of each piece which may be simultaneously machined with such accuracy that erection and assembling charges are reduced to a minimum.

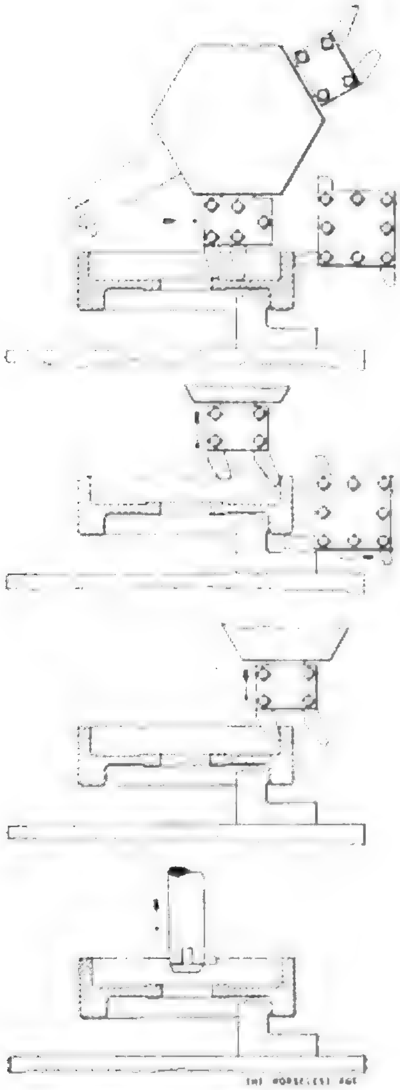
That the various surfaces of a piece must be machined simultaneously, as far



FIRST SETTING.



SECOND SETTING.



Operations at First Setting.

as possible, is axiomatic of present day economic shop practice, and even so simple a part as a flywheel presents possibilities for such work, when studied, as is shown in the accompanying half tones and line drawings—which graphically illustrate the methods employed by one of the most progressive manufacturers of low priced cars in this country.

In Fig. 1 the outside diameter, one edge of rim, hub flange and web are being machined, the roughing operation being shown. At this setting the friction seat is also machined, while an undercutting tool in the side head is finishing the other edge of rim. The hole for the shaft is bored last, insuring concentricity, as all other surfaces to be machined at this setting have been finished and the movement of the piece by further cutting strains is obviated.

The second setting, Fig. 2, serves for the finishing of all other surfaces; including the boring of the inside of the rim and facing of the hub and the web on the engine side. Soft jaws, bored under strain to the exact diameter of the finished wheel, secure the piece concentrically and insure a truly balanced wheel.

A Study in Carburetor Action—A Glass Carburetor.

By J. S. V. Bickford.

Some time ago, while testing the engine of an 18 horse power car, the small plug over the carburetor jet was removed while the engine was running, and it was noticed that the gasoline issued in a solid stream from the jet and entered the induction pipe in this form. There was no sign of spraying or atomizing. This carburetor was both economical and effective. I therefore decided to carry out a few experiments with a view to determining exactly what does go on inside a spray carburetor.

I wished in the first place to see what takes place, and I also wished to determine the law which governs the flow of gasoline and air, respectively, under the influence of suction, so that some data would be available to determine the ruling principles of design.

My first consideration was a method of measuring the air sucked. For my apparatus I had a Crowden blower, which when run backward sucked effectively. The delivery pipe of this blower (now the suction pipe) was brought over to a bench and terminated in a T piece, A, Fig. 1. The upper limb of this T piece was left open as a convenient method of stopping the suction through the carburetor by allowing air to enter at B. To the other (horizontal) branch of the T the carburetor to be examined was attached, and the far end of the carburetor was attached to another iron pipe, also terminating in a T piece (the up-This pipe, D, communicated with a small be closed, like the other, by a greasy plate). This pipe D communicated with a small box E, to which we shall return presently, and then passed through the side of a 36 gallon cask, and, turning upward, finished about level with the top of the barrel.

Over the barrel was a tin plate bell, suspended and balanced by a string and pulley and weight. The barrel was nearly filled with water. It will be obvious now that if a carburetor is fitted and the holes B and G are closed and the blower is started, the bell H will be sucked down, and by determining its rate of fall and its capacity the capacity of the blower can be determined. The small box E was provided in order to determine the suction at this point, for I assumed (perhaps unwarrantably) that the barrel and its pipes could not "know" what was going on beyond it, and if I found that the rate of flow was so and so much with a certain given suction at this wind box, then it could be assumed that this rate of flow would always be taking place when the suction was the same.

The air pressure was measured with a water gauge both here and immediately over the carburetor jet. This last pressure was taken by inserting the end of a fine glass tube through the joint over the jet.

The preliminary calibration of the apparatus gave the following results:

Table 1.

Air Depression at I, Inches.	Time in Seconds for Exhausting 3 Cubic Feet.	Cubic Feet Per Minute.
4 5-8	5 4-5	33 1-2
4	6 1-2	29
3	7 1-5	24
2	8 2-5	21 1-2
1 1-16	11 1-4	16
5-8	15	12
1-2	17	10 1-2
1-4	25	7 1-4
3-16	29 4-5	6

In this experiment the pressure was regulated by partly opening the hole at B. In all the gasoline experiments the gasoline was supplied from a one-quarter inch glass tube, marked off in 10 cubic centimeter lengths from a measuring glass, so that the quantities could be rapidly read. Before proceeding to give the results of tests of capacities it may be as well to describe the appearance of the jet and tubes.

ACTION OF THE JET.

In the first experiment the carburetor consisted of lamp chimneys of the shape shown in Fig. 1A. The carburetor jet was inserted between the first and second elbows and four lamp chimneys intervened between the jet and the suction tube A (only two shown). The distance from the jet J to the tube B was about 3½ feet. As soon as the apparatus was started up at full power, the gasoline was seen to be spraying to some extent. That is to say, it was in no sense of the term atomized but simply blown into comparatively small drops which impinged on the surface of the first lamp chimney and were then blown along the surface of the glass in wavelets.

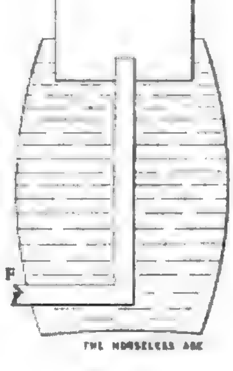


Fig. 1.

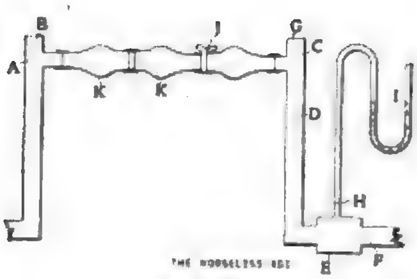


FIG. 1A.

The same effect can be produced by pouring some water onto a sheet of glass and blowing tangentially on its surface. Further, gasoline accumulated in every one of the bulbs K until the level rose sufficiently for the gasoline to run along the bottom of the lamp chimneys to the next bulb, and liquid gasoline was running down the suction pipe, and for all I know to the contrary was running into the blower itself. A more unpromising looking piece of apparatus to work an engine with I have seldom seen, and an examination of it leads me to believe that half the engines on the market are taking liquid gasoline on to the top of the inlet valve, possibly into the cylinder itself. Complete vaporization does not seem to exist.

Afterward we tried the arrangement shown in Fig. 2. Here a lamp chimney is arranged vertically, and a small brass annulus is arranged over its lower mouth. Into the middle of this is fitted the carburetor jet and the apparatus is started up. This is a common form of carburetor used, for instance, on the 1908 Siddeley cars, with an auxiliary air inlet relatively at B. In the Siddeley this vertical tube is hot water or hot gas jacketed for about three inches.

On starting this apparatus up the inside of the vertical tube looked very much like one of the parlor fountains one sees under a glass shade with a small ball riding on the top of the jet. The glass was wet all over, and the gasoline ran down the sides and lodged on the diaphragm, as shown in Fig. 3, enlarged. Here it was again picked up by the incoming air and blown about. There was, in a word, a sort of rainstorm going on inside the glass lamp chimney and liquid gasoline was to be seen all through the system as far as C.

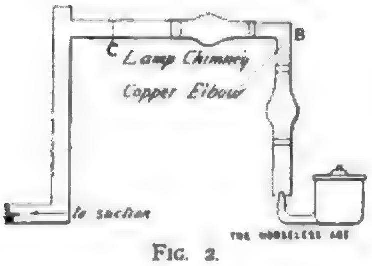


FIG. 2.

Returning to the first experiment, with the horizontal tubes, when the air pressure was reduced to about one inch water gauge the last sign of spraying disappeared and the gasoline could be seen dribbling down the side of the jet and running along the bottom of the tube into the first depression, which it filled, and then went on to the second. Even then the last depression, three feet from the jet, was filled with gasoline.

All this is not very extraordinary if one begins to think it over. Sturtevant's catalogue gives the velocity of air under a pressure of 1 inch water gauge as 70 feet per second, or, say, 44 miles per hour, the velocity of a fresh breeze. What sort of spraying effect would be expected from allowing a jet of water or gasoline to issue into a summer gale? Considering these points, it struck me that if the gasoline in a liquid form passed with the air through a small hole immediately after leaving the jet, the blast would be enormously greater and would probably approach near to the blast produced by a perfect vacuum. Acting on this idea the experiment described below (Fig. 4) was tried. It may be mentioned that the carburetor of the 6 horse power Rover car is arranged something on this principle, and seems to work well.

A hurricane lamp chimney, A, was mounted on the suction pipe B to observe the effect through, and on top of this a shutter valve, C, was arranged, terminating in a short length of 1½ inch copper pipe, D, to prevent the entering mixture from running down the sides of the hurricane lamp chimney. Immediately over the shutter valve was an elbow, E, which communicated with a 4 inch length of 1½ inch copper pipe, F, terminating in a diaphragm with a hole in it to regulate the suction, so that the relative quantities of gasoline and air would be about as in an engine taking the correct mixture for perfect combustion.

The effect on the jet could be observed through the hole in the diaphragm. As will be seen, almost immediately on leaving the jet the gasoline would have to pass through the hole in the shutter valve, which was nearly closed, through which the velocity of the air would be very great. The effect was much better. For considerable periods the hurricane glass would be quite clear and transparent, and then a cloud would suddenly whirl through it and down the suction pipe. This seemed to show that much better evaporation was taking place than with the ordinary type of carburetor. It may be worth while to mention that the White & Poppe carburetor acts something on this principle, but in order to obviate the use of too low pressures at the jet the designers arrange for the jet to be partly closed as the throttle closes, so that not only is the mixture atomized in passing through the throttle, but also a much stronger blast can be maintained across the jet. Incidentally I may say that an engine which I have seen fitted with a White & Poppe carburetor ran, without load, far slower than any engine I have ever seen, turning over regularly at 140 revolutions per minute and being quite inaudible about 8 feet away. What is more, the engine would "pull" at this speed and no acceleration was required before letting in the clutch.

Consideration of these effects enables us to give reasons for some peculiarities in the gasoline engine. For instance, many people will be familiar with the effect of the engine refusing to pull for a second or so after the throttle is opened. Now, if we picture the inside of the carburetor in the light of these experiments, the reason is fairly clear. All the pipes and passages are covered with liquid gasoline, which by surface evaporation gives the right mixture. When the throttle is closed one of two things happens. Either there is a leakage of air past the throttle and all this gasoline is evaporated and taken into the engine, and the pipes and passages are left quite dry. Under these conditions when the throttle is again opened all these ports and passages must be wetted with gasoline before the correct mixture is supplied to the engine. Or, on the other hand, the throttle is quite tight, probably evaporation goes on, and when the throttle is opened the mixture is first of all too rich through the induction pipe being full of gas, and after that too weak for a time, the result being the same as before, as far as the pull is concerned. Where a hot water or hot air jacket is used the effect is much reduced, because, in all probability, the wetting of the pipes does not take place to the same extent.

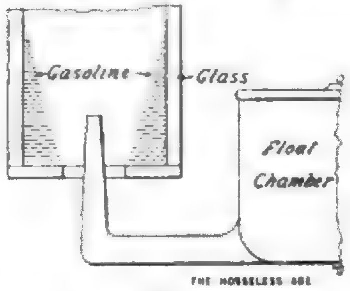


FIG. 3.

In the course of our experiments we had intended to try the effect of hot air supply and to make some endeavor to ascertain what temperature would be necessary to obtain complete evaporation, but the time did not permit. The apparatus which I had intended to use was a coil of big bore pipe over a gas burner with a thermometer just before the jet itself.

We can now pass on to the action of carburetors with reference to the relative supply of air and gasoline. Table II explains it-

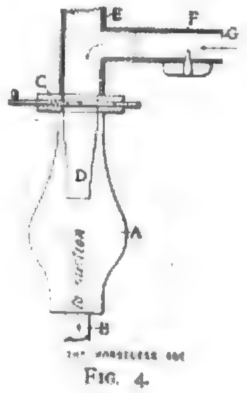


FIG. 4.

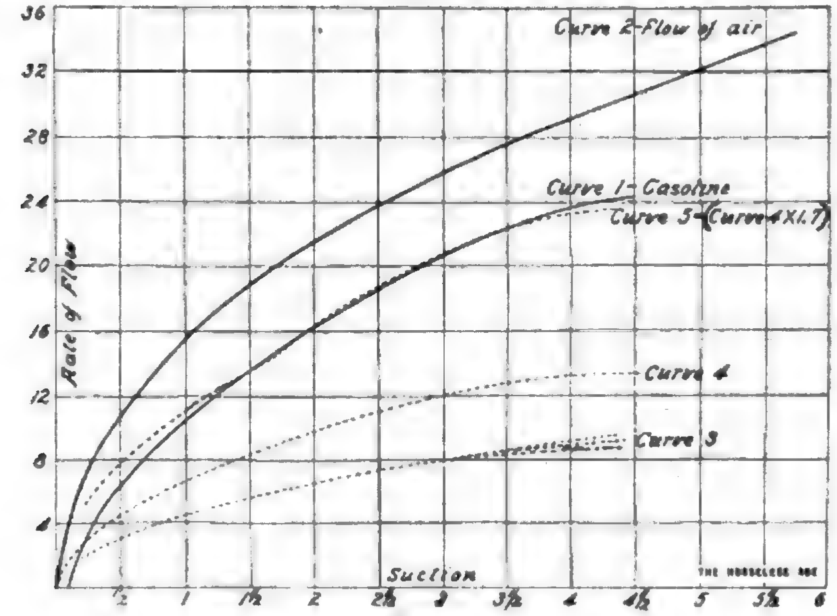


FIG. 5.

self. It gives the time in seconds as recorded in the experiment for the discharge of 10 cubic centimeters of gasoline of 715 specific gravity under the influence of varying suctions. One pound of gasoline would contain 635.3 cubic centimeters. From this table the curves, Fig. 5, have been prepared. These curves are only intended to illustrate the remarks I have to make, and must not be taken as absolutely quantitavely accurate.

TABLE II.

Suction at Jet, Inches Water.	C. C. Per Minute.	Cubic Ft. of Air Required for Perfect Combustion.	Cub. Ft. of Air Actually Passed.
6 1-2	76	24	32
6 1-8	67	21	25
5	61 1-2	19 1-2	24
3 3-4	53	16 3-4	23
3 1-8	46	14 1-2	19
1 7-8	34	10 3-4	15
1	20	6.3	10.5
3-4	16.3	5.1	10
11-16	14.5	4.6	8
17-32	10	3.15	7.2
1-2	9.8	3.1	7.2
13-32	5.8	1.82	6
7-16	fluoroscope.		

Curve 1 is the flow of gasoline in cubic centimeters per minute. Curve 2 is the corresponding air supply in the actual experiment which was too high for perfect combustion. Curve 3 shows the air supply which would have been given if the proportions had given a correct mixture at the minimum rate of flow. Curve 4 shows the air supply which would be obtained if the proportions had been correct at an air flow of 3 cubic feet per minute (about the minimum flow into a four cylinder 4x5 inch engine).

Curve 5, which very closely coincides to part of the gasoline curve, is obtained by multiplying Curve No. 3 by 1.7—that is to say, it represents the supply of air if a definite proportion be added to the quantity represented by Curve 3. It corresponds to the effect of opening an additional air valve mechanically, and may be assumed to be brought into operation at any part of the curve, according to the will of the operator. In other words, if the supposed additional air supply is opened wide at any point of the curve, the result is to jump the air supply from Curve 2 to Curve 3.

Besides the old fashioned carburetor with no means of adjustment at all, we have the Krebs type of carburetor, which adds air according to the suction, which works well, and, on the other hand, we have such carburetors as the White and Poppe, which arrange the mixture and alter it by mechanical means only. These three types seem contradictory, but I think that an examination of the above curves will give us a clue to the reason.

First I would point out that if by any means an additional air valve were opened wide as soon as the suction had reached the point X on the curve (Fig. 5), then the air curve would jump up to the gasoline curve and from that place on would follow it without further adjustment. If, therefore, an additional air valve were provided on the carburetor suction, so arranged that it would open full bore as soon as the suction had reached one inch of water, an approximately correct carburetor action would be the result. More especially would this be true if the carburetor were arranged to give a rather weak mixture at the lowest rate of flow. In this case the air curve would begin on the left hand side of the gasoline curve, indicating that there was too much air, and would cross the gasoline curve at some point at which the mixture would be correct, and thereafter the mixture would grow too rich until the additional air valve opened. Under these conditions the additional air valve would of course be smaller. Further, it should be noted that an additional air valve does not open full bore in an instant, but gradually. If, therefore, the mixture were right at the lowest rate of flow as in Fig. 5, Curve 3 or 4, then the rate of flow of air would be, under the influence of an additional air valve with spring loading, as in the dotted line, Fig. 6. That is to say, the approximation to accuracy would be even closer than we have assumed hitherto.

Let us now turn to the relative action of the Krebs type of carburetor and, say, the Tourist Trophy Rolls-Royce of two years ago. The latter was purely mechanical; in other words, as the throttle was opened it not only gave more mixture but added air to this mixture. At first sight this would appear to be the wrong method. Consider for a moment, however, what amount of variation occurs at full throttle operation. Under normal working conditions an engine will run at a maximum speed of 1,200 revolutions, and pulling hard on a hill it will not fall below 300. If we assume, for the sake of argument, that it is taking 60 cubic feet per minute at maximum speed with open throttle, it will be taking 15 cubic feet at minimum speed with open throttle. Now compare this with the curves given in Fig. 5. Assume that the mixture of air and fuel is correct at the maximum rate of flow (at the extreme right of the curve). You will note that it will remain correct until the rate of flow falls to approximately one-third of the maximum. It therefore appears that the plain carburetor is very closely automatic within the range of gas variation possible with an open throttle, and it is only when we come to reduce the amount of gas by wire drawing through the throttle that incorrect mixtures are supplied. This principle is therefore vindicated, and, as long as it is found possible to so arrange the air ports as to give a correct mixture, then the design has much to recommend it. Further, it is doubtful whether with the throttle partly shut any variation takes place whatever in the amount of gas passing through it (the throttle opening) due to variations in the engine speed. At least there will be none after a certain point has been reached. To make my meaning clear, let A B C D be various points on the throttle sector and let the throttle begin to close as the lever reaches A. Then I believe that when the throttle has reached, say, C, the rate of flow of gas through the throttle is entirely independent of the engine speed, and for this reason: Once the throttle is more than "a shade" closed, a considerable vacuum is created behind it, and it is understood that the rate of flow of gases into vacuum rises until the vacuum reaches about 7½ pounds per square inch, and after that no further increase is possi-

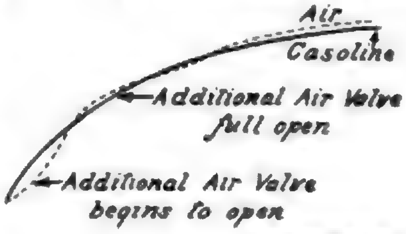

Air
Gasoline
Additional Air Valve full open
Additional Air Valve begins to open
THE HORSELESS AGE.

FIG. 6.

ble, even with a perfect vacuum. It would seem, therefore, that for the more advanced positions of the throttle it would be perfectly easy to have an absolutely correct mixture if this theory is in accordance with fact, and the only points where some uncertainty would exist would be the positions just after the throttle begins to be closed. The mixture would be no worse at these positions, however, than when the throttle is wide open, and we have already seen that with an open throttle the mixture will be approximately right for all engine speeds. On the whole, therefore, this throttle has much to recommend it.

The Krebs type, when properly made, is of course automatically correct at all and every engine speed and position of the throttle, as it depends on the suction alone.

In this article I have tried to lay before my readers a few of the deductions which I think may legitimately be made from the experiments carried out. I should, however, caution them that for the design of a carburetor it would be necessary to carry out a much more careful series of tests than the ones here described. The methods of experimenting might be followed, but much greater care would have to be taken to insure accuracy of result.

Statistics of Rare Minerals Used in the Automobile Industry.

By Morris A. Hall.

What might be spoken of as the rarer minerals (because they are not all metals nor elements) now in use in the automobile industry in one or more forms are worthy of a little study. Figures as to the quantity produced, used, imported, etc., will also be of interest. In many cases these figures will astonish by their size, as, for instance, the production of aluminum, while in others the figures will astonish equally for the very opposite reasons, as in the case of platinum.

Let us consider then the metals aluminum, chromium, manganese, nickel, platinum, tungsten and vanadium. Also, so as not to slight anything that properly ought to come within the scope of this article, let us look into the case of the following non-metallic but rare earth products, alundum, asbestos, calcium (carbide), carborundum, corundum and graphite.

ALUMINUM.

To take these up in order, it will undoubtedly be a great surprise to the automobile world to know that the world's production of aluminum in 1907 was 71,700,000 pounds, and this was estimated by experts to be but 75 per cent. of the capacity of the existing plants. Even at that, this was 78 per cent. increase over the previous year. Of this total the United States produced 26,000,000 pounds, which sold at an average price of 42 cents per pound and brought in the neat little total of $10,920,000. The tonnage was an increase over that of 1906 of 81 per cent., the average price per pound of 16½ per cent. and the total value 111 per cent. This same year (1907) we imported 16.7 per cent. more, or $182,475 worth, while the exports declined 16.3 per cent. or $304,938. The balance in our favor was then $122,463, a loss of 41 per cent.

To realize these figures it is only necessary to say that the automobile business uses perhaps 70 per cent. of the aluminum produced. It is figured that 120,000 automobiles will be built in this country the coming year. Allowing 175 pounds per car (the writer knows of one high grade car that uses 350 pounds) this amounts to 21,000,000. If we use 70 per cent., this is 30,000,000 total in the United States. This metal is now used liberally for crank cases, gear cases, clutch parts, radiator supports, foot and toe boards, inlet pipes, fans, running boards, ignition cable supports, steering wheels, steering gear cases, fenders, lamps, trimmings and other parts.

Of the whole amount the United States produced 36.4 per cent. and yet the two plants in the country, viz., those at Niagara Falls, N. Y., and Messena, N. Y., had previous to 1907, 12,000 horse power each, and at the end of the year 40,000 horse power and 20,000 horse power respectively, a total of 60,000 horse power employed in this one branch. The world's total horse power employed for this work must then be very close to the stupendous total of 175,000 horse power. The prices paid at New York in cents per pound for ton lots varied about as follows:

	Dec., 1906.	July, 1907.	Dec., 1907.
99 per cent..........	38	42	33
90 per cent..........	37	41	32
No. 12 casting alloy.	37	41	32
No. 21 casting alloy.	35¼	39½	30[illegible]
No. 31 casting alloy.	35¾	37¼	28½

Bearing directly upon the prices, and of more than passing interest for this reason, is the fact that the Bradley or basic patents expire in February, 1909. After this date we may expect more competition and consequently lower prices, although the older firmly established companies will no doubt get most of the business.

In this connection it is interesting to note that in the past few years several new things have been developed in this line, as extruded aluminum, which may be had in any shape or of any desired cross section, in any length and free from joints. Bimetallic tubing and cable are now also made; the former may be had in aluminum and copper or aluminum and steel, with either metal inside or outside or both. This is useful for condenser tubes where the water is acid, and could be used for radiators, in which case any anti-freezing solution could be used.

CHROMIUM.

Passing next to chromium, this is used in the automobile business in combination only. Thus we have all of the various chrome steels, chrome nickel, chrome vanadium, ferro-chrome, etc. These are now so generally used for such parts as crank shafts, connecting rods, valves, piston pins, cam shafts, axles, steering worms and sectors, knuckles, hubs, gears, etc., that we might stop to see how much of this element we actually use.

Our chromium ore all comes from California. There, in 1907, they mined 335 tons, valued at $20 a ton or $6,700. Although these figures show increases of 5.7 per cent., 122 per cent. and 19.2 per cent. over 1906, respectively, they are insignificant when compared with the figures of Canada's production (6,528 tons) and New Caledonia's (31,552 tons). We imported 42,000 tons of ore at $11.71 per ton, totaling $491,925, this bringing our consumption up to an even half million dollars.

MANGANESE.

Manganese has found less use in the automobile industry than in others, but in the last few years its many sterling qualities have come to be approved and applied more. We use this in special steels for high grade springs, both leaf and coil, for gears, etc., and as manganese bronze for many parts, main engine and connecting rod bearings, crank cases, front axles, gears, etc.; also for cutting and other edged tools. It gives a very peculiar toughness to brass or bronze. Thus good manganese bronze may be bent, twisted or deformed in any way, but it is another thing entirely to break it.

In 1907 we produced 1,324,871 long tons of manganese ores worth $3,860,265 and imported 208,321 tons worth $1,793,143. The total consumption was thus $5,653,408. In the form of ferro-manganese and spiegeleisen the production was 336,348 long tons, worth $21,887,946, which figures out to $65.14 per ton. How many people who own automobiles give a thought to the use of manganese other than to consider it a salesman's talking point, yet in a single year the combined product was worth in excess of $27,500,000.

NICKEL.

Nickel is used in the special steels to such an extent that you may now buy it in any commercial form, rounds, flats, squares, hexagons, tubing, etc., and it is also used in the latest storage batteries. There is none mined in the United States. All that we get comes from Canada. In 1907 the amount was 8,750 tons, 22.4 per cent. increase. This was worth $7,875,000, an increase of 23.8 per cent., and figures out to $900 a ton or 45 cents a pound.

PLATINUM.

Coming now to platinum, which really is a rare metal, we find that our total output in 1906 of the pure metal amounted to only 400 troy ounces and a little more than this in 1907. So a man could hold the whole year's output in one hand. Yet this little handful was worth $8,800. That year we imported $3,788,700 worth. The following year imports fell off 30 per cent. The high prices stimulated new efforts and so more was saved at the gold fields in Oregon and California, while new fields were opened up in Yuba and Sacramento counties in California; Lincoln County, Nevada, and near Helena, Montana. The average price for 1907 was $28.83 per troy ounce, or $346 per pound. Scrap averaged $22.31 per ounce. At this date, November 21, prices are down to $26.25 and $18.

In our work this is used mostly for contact points on electrical apparatus, such as spark coils, magnetos, switches and the best spark plugs.

TUNGSTEN.

Tungsten comes mainly from Boulder County, Colorado, where is produced 85 per cent. of our total. This in 1907 was 1,468 tons, costing $715,031, an average of $487.07 per ton, or 24 cents per pound. These figures exceeded those of the year before by 34, 61.5 and 20.5 per cent. This metal is used in special steels for leaf springs, in magnet steel for high grade magnetos, and by far the largest amount in cutting tools to work other hard metals like chrome nickel, ferro-silicon, etc. In fact, this is the element which gave to Jessop's tool steel the qualities that made it famous. Our trouble with this element is that we don't know much about it, except that it cannot be worked or machined. The field magnets of the magneto incorporated within the flywheel on the new Ford cars are made of a tungsten-vanadium steel.

VANADIUM.

Relative to vanadium, no figures on the output are available, but some facts in regard to it may be of interest. There are, roughly speaking, nine sources of vanadium, eight of them minerals and the other a low grade coal. These minerals with the percentage of vanadium in the form of oxide and the localities where they are found are: Canotite carries 15-18 per cent. and is found in Montrose, Cal.; oasclorzite, 22.7 per cent., and banadanite, 19.47 per cent., are both found in Arizona, New Mexico and Spain; mottramite, 18.9 per cent., Cheshire, England; patronite, 15 per cent., Minasraga, Peru; pucharite, 28.2 per cent., Saxony; roscoelite, 24 per cent., southwest Colorado; balborthite, 19.6 per cent., Ural Mountains; also in the ash of a coal from San Rafael, Mendoza, Argentina, which carries as high as 38.2 per cent. oxide. There are but four companies, viz., the Primos Chemical Company, Primos, Pa.; the Electro-Metallurgical Company, Niagara Falls; the Vanadium Alloys Company, who have a plant at Newmine, Col., and the American Vanadium Company, Pittsburg, Pa. The Vanadium Alloys Company do not make ferro-vanadium, but sell a vanadate of iron containing 34 per cent. vanadium, for $2 per pound of metallic vanadium content. The American Vanadium Company import Peru ore free of duty and make it into ferro-vanadium in their works at Pittsburg. This product, free of carbon, is sold at $5 per pound of metallic vanadium contained. This is used in special steels for most every purpose. It has been called the anti-fatigue metal, owing to its unusual property of continuously resisting alternating stresses. Several makers using this product liberally call their car the anti-fatigue car. While this steel may be used for any purpose that steel can be put to, the price will undoubtedly restrict its use to parts which are subject to alternations of stress.

Turning now to the non-metallic rare minerals, we may group these into two classes, the abrasives, alundum, carborundum, corundum, and the others, asbestos, calcium (carbide) and graphite. It will be noticed at once that all but one of these (asbestos) are forms of or compounds of carbon, the last named (graphite) being one form of pure carbon.

ALUNDUM.

Alundum has no foreign competition, as the Norton Emery Wheel Company, at their Niagara Falls plant, produce all that is produced, and control the patents as well. This material is of about the same composition as corundum, but is harder. The powder is used for cutting rubies and sapphires. It is made up into all kinds and grades of grinding wheels, also various shaped and sized stones. On the automobile itself it is not used, but in all automobile factories its use is very general. In fact, in the past two years grinding has been developed as a separate and distinct trade. The production in the past year was 6,751,444 pounds—36 per cent. more than in 1906. Being worth 6 cents per pound, the total selling price was $405,086.

CARBORUNDUM.

Carborundum has the same uses as alundum. It is produced at but one place, Niagara Falls, N. Y., the Carborundum Company operating the only factory. Early in 1907 they were obliged to increase their plant to 7,000 horse power. The output was 7,532,670 pounds, which at 6 cents was worth $451,960. At a decrease in the price of 16⅔ per cent. the total value still increased 36 per cent., owing to the 21 per cent. increase in output.

The same remarks apply to corundum and emery. We mined 1,060 tons, worth $12,294, and imported grain, ore, rock and manufactured articles to a value of $412,622. Thus our production was 2.8 per cent. of our consumption.

ASBESTOS.

First in the class of non-abrasive materials is asbestos. Very little of this is mined in this country, as compared with that mined in Canada, which not only produces the most but the longest and best fibres. In 1906 we produced 1,695 tons, valued at $28,565. Alongside of this our imports, valued at $1,106,615, look big, as does also the Canadian production, totaling $2,000,000. In 1907 our imports increased 18 per cent. and Canada's production 25 per cent. The prices for the better material were: No. 1 crude, $350—$300 per ton; No. 2 crude, $250—$175 per ton; No. 3, $150—$100 per ton, and the poorer grades down to $37.50 per ton.

Asbestos is used in sheets for gaskets, like the exhaust pipe gaskets; for covering the engine side of wood dashboard; for covering, and in some cases lining, mufflers and muffler protectors and guards; in the form of rope for wrapping exhaust pipes where they are close to an adjustable part; in the form of asbestos paint for exhaust pipes, cutout valves and mufflers. The latest application is in a patent or secret form for clutch and brake linings. The modern gaskets, used liberally on exhaust, inlet under valve caps, cylinder plugs, spark plugs, etc., have an asbestos centre, around which is a V shaped copper ring. Where the exhaust is used for heating the body is covered with asbestos to lessen the danger of fire.

CALCIUM CARBIDE.

Calcium carbide, usually spoken of as carbide, is a compound of calcium and carbon. It is a soft bluish-gray powder, which in contact with water forms the gas, acetylene. This is used in the automobile industry solely for lighting purposes, head and search lights, interior lights, etc., being supplied with it. Formerly this gas was generated in special generators, the user buying his own carbide and filling the tank from time to time, as was necessary. Now the accepted method is to buy the gas in storage tanks. These are known under several trade names and contain the compressed gas under a pressure of about twenty atmospheres.

Some factories use acetylene for lighting, and lately it has appeared again in the oxy-acetylene flame process of high temperature welding. By means of this process a temperature of 3,482° Cent. may be obtained. This temperature is produced by the combustion of 1 volume of acetylene gas and 1.7 volumes of pure oxygen, both under pressure.

THERMIT.

It might be mentioned here that a familiar compound used in high temperature welding, and known by the trade name of Thermit, is simply pure granulated aluminum mixed with the oxide of the metal to be welded, as iron oxide. When fired the unusual affinity of aluminum for oxygen results in the reaction, aluminum + iron oxide = aluminum oxide + iron, and incidentally in a temperature only a few degrees below that of the oxy-acetylene flame, viz., 3,000° C. This process may be varied to obtain other pure metals than iron, as, for instance, pure chromium, manganese, titanium, molybdenum, vanadium, etc., by using chromium oxide, manganese oxide, etc.

GRAPHITE.

The last of the non-metallic materials is graphite. For many years our sole source of this lay in nature's deposits, which we had to take as they were, pure or impure.

There are deposits in this country in New Jersey, Connecticut and Rhode Island, respectively, and there are also deposits in Germany, Ceylon and elsewhere abroad. Of late, however, with the increase in electrochemical activity, we have been able to make graphite artificially, and purer than it is found in nature.

Coming down to figures, we find that the United States produces only 20 per cent. and uses 30 to 35 per cent. of the world's supply. In 1907 we produced 4,585,149 pounds of refined crystalline graphite, which sold for $149,548; 26,962 pounds of amorphous graphite, which sold for $138,381, and 6,924,000 pounds of artificial graphite, which sold for $483,717. The first named kind lost ground, but the two latter gained, there having been an increase of 37.5 per cent. in the production of amorphous and 42.2 per cent. in the production and 55 per cent. in the value of artificial graphite. These last figures, taken in conjunction with the prices of the product, are very interesting as showing that the artificial product must have taken a very strong hold. Otherwise an increase in price would not have been accompanied by an increase of 42 per cent. in production, while the production of the natural products (lumped) dropped off over 6 per cent. The sole manufacturer of the artificial graphite is the International Atcheson Graphite Company, Niagara Falls, N. Y. The prices in 1907 were: Best pulverized Ceylon, 4 to 8 cents; best pulverized German, 1½ to 2 cents, and artificial, 7 cents per pound.

Graphite is used on automobiles in various forms, as a lubricant mostly, although some bearings have been made with graphite plugs in which the graphite serves the double purpose of bearing metal and lubricant. These are not supposed to be oiled or otherwise externally lubricated. Similarly the graphite is used as a binder in heated high pressure joints which must not be allowed to rust in, for which purpose it is better than red lead or other compounds. These are valve caps, cylinder plugs, screwed-in cylinder heads, etc. It is also used for gaskets subjected to heat. Thus for exhaust pipe gaskets, heavy unglazed, unsized paper or cloth painted with pure graphite on both sides is used. Cotton and other ropes coated or saturated with graphite are in some shops used to cover exposed hot pipes instead of the asbestos rope previously spoken of. Graphite is also used as a base for paints which may be used on hot pipes successfully. There is also a graphite mixture marketed which is smeared on iron and steel screw threads to keep them from rusting.

The graphite put on the market by the Atcheson Oildag Company under the name of Oildag is successfully used in some engines. The points claimed for it are that it cuts the oil consumption in half; that it increases the power by reducing friction and increasing the compression; that it eliminates smutting of spark plugs and pitting of valves and valve seats.

Clutches and Transmission Systems.

By E. A. Nelson.

Several years ago, when the slow running motor satisfied the public, the planetary and individual clutch systems of transmission were regarded as good constructions, but since the adoption of the high speed motor these gears are losing ground very rapidly, being superseded by sliding gears on high grade cars and the friction disc on lower powered cars. The public are dissatisfied with the old type of gears because of noise and frequent need of adjustment; the engineer is discarding them for the same reasons and also because of their low efficiency. It is very difficult to adjust these gears so they are perfectly free. A little friction at slow rotative speeds is not noticeable, but at high speeds results in a considerable loss of power.

The slow running single or two cylinder motor with a heavy flywheel and sluggish pick-up is an awkward proposition to handle with a sliding gear, and rapidly burrs the end of the teeth, but now that the high speed motor has come into general use the sliding gear will do likewise. When properly designed this transmission is as easily handled as a planetary and anyone who has once driven it will not revert to the older systems. The planetary would at present be an obsolete type if it were not favored for economical reasons by a few of our large manufacturers, whom I regard as a Southern statesman expressed it as "hanging onto the shirt tail of progress and shouting ho! ho!"

Where cost must be considered enclosing the clutch and transmission in an extension of the crank case, with a fan blade flywheel in front, makes a very simple manufacturing proposition for a low powered car. The majority of designers call for a separate compartment for the clutch, but this complicates the construction unnecessarily. It is done so that oil may be used on the clutch and "dope" in the transmission. A little more spring pressure would obviate this compartment. I recently designed a 6 inch bronze to cast iron 10 degree cone clutch directly actuated by a spring. It transmits 15 h. p., and I have had no trouble with it, although it operates in the gear case and is lubricated with a mixture of non-fluid dope and oil. Naturally it will slip if graphite is used, but graphite I consider only as a last resort, and a little of it goes a long way, and usually ends its career by short circuiting the spark plug.

For high powered cars the metallic disc clutch set up by a direct acting spring seems to be the coming type.

One trouble makers have had is that clutches failed to stop spinning when thrown out, which, I believe, can be traced to the use of a ball thrust collar on the driven member to throw it out, or some form of toggle or auxiliary cone. When a plain bronze shoe of large diameter is used to throw out the clutch and a single direct acting spring is used for engagement, there is considerable friction caused by throwing out the driven member, and this will stop it from spinning, thus allowing a quiet gear shift. The end thrust on the crank shaft can be taken on fibre and bronze washers.

This causes some load on the motor when the clutch is thrown out just enough to keep it from racing on a closed throttle. When a stop is made pull the gears into neutral and let in the clutch. This takes the thrust from the crank shaft. With the flywheel in front and the clutch in an extension of the crank case, it can be designed so there is no thrust on the crank shaft at any time by feathering the driving clutch member on the crank shaft and taking the thrust on the bearing end.

Some makers of high grade cars are still holding to the leather faced band and cone type. The expanding band has reached a high state of perfection, but on Broadway and Fifth avenue many drivers come to grief by slipping the clutch instead of coming back into the low gear. It is also affected by oil or water and needs constant adjustment. I believe in placing a clutch in a bath of oil where conditions do not change. Such a clutch never needs adjusting and can be slipped without danger.

I mentioned the friction wheel and disc as a coming gear for single and two cylinder light cars. It is an easy gear to handle, cannot be put out of commission by abuse, is very easy on the engine and all parts of the car.

It is a very low priced manufacturing proposition, the car can be geared higher than with any other type, thus more than compensating for its slightly lower efficiency on the high gear. It has a rather low efficiency when the wheel is near the centre of the disc, but as it is there only on starting or when pulling heavily this loss does not matter. With this gear a single cylinder will speed up a car in good shape; it is particularly adapted for a solid tire car or delivery wagon, as it has just enough slip to relieve the engine and mechanism of sudden shock.

Drop in European Aluminum Prices.

Aluminum is produced by only a very small number of manufacturers, all of whom work on a large scale. In Europe there formerly existed a "convention" between the different manufacturers with the object of keeping up prices. This convention came to an end on September 1 of this year, and the immediate result was a sharp decline in prices. Whereas at the beginning of the year aluminum still sold in Europe at 33 cents per pound, it has recently been selling at 15 cents per pound, and even as low as 13½ cents. This enormous decrease in the price will make aluminum much more of a commercial metal, and the recent tendency in Europe to replace aluminum in the cheaper automobiles with cast iron will probably receive a check. The discontinuance of the convention seems to have been the result of a growing decline in the demand.

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Our Engineering Number.

Progress in automobile engineering has by no means reached its limit, as might possibly be inferred by the non-technical from the increasing similarity in the general layout of automobile power plants and in the external appearance of the vehicles. Technical work of recent years has been more in relation to details, and its results have not been so obvious on mere inspection as in earlier periods. It is also possible that a practical limit has been reached in one particular direction of development, namely, that of speed and luxuriousness. It is not likely that road vehicles will ever be built capable of much greater speed than has already been attained, and if they should be produced there would be very few, indeed, willing to pay for them; so there is little incentive to further work in that direction. Reliability also is possessed in a remarkable degree by the highest grades of cars now turned out, but most of the lower priced cars are lacking in this most essential quality.

The chief object of further technical development must necessarily be to obtain greater reliability and durability in cars selling at a sufficiently low price to bring them within the means of a large class of road vehicle users. One way to attain this end is by simplifying the construction of individual parts. There are many parts in a gasoline automobile which can obviously be simplified, but generally such simplifications carry with them certain disadvantages, and it then becomes a question whether these disadvantages overbalance the advantages of the increased simplicity or not. As an illustration of what we are referring to we may mention crank shafts for four cylinder engines. These may be made with either five, three or two bearings. The three bearing shaft is evidently simpler than the five bearing shaft, but it must be made of larger section, which means increased friction losses, or if not made of sufficiently greater section it is not as safe as the five bearing shaft. Similarly, almost every other simplification involves some accompanying disadvantage that must be taken into the bargain, as it were, and whether it is really an improvement cannot be decided by any a priori reasoning, but only by careful observation of results extending over long periods and by the comparison of these observations.

It is with the object of affording students and investigators of automobile engineering problems an opportunity of comparing their observations that this Engineering Number is published. It will be found to contain articles on a wide variety of subjects, mainly based on personal observation by the authors. The articles cover materials of construction used in automobile and parts manufacture, shop processes, methods of design, laboratory tests and road experiences with particular constructions, and we have no doubt that every reader will find at least a number of articles of particular interest to him in connection with his daily work.

Where Some of the Old Cars Go.

We often hear people wondering what becomes of all the old touring cars which are discarded by those who first used them. Of course their fate is varied, but there are two ways in which a good many of the large cars are disposed of. The heavy, high powered touring car does not bring a very large price second hand after it is out of date either mechanically or in appearance. Its running cost, particularly for tires, is too high to appeal to the average purchaser of second hand cars.

Still these cars usually embody good materials and workmanship, and in many cases they are good for much longer service than they have received. Since they are usually capable of carrying seven passengers, a great many of them are bought for livery service. The practice of hiring out such cars has grown rapidly the past year or so, and the number of large second hand cars used in such service at the present time must run well into the thousands.

A second field for their disposal, which appears to be growing rapidly, is that of delivery wagons. To serve for such work the cars must of course be partly reconstructed and provided with suitable bodies. Being fitted with high class powerful motors and well designed change gears, many of these cars are capable of doing good work delivering light goods. To be sure they are usually geared too high, but this fault may be remedied, especially if the chassis is chain driven. In that case a change of sprockets is often all that is required. Where the machine is shaft driven a new pair of bevel gears must usually be provided.

Of course these machines are not so economical as vehicles designed specially for the work, for in many cases it will not do to equip them with solid tires, since their axles are not heavy enough to stand the resulting vibrations, but in some few cases they have proven entirely satisfactory to their owners, owing largely to the beforementioned good material and workmanship.

Probably it is a knowledge of these conditions which has prompted a number of builders to sell their old models of touring cars, "left overs" from the past two years, equipped with delivery bodies. Very frequently large makers who market a number of models will have quite a number of one of these models left over. It is likely that there will be quite a call for these for certain classes of light delivery work where considerable speed is essential.

A Blow to Racing.

The Society of Motor Manufacturers and Traders of Great Britain, the largest and most influential trade organization in that country, has requested its members not to participate any more in speed contests (road and track races, hill climbs, etc.), and has urged the Royal A. C. to prohibit the organization of and participation in such contests. The action of the association followed the publication of a notice by the Local Government Board to the effect that racing of automobiles on the public roads of England is unlawful, and is said to have been taken in the interest of a sound development of the industry.

It is not to be expected that this remarkable action will at once kill all forms of speed contests in England. There are powerful interests at stake, and the association will meet with much opposition in preventing their members from taking part in these events. There is, first, the Brooklands Automobile Racing Association, which, having built a very expensive track specially for automobile racing, will naturally employ every means to defeat the Society of Motor Traders and Manufacturers in their present move. Then it must be considered that any decision on the part of a large number of prominent, capable manufacturers to refrain from racing will lead others who would ordinarily have no chance of success to take up this form of advertising. But whatever degree of success may attend this attempt to suppress automobile racing in England, it is cause for congratulation that a powerful trade organization has at last thus publicly acknowledged that racing is injurious to the best interests of the industry. The members of the society are well aware that racing is indirectly responsible for the strong anti-motorist feeling in England, and they also know that the countless petty hill climbs and similar contests to which they have been obliged to contribute in recent years have greatly eaten into their resources, without benefiting them to any extent. Of course the many provincial clubs, which all have their annual hill climbs, will also oppose the discontinuance of racing, and will bring pressure on the Royal A. C. not to issue the ban on racing requested by the Manufacturers' Society. But in Britain, as in other countries, the manufacturers hold the key to the situation; if they are actually in earnest in their decision to quit racing neither the clubs nor the race track owners can force them to alter their decision, and without their assistance no successful meets can be held. It is to be hoped that the society will be as successful in dealing with the racing situation as it has been in its efforts to regulate the show question.

When will the American trade take similar action?

Facilitating the Adoption of Larger Tires.

It is a pretty well established fact that the overloading of pneumatic tires is one of the most serious economic mistakes which a user can make. Although tires of large section are higher in first cost than are the smaller sizes, it has been proved again and again that, taking everything into account, the operative cost per mile of the larger tire is less than that of the smaller. It more than makes up in long life and freedom from trouble for its larger first cost.

Although automobile manufacturers have acceded to the recommendations of the tire manufacturers and users, and have of late specified larger tire sizes on their products, thereby greatly improving the situation, it is believed that a great many cars are put out equipped with tires which are rather smaller than they should be to give the best economy in the long run. Possibly the recent movement toward lower prices for machines may be acting to prevent the fitting of as large tires as could profitably be used.

There are certainly a great many cars in service which could advantageously be equipped with tires of larger section, and many users are making changes in this direction. The recent reduction in tire prices has tended strongly to stimulate this movement.

Considerable trouble, expense and loss of use of a car are, however, entailed by the work of fitting the new rims required by the larger section tires. The wheels require to be removed and usually sent away to be properly equipped. Meanwhile the car is out of service.

Rather recently certain tire manufacturers have brought out tires which provide an increase in section while avoiding the necessity of a change of rims. By their employment a user can change from 3½ inch to 4 inch tires and continue to use his old rims, whether of the clincher or quick detachable type. These tires are necessarily of outside diameters intermediate between two of the standard diameters. For instance, in changing from a 3½ inch to a 4 inch tire, to be used upon a 30 inch wheel, the new tire has an outside diameter of 31 inches instead of 30 inches and a 4 inch section. The new tire can be put upon the old rim at once, without change, and as readily as can the old. Such a change of tires as this, of course, increases the speed of the car, at a given engine speed, but so slightly as not perceptibly to modify its performance.

Whatever renders a change easy and convenient tends to popularize such change, and it is probable that the bringing out of these special tires will lead many users to adopt larger and more economical tire sizes.

Auto Men Divided on Question of Tariff.

A hearing on the proposed change in the tariff on automobiles was given before the Committee of Ways and Means of the Treasury Department, at Washington, D. C., on November 27. The A. L. A. M. interests, represented by officials from the Packard, Locomobile, Winton, Peerless and Thomas companies desired the duty to be raised from the present rate of 45 per cent ad valorem to 60 per cent., on the ground that the present rate is but a blanket provision of the tariff act covering machinery, and that automobiles should have a special classification, the rate of 45 per cent. having been imposed without a knowledge of the "social needs" of this manufacture, and that 60 per cent. would be a fit and proper duty, increasing the revenues 15 per cent. over the present income. The importers wanted the duty to be reduced to 30 per cent., and claimed that the A. L. A. M. interests had not benefited the revenue in respect to import duties, and also that the move on the part of the association was selfish and not at all beneficial to trade. Estimates were presented showing that the importers spent more money in this country in proportion to the aggregate horse power of cars sold than the domestic manufacturers, and that a reduction of the tariff to 30 per cent. would give an increase of nearly double the amount of revenue from imported cars.

The A. M. C. M. A. held that the 45 per cent duty is a proper one, on the grounds that according to the wage rate in both Europe and America the prices charged for the imported and domestic cars are approximately equal. Further, that any concessions in the tariff rates would make it possible to sell imported cars at a price at which the American manufacturers could not compete. The fourth party, represented by Henry Ford, did not care whether the duty was raised, lowered or abolished, holding that they could compete with any country on the matter of price. Ford said that as his market was the world and not restricted to one country, the question of import duties did not concern him in the least. Further sittings of the committee will be held on the subject. One of the coming Cabinet officials, whose business interests are in Detroit, is reported to be strongly in favor of the movement on the part of the A. L. A. M. to increase the duty to 60 per cent.

Coming Events.

December 22 to 29—Paris Commercial Vehicle Show.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 1 and 2—Endurance Run from Philadelphia to Wilkes-Barre and return, Quaker City Motor Club, Philadelphia, Pa.

COMMUNICATIONS

Aims and Objects of the National Retail Automobile Dealers' Association.

Editor Horseless Age:

The writer has just returned from the East, and finds on returning home a letter from your paper, dated November 11, referring to our Retail Dealers' Association and some of its policies. While in New York the writer called on the secretaries of the two national automobile shows which are to be held in New York shortly. I endeavored to secure headquarters, and, if possible, co-operation from the two existing manufacturers' associations.

We argue that only by a "get together" policy of the dealers and manufacturers of cars can both be mutually benefited. In your letter you say that you understand that we are trying to break down the exclusive agency proposition of the A. L. A. M. This is a question that is open to argument from various angles. Some of our members seem to think that under the exclusive agency clause of the A. L. A. M. the contract is unjust to the dealer, and that it places one more restriction on his already limited scope of operation. It is a well known fact that the pioneer automobile dealers have not made any money, and that as a matter of fact but a small percentage of dealers who started to handle automobiles five years ago are today still selling machines. That this condition did and still does exist today is no doubt the dealers' own fault, and, as a whole, many of our dealers in the past were made up of men who engaged in the automobile business as a sort of joy riding affair and never seriously contemplated building up a permanent establishment. Today, I believe, the greater number of legitimate and established automobile dealers throughout the country are, at least on an average, fair business men, and it is obviously to the interest of the manufacturer to at least to some extent make the conditions in the trade, if it is within his power, sufficiently attractive to not only retain in this line of trade those dealers who are already established, but also attract a good class of business men with capital to enter the field of selling automobiles.

A number of our members therefore argue, as previously stated, that if a man or concern is just making a living by handling a certain car, if the contract permitted the handling of some other car which would not directly conflict with the one he is already handling in either price or size, and conditions were such that there would be more or less ready sale for this additional car, he might be able to make a good enough profit in his business to warrant him to remain in same and give it his best efforts. There is another side to the question, taken by others of our executive committee, and that is, that possibly, if there were no restrictions whatever placed on the dealer in regard to what kind of cars he could or should handle, it would be detrimental to the dealer, and he would eventually lose his individuality and standing in his community, as being a representative for what at least, in his opinion and from his experience, is the best car for a certain purpose and a certain price. One thing, however, is certain, that if the retail dealer's conditions are improved and his business is put on a good, stable foundation, he will put forth greater efforts, invest more capital, carry better equipment, and consequently be better prepared to take care of his customers to whom he has sold cars, and thereby help to popularize the motor car both as a pleasure vehicle and as a commercial delivery proposition.

The dealer in this, as well as in any other new line of business, or the majority of them at least, have no doubt been very indiscreet in the past as regards the cutting of prices on cars, accessories, etc., but through our executive committee we are going to try to teach the members of our association to profit by past experience, because it is indeed only through actual experience that a man can gain knowledge which should be beneficial to him in the future, and we realize that by banding together, getting in closer communion with one another, meeting at our annual elections, we will become better acquainted and consequently have more confidence in one another as dealers. We, therefore, feel that we can benefit ourselves and the industry in general, even though we do not attack vigorously any existing restrictions which are at present placed about us by certain manufacturers. We cannot see from our standpoint how our association, if fairly conducted by fair minded men, could possibly be anything but a help to the motor car industry as a whole. Our purpose as selling agents of cars is to sell as many cars as possible, and this is naturally the aim of every manufacturer, so our ultimate purpose is the same and our interests are identical, and we feel that as agents we come in closer contact with the user and owner than the manufacturer himself, and are, therefore, better able to judge the means which would best promote sales in the various communities, and we feel that if we can present our views and purpose to the automobile dealers of America in such a light that we can enroll a representative membership at such a time, we ought to have a voice in vital matters which pertain to the marketing of cars.

Mr. Reeves, secretary of the A. M. C. M. A., has kindly placed at our disposal and decorated a space suitable as headquarters for our association at the Grand Central Palace Show in New York, and in addition to this he has promised to mail an invitation to every legitimate automobile dealer in the United States, and upon presentation of this invitation at the Palace a season pass to the show will be issued to the bearer. Mr. Downs, secretary of the A. L. A. M., has not up to the present time been able to find a space suitable for our purpose, but has promised to do all in his power, talk the matter over with the officers of his association, and give us whatever consideration our association and its aims, in their opinion, seem to merit.

The writer, in behalf of our association, does hereby wish through the columns of your paper to extend our hearty thanks for the courtesy extended to our association by Mr. Reeves, and we feel that he is to be complimented on his good judgment in joining hands with us in our effort to improve the existing conditions in the trade.

National Retail Automobile Dealers Association,
Per C. F. Jensen,
President.

The Charlotte, N. C., Garage License Fight.

Editor Horseless Age:

In your issue of November 11, on page 658, you refer to the Charlotte, N. C., garage men winning their fight. The undersigned begs to state that it is they who have their garage in the Auditorium and not the Mecklenburg Garage, who are located elsewhere in the city, and the fight was aimed at the Southern Automobile Company. We wish you would correct this in your next issue.

We enclose you a clipping from the *Commercial and Financial World*, New York, dated October 24, commenting on this fight. We handle the Reo and Maxwell automobiles and are subscribers to your paper.

J. H. Ham,
President and Manager,
Southern Automobile Company.

Crank Mechanism of the Holsman Four Cylinder Engine.

Editor Horseless Age:

Can you explain through your columns how the piston of the new Holsman four cylinder engine is connected to the crank shaft? In your issue of October 14 you show a double piston for this motor with a ball bearing in the centre, and a crank shaft with eccentric throws evidently intended to engage this ball bearing, but it looks like a mechanical impossibility to couple them directly together and change reciprocating to rotary motion by this means.

In a recent article on the Silent Knight engine the statement is made that the makers of this engine and some others have found that an offset crank shaft makes an engine pound, prevents running it at a high speed and decreases power.

Some makers who have discarded the straight line for the offset crank shaft say that it makes the engine run much smoother and quieter and increases power. Which of them is right? Arthur L. Taber.

[We have not seen the inside of the new Holsman motor, but we understood from the attendant at the Holsman booth at the recent carriage dealers' show in the Grand Central Palace, New York, that our explanation of the construction, which was to the effect that an eccentric was interposed between the crank pin and the ball bearing in the piston distance piece, was correct. We laid this out on paper in our office and found that it is quite possible to change reciprocating into rotary motion in this manner, but the stroke must be very short, or else the eccentric be very large in diameter.

Whatever the effect of the offset in the Knight engine may be, a reasonable offset in an Otto engine must have the effect of reducing cylinder friction and wear, and consequently producing a smoother running engine. In the Knight engine it must, of course, somewhat affect the valve timing. We have not looked into this engine close enough to give an opinion as to why it was that offsetting was found disadvantageous. —Ed.]

Chauffeurs' Employment Conditions.

Editor Horseless Age:

Will you kindly answer through the columns of your paper the following question: Does New York afford better chances than any other city in the United States for a chauffeur to make a living? I am willing to go to any place in the country where chauffeurs are in demand the year round.

Dennis Sheridan.

[New York is the greatest centre of wealth in the country, and there can be no doubt that many more chauffeurs find employment here than in any other American city. The use of automobiles is more uniform throughout the year in Southern California, but we do not know whether there is much of a demand there for chauffeurs. We know that that part of the country suffered heavily under the recent depression, and probably the chances of a chauffeur securing employment are no better there than in New York.—Ed.]

Advantages of Offsetting the Crank Shaft.

Editor Horseless Age:

I was very much amused to notice that in the issue of November 18 of The Horseless Age, in which L. E. French shows the absurdity of an argument used in an advertisement of an engine with offset crank shaft, the same cuts appeared but with an equally absurd explanation. The cut of the engine without offset crank shaft shows the piston at its extreme upper position, or at point of greatest compression, and calls this "the explosion centre." I suppose by this they mean the position of the piston when the explosion takes place. Now, in the second cut they show an engine with offset crank shaft, and with the piston considerably below its highest point, or at a point where the charge has begun to expand, and call this "the explosion centre." From these two cuts and the appended explanations I would understand that this company concedes that the point of maximum compression is the time when the charge should be exploded in an engine without offset, but for their engine with offset crank shaft the proper thing is to retard the spark so as to explode the charge after part of the advantage of compression is lost. When I saw the first advertisement I smiled, and thought they were trying to fool the public, but after seeing the second I concluded that the company wasn't just sure itself why it had changed to the offset crank shaft.

The roads here in Cuba are ideal for automobiles. One road out of this city has only five turns in 15 miles, and only three cross roads, and is as level and smooth as a floor. The power of your engine is your only speed limit, but gasoline is 45 cents per gallon.

J. F. Bard.

Indiana Bureau of Good Roads Formally Organized.

The Indiana Bureau of Good Roads was formed at a mass meeting held in Indianapolis, November 24. Permanent officers were elected and plans outlined for carrying on the future work of the bureau. Officers elected were: President, R. A. Brown, who was chairman of the temporary organization committee; vice president, Geo. C. Pyle; secretary, J. C. Crabill, and treasurer, F. I. Willis. A legislative committee was appointed as follows: R. H. Losey, Geo. C. Pyle, C. A. Kenyon and W. H. Roberts. As mentioned previously, the organization will urge the creation of a State Highway Commission by the Indiana Legislature, when it meets in January. It is proposed that all road building shall be done under the supervision of engineers employed by the State, and that the State shall pay one-half of the expense.

Chauffeurs to Form National Organization.

The Chicago Automobile Show, to be held February 6 to 13, 1909, will be the scene of a meeting to be held for the purpose of forming a national organization of chauffeurs. The subject was broached by the Professional Chauffeurs' Association of Louisville, Ky., shortly before the last Chicago show, and has been simmering since, with the result that correspondence has passed between James B. South, president of the association above named, and J. M. Harrison, president of the Professional Chauffeurs' Club of America; Xenophon P. Huddy, counsel for the association last named, and others, resulting in a determination to hold a convention during the Chicago show. The date selected is Friday, February 12, and the meeting will probably be held in one of the rooms of the First Regiment Armory.

A New Runabout Manufacturer in Detroit.

The Hupp Motor Car Company has just been incorporated for the purpose of manufacturing runabouts. It is capitalized at $25,000, the model car is built and is being tested on the road. The officers of the company are as follows: President, J. Walter Drake; vice president and general manager, R. C. Hupp; secretary, John E. Blake; treasurer, J. R. Drake, of New York city; chief engineer, E. A. Nelson. The factory formerly occupied by the Gies Gear Company is being remodeled for the new company, who expect to begin deliveries the latter part of February. The present plans are to build 500 runabouts for 1909.

This runabout is a small car which in general appearance closely resembles many of the high powered runabouts now on the market. It has an 86 inch wheel base, 30 inch wheels, and is shaft driven by a 3¼x3½ inch, four cylinder, water cooled motor. The change gear is a two speed and reverse sliding, and the clutch is a metal to metal cone. Ignition is by Bosch magneto. The price will be $750. We expect to publish a complete description of this new car in an early issue.

Trunk Line System of Automobile Roads in Alaska.

Major W. P. Richardson, chairman of the Road Commission of Alaska, says that there is now a fine road through Keystone Canyon, beginning at Valdez. This road was blasted out of solid rock and opens a canyon that has hitherto been a great stumbling block to Alaskan travelers. From the canyon the road proceeds across Dutch Flat to Wortman's. An 8 foot trail that a wagon can use leads on over Thomson's Pass. Next year Gulkana River will be bridged, and in 1910 the road will be ready for stage coaches. In 1909, if a large enough appropriation can be obtained, the road down the Big Delta will be widened and a ferry put over the Tanana River at McCarty's. The trunk lines will be of great value to the large mining camps, and the branch lines will increase the amount of travel enormously. The roads will be available for use by automobiles, men on foot, horseback or with dog teams. Mail can then be delivered regularly during summer and winter, and will not be delayed for several days by a boat getting caught on a bar.

Additional Exhibitors at the Palace Show.

In addition to the list of exhibitors at the Grand Central Palace Show on December 31 next, which was given in last week's issue of The Horseless Age, the following firms will also exhibit:

Brewster & Co.
Cameron Motor Company.
Auto Tire Inflating Company.
J. N. Bunnell & Co.
Gloversville Auto Glove Company.
Havoline Oil Company.
New York Coil Company.
Rubly Manufacturing Company.
Shore Instrument and Manufacturing Company
Union Battery Company.
U. S. Macadamite Metal Company.

The Delaunay-Belleville Company, the Breeze Carburetor Company and the High Frequency Ignition Coil Company have withdrawn and will not exhibit.

LEGISLATIVE and LEGAL

The Adequacy of the Present Connecticut Automobile Law.

The following letter on the above subject from Senator F. S. Luther, president of Trinity College, was printed in the Hartford *Times* of November 18, 1908, and is being circulated by the Connecticut automobile clubs:

"The successive tragedies in Hartford and in New Haven, which have attended the use of motor vehicles upon our streets, have unquestionably aroused public sentiment to a degree of which the civil authorities should take note. Putting aside as far as possible our natural indignation at the slaying of our fellow citizens, and looking at the situation fairly, is it not evident that the danger on our streets has become intolerable? We have had only two people killed recently in Hartford, but the number of extremely narrow escapes is so great that there is a real feeling of alarm in the minds of a great many of our people. It will be a misfortune if this natural and justifiable feeling shall lead to hasty, ill considered and ineffective legislation before any real attempt has been made to enforce our present State law. I am moved to call attention to this by reading that certain officials in New Haven propose a law restricting the speed of automobiles in that city to 8 or 10 miles an hour. It cannot be too positively insisted that there is no formula which will state what speed is reasonable under all conditions. The speed limit law has been tried, and it worked badly. It works badly now in many States. Under many conditions a speed of 8 miles an hour would be criminal. For example, what would have happened if an automobile had been run at that speed in front of your office on Main street during the evening of election day or while you were reporting the football game last Saturday afternoon?

"The law passed by our Legislature at the last session is adequate for the securing of safety to all citizens. The provision is as follows:

"'Sec. 11. No person shall operate a motor vehicle on the public highways of this State recklessly, or at a rate of speed greater than is reasonable and proper, having regard to the width, traffic and use of the highway, or so as to endanger property, or the life or limb of any person.

"'Sec. 19. Any person violating any provision of Section 11 * * * of this act shall be fined not more than $200, or imprisoned not more than thirty days, or both, for a first offense, and shall be fined not more than $500, or imprisoned not more than sixty days, or both, for any subsequent offense.'

"Now this law does not contemplate that the authorities shall wait until somebody is killed or injured for its application. The offense consists in driving recklessly or at an improper rate of speed. Automobilists have been driving recklessly and at an improper rate of speed day and night for months and months in Hartford. The names of many drivers guilty of this practice may be ascertained without difficulty.

"How many persons have been punished for reckless driving? Whose fault is it if the law is ignored? Somewhere, either in the police force, in the office of the prosecuting attorney, or on the bench in the police court, has there not been neglect to enforce the plain provisions of the so called motor vehicle law of this State? It will be a great pity if this reasonable, satisfactory, and most useful statute shall be displaced by something less just, because the better law has never been put into operation. There seems to be an opinion, and it found expression in your dispatches from New Haven, that a motor vehicle may be driven at any speed up to 25 miles an hour without violation of the law. Nothing could be farther from the meaning of this statute. It is indeed stated, in effect, that if a motor vehicle is driven more than 25 miles an hour for a distance of one-eighth of a mile, no other evidence of recklessness is necessary; but the law is so phrased that a man may reasonably and properly be arrested, fined $200, and imprisoned for thirty days, for driving an automobile at 6 miles an hour. Everything depends on whether under the circumstances the rate of speed is reasonable and proper. Of the facts the civil authorities must be the judges, acting upon such evidence as may be secured; just as, for example, contributory negligence is a question for judgment and consideration by others than the interested parties."

Los Angeles Prosecuting Attorneys Strike.

Owing to a conflict between the city automobile ordinance and the California State law the deputy district attorneys and the prosecuting attorneys of Los Angeles, Cal., refuse to issue any complaints against automobile speeders. The deputy district attorneys issue complaints for violations of the State law and the prosecuting attorneys for violations of the city ordinance. As automobile speeding cases are violations of both measures, there have been numerous clashes between the two sets of officials, and in consequence they have entirely ceased to issue complaints.

Arrests to Be Recorded On Chauffeurs' Licenses.

The authors of a bill to control drivers of motor vehicles, which was introduced at the last session of the State Legislature at Albany, N. Y., have put in a section which would compel every driver of a motor vehicle to carry a form of license, with blank spaces thereon for his record. If the holder were arrested and charged with speeding, reckless driving, etc., it would be the duty of the police official before whom he was taken to ask for the license, and upon it being produced to endorse upon it the facts of the arrest, fine, etc. In this way it is believed that a check would be put upon recklessness, incompetency and dishonesty, which could not be achieved in any other manner, and which would "automatically embrace in its effects the requirement of establishing professional ability and knowledge." If when arrested a chauffeur did not produce his license, he would be punished for operating without a license. It is expected that the bill will be passed by the next Legislature.

New Rulings Under Pennsylvania Law.

Two important rulings under the Pennsylvania automobile law were made at Allentown, Pa., recently. Judge Wanner, in setting aside the conviction of William G. Leas, who was charged with speeding at West Manchester, ruled that the section relating to the exemption of manufacturers' and dealers' cars only exempts these cars from the requirements of carrying license numbers, and does not exempt the drivers of such machines from keeping within the speed limit. He also held that in order to show an excess of speed it is not necessary to prove that the prescribed rate of speed was exceeded for a full mile.

Legal Notes.

Chief Robert Metzger, of the Indianapolis police, has notified automobile dealers and garage proprietors that they must see to it that their drivers do not take out cars to which are not attached the State registration numbers. About twenty arrests have been made during the last few weeks of drivers who have failed to display the numbers.

Police Commissioner Earl Hewitt of Denver recommends the confiscation of automobiles for speeding the same as "concealed weapons" are now being confiscated. He further recommends that in case an accident is caused by a speeding automobile, resulting in personal injuries to outsiders, the car should be sold by the city and the proceeds paid to the injured party as part of the damages. In the case of less serious accidents the cars would be returned to their owners after a month or two.

An interesting question under the New York State automobile law recently came up in Rochester, N. Y. Judge Chadsey of the Police Court in that city had sent a Buffalo business man to prison for speeding; but after ten days, having learned in the meanwhile that he could not impose a prison sentence for a first offense, he changed the penalty to a fine of $50. The question then arose whether the judge could send a first case offender to jail if he should fail to pay the fine imposed. It has been held that such an offender may be adjudged to be in contempt of court and may therefore be sent to jail.

The Savannah Small Car and Grand Prize Races.

Wm. Hilliard, driving a 12-18 horse power Lancia car, fitted with Continental tires, won the A. C. A. international light car race at Savannah, Ga., on November 25, in 3 hours 43 minutes 33 seconds, averaging 52.85 miles per hour for the 196 miles. Robt. Burman, driving an 18 horse power Buick, was second, in 3 hours 49 minutes 45 seconds. Five other cars were allowed to finish before the race was called off, these being L. B. Lorimer, 30 horse power Chalmers-Detroit; E. A. Hearne, 18 horse power Buick; Al. Poole, 10 horse power Isotta; A. See, 20 horse power Maxwell, and C. W. Kelsey, 20 horse power Maxwell.

The course was oblong, 9.8 miles in length, and was covered twenty times, making 196 miles. Guards from the State troops were stationed at regular intervals, and there was no trespassing on the course, as in all previous races around New York. Of the seventeen entrants, only fifteen started, the Grégoire and the American Aristocrat withdrawing just before the race was started. At 11 a. m. the S. P. O. car, driven by A. Connors, was sent away, followed by Hilliard in the Lancia and Bergdoll in the Chalmers-Detroit at one minute intervals. The remaining twelve were dispatched in the following order: F. I. Cameron, 20 horse power Cameron; Al. Poole, 10 horse power Isotta; R. Burman, 18 horse power Buick; A. See, 20 horse power Maxwell; L. Lorimer, 80 horse power Chalmers-Detroit; E. A. Hearne, 18 horse power Buick; T. Costello, 20 horse power Maxwell; W. Burns, 30 horse power Chalmers-Detroit; E. Easter, 18 horse power Buick; J. Muntwyler, 20 horse power Maxwell; J. Jeffers, 18 horse power Buick; C. W. Kelsey, 20 horse power Maxwell. On the first round the Lancia passed first with Bergdoll's Chalmers-Detroit in pursuit. Burman in the Buick made the best time for the first round, 10 minutes 58 seconds. Easter in another Buick was second in time, with 11 minutes 6 seconds, and Hilliard in the Lancia third in 11 minutes 43 seconds. The Chalmers-Detroit of Burns ran into a tree, breaking a steering pivot and slightly hurting the driver. The race lay between the Lancia and the Buicks, as one or the other of these cars was always ahead in point of time. After the third round Burman's Buick was the leader until the tenth, when Hilliard on the Lancia took first place and maintained it to the finish, Burman running up closely. The Cameron kept pluckily on, but was obliged to withdraw with a bent crank shaft and a burned out clutch on its sixth round. Jeffers on a Chalmers-Detroit went into the ditch on his second round and made but one more round before the race was called off. Easter on a Buick lost a wheel near the end of his fourteenth round and withdrew, his mechanic being slightly hurt. Bergdoll retired on his eleventh round with motor trouble. The race was well attended, it being estimated that 30,000 saw the event from various parts of the course. Following are the times:

Car and Driver.	Time.
12-18 H. P. Lancia, Wm. Hilliard	3:43:33
18 H. P. Buick, Robt. Burman	3:49:45
30 H. P. Chalmers-Detroit, L. B. Lorimer.	3:53:55
18 H. P. Buick, E. A. Hearne	3:58:04
10 H. P. Isotta-Fraschini, Al Poole	4:11:22
20 H. P. Maxwell, A. See	4:18:38
20 H. P. Maxwell, C. W. Kelsey	4:20:44

THE GRAND PRIZE RACE.

By only a margin of 56 seconds over his nearest competitor, Hemery, Louis Wagner, driving a 120 horse power Fiat, won the contest for the Grand Prize of the A. C. A. at Savannah, Ga., on November 26, his time being 6 hours 10 minutes 31 seconds for the 402.8 miles of the course, an average of 65 miles per hour. Victor Hemery, on a 120 horse power Benz, was second, in 6 hours 11 minutes 27 seconds, and Felice Nazzaro, on a 120 horse power Fiat, third, in 6 hours 18 minutes 47 seconds. Hanriot, on another Benz, was fourth, and Hautvast, on a 125 horse power Bayard-Clément, fifth, their times being, respectively, 6 hours 26 minutes 31 seconds, and 6 hours 34 minutes 6 seconds, respectively. American cars made an indifferent showing, only two running at the end of the race, the Simplex and the Lozier, which were in eleventh and thirteenth positions out of a field of twenty.

The course was one of 25.05 miles, and was covered sixteen times. At 9:45 Regal, on a 120 horse power Bayard-Clement, was sent off, followed by Mulford, on the Lozier, and Seymour, on the Simplex, at intervals of one minute. Burman, driving the 40 horse power Buick, made two laps, when he broke down and withdrew. Haupt, on the Chadwick "50," made four laps, retiring on account of engine trouble. Zengle, driving the 60 Acme, broke a spring and retired after six laps. Szisz, driving a 120 horse power Renault, kept second place from the start until, by the breaking of an axle on his seventh lap, he was put out of the contest. Piacenza, driving a 100 horse power Itala, was ditched on his sixth lap and retired. Erle, on a 120 horse power Benz, hit a tree on his eleventh lap, owing to being struck by a tire thrown off by one of his wheels. Cagno, driving an Itala, broke a spring on his tenth lap and withdrew. Duray, driving a 120 horse power De Dietrich, ran out of fuel on the fourteenth lap and just reached the supply camp, but the delay in filling the tank prevented him from finishing in better than tenth place. Nazzarro, on a Fiat, had tire trouble and only by strenuous efforts gained third place.

Strang, driving a 120 horse power Renault, made some fast time on a single mile stretch, covering it in 35 2-5 seconds. Fournier, on a 100 horse power Itala, ran well, but could not equal the pace of the leaders, Wagner, Hemery, Nazzaro and Hauriot. At the finish Hemery came over the line first, but Wagner had several minutes to spare, and coming in shortly after was declared winner by a margin of 56 seconds. The accompanying table shows the order of finish:

Car and Driver.	Time
120 H. P. Fiat, Louis Wagner	6:10:31
120 H. P. Benz, Victor Hemery	6:11:27
120 H. P. Fiat, Felice Nazarro	6:18:47
120 H. P. Benz, Rène Hauriot	6:26:31
125 H. P. Bayard-Clément, Hautvast	6:34:06
120 H. P. Renault, L. Strang	6:43:37
120 H. P. Bayard-Clément, G. Rigal	6:45:49
120 H. P. Itala, Henri Fournier	6:46:32
120 H. P. Fiat, R. De Palma	6:41:34

The course was guarded by State militia, and there was no trespassing. A driver, who drove his horse onto the course was warned by one of the guards and not obeying was bayonetted, the wound being but slight. Outside of Erles' mishap no serious accidents occurred.

Coil Patents Holding Company Formed.

Richard Varley and E. C. Wilcox have organized the Unit Coil Company and incorporated same under the laws of New Jersey. The company has acquired all rights to United States Letters Patent No. 878,435, issued to Richard Varley on February 4, 1908, and No. 884,116, issued to E. Q. Williams on April 7, 1908. These two coils relate to the so called unit construction of induction coils for the ignition of multiple cylinder motors, and it is claimed by the new company that they cover every practical form of removable unit induction coil. Messrs. Varley and Wilcox are connected with the Autocoil Company, of Jersey City, N. J., and the Connecticut Telephone and Electric Company, of Meriden, Conn., respectively. These two companies have been involved in a suit growing out of alleged infringement of the Varley patent by the Connecticut concern, and the formation of the patent holding company indicates that this matter has been settled. We understand that it is the intention of the new company to issue licenses under their patents to coil manufacturers.

Business Troubles.

A petition in bankruptcy has been filed in the United States District Court at Utica, N. Y., against the Sterling Motor Company, of Binghamton. The claims against the company aggregate $1,314.63. The petitioners are the Firestone Tire and Rubber Company, the Prest-O-Lite Company and the Syracuse Rubber Company.

A bill in equity has been filed against C. A. Vetter, of Pittsburg, Pa., by A. M. Fraunheim, in which the appointment of a receiver for the Goodyear Auto Tire Repair Company of that city is asked for. Fraunheim claims that he invested a large sum of money in the company and that Vetter transferred all his stock in trade in the company as his own property.

The Automobile Coaching Company of New York has made an assignment to Frank Ortz, of 147 Spring street. The company was incorporated in 1905, with capital stock of $12,000, and discontinued business about two years ago. The assignment, it is said, was made on account of a judgment for $2,151 for negligence, which was entered against it in May last.

Judge Hotchkiss Re-Elected President of A. A. A.

At the annual election of the American Automobile Association, which was held at national headquarters, 437 Fifth avenue, New York, on December 2, Judge William H. Hotchkiss, of Buffalo, who has been president for the last two years, was reelected again, although he had let it be known that he did not wish to retain the office. Aside from the re-election of Judge Hotchkiss to the presidency, the most important action taken at the meeting was the abolishment of the racing board, of which Jefferson De Mont Thompson was chairman. The functions of the racing board will hereafter be vested in the recently created contest board, at the head of which will be F. B. Hower, who managed the last several Glidden tours. The abolishment of the racing board means apparently that the American Automobile Association will refrain from conducting any races itself in the future.

The other officers elected besides President Hotchkiss were as follows: First vice president, L. R. Speare; second vice president, Ira M. Cobe; third vice president, Frank H. Joyce; treasurer, H. A. Bonnell; secretary, F. H. Elliott. The following chairmen of boards were appointed: F. B. Hower, contest board; Charles T. Terry, legislative board; C. Gordon Neff, good roads board; Powell C. Evans, touring information board.

Annual Report of the American Automobile Association.

At the annual meeting of the A. A. A. held in New York on November 30 President Hotchkiss presented his annual report, in which he reviewed the work of the past year. It appears from this that no efforts were made during the past year to increase the membership. With the exception of Maine, New Hampshire and Iowa practically all of the so called Eastern, Northern and Middle Western States have State associations, while the movement is well along on the Pacific Coast and in the Rocky Mountain territory, as evidenced by the activities of the two associations in California and that in Colorado. Of the Southern States, Virginia, West Virginia and Kentucky already have State associations, while promising movements are under way in Georgia, Alabama, Louisiana and Arkansas. President Hotchkiss believes that if the secretary can be relieved of some of his burdens and permitted to visit the States not yet organized thirty-five, and perhaps forty, of the States of the Union will have federations of automobile clubs affiliated with the A. A. A. before the end of the fiscal year now beginning.

The president in his report urges that the association either create a new office, to be known as secretary of boards, or else that the secretary be given an assistant who would relieve him of much of the routine work and permit him to become a national secretary in fact. Such a secretary should devote his time largely to the organization of State associations and clubs, where there are as yet none formed, toward keeping affiliated bodies active, and in seeing to it that the policies of the national body are, so far as possible, carried out by its constituent members.

Referring to the finances of the association, Judge Hotchkiss remarks that "until the association is supported by the dues of its members and proper profits, resulting from the exercise of its legitimate functions, its permanency will be a question. We have heretofore relied largely upon the revenue from contests to meet our bills. The total amount paid by our members during the last fiscal year does not begin to meet the bills for printing and postage.

"In this connection I call to your attention the action of the recent conference, increasing the dues of individual members from $2 to $3, directing that an active canvass for such members be begun, and requiring State associations hereafter to pay 50 cents per member, instead of 25 cents. These changes are, however, not enough to accomplish the desired revenue. Something can, of course, be expected from the contests of the coming year; something, perhaps, from royalties; but these sources of revenue are always likely to fail, and a fiscal policy eliminating them must, sooner or later, be adopted."

An increase in the number of executive committee members from seventeen to twenty-one is recommended.

Last year's Glidden Tour resulted in a substantial benefit to the association. It is suggested that in next year's tour technical examinations will be made of the cars before and after the test, to reduce the number of perfect scores. Reference is made to the resolutions recently passed by the board of directors, according to which the A. A. A. will have nothing to do with circular track racing hereafter. Judge Hotchkiss remarks:

"I trust the day is not far distant when the representative body of American motorists will no longer have to be responsible for contests that are purely those of speed. When that time comes the racing board—which was once the important board of the association—will cease to be. Until then extreme care should be exercised not merely in the granting of sanctions but also and more in the regulation of speed contests. May there be as marked a decrease in sanctioned motor racing next year as there has been this!"

At the recent conference in New York the first steps were taken toward the printing by the association of an official journal, perhaps something like that issued by the Royal Automobile Club and Motor Union in England. If the action of the conference is ratified by this board the preliminary publication will be placed in the hands of a special committee, and, after the matter is well started, the whole subject will be turned over to the publications board.

Imports and Exports for October.

The month of October brought a considerable increase in the imports of automobiles, both as to number and value, and an even much greater decrease in the exports. There were imported in October, 1908, 179 cars valued at $327,511 and parts valued at $54,349, as compared with 132 cars valued at $291,094 and parts valued at $44,166 in October, 1907. Of the cars imported in October last 111 were from France, 48 from Italy, 12 from the United Kingdom and 6 from Germany. During the ten months ending with October, 1908, there were imported 1,135 cars valued at $2,131,400 and parts valued at $505,818, as compared with 862 cars valued at $2,602,016 and parts valued at $590,967 during the same period the previous year. A greater number of cars were imported from France and Italy during the first ten months of 1908 than during the same period of 1907, while the imports from Great Britain and Germany decreased.

During October, 1908, there were exported from this country 106 cars valued at $165,837 and parts valued at $47,938, making a total of $213,775. During October, 1907, there were exported 201 cars valued at $276,198 and parts valued at $41,905, a total of $318,103. The exports were, therefore, substantially 33 per cent. lower in value in October, 1908, than in October, 1907. During the ten months ending with October, 1908, there were exported 1,918 cars valued at $3,971,406 and parts valued at $525,097, a total of $4,496,503, as compared with 2,622 cars valued at $4,718,676 and parts valued at $563,312, a total of $5,281,988. While there has been a very considerable decrease in the export of complete cars the exports of parts have held up well.

Prize for Tire Test Suggestion.

The Poetting prize of 2,000 crowns, which is given annually by the Austrian A. C. for some invention or work calculated to advance the use of automobiles, will this year be awarded for an improvement in the methods of testing pnuematic tires or for a new method of testing, and the machinery and devices used. Contributions on the present methods or improvements thereon should be accompanied by descriptions of the machines used, while those on new methods, involving new machinery, should be accompanied by drawings and descriptions of the same. The contest will be closed on the 20th of March, 1909. The A. C. has contributed the sum of 3,000 crowns for the practical testing out of the device or method winning the prize. The competition is limited to Austrian subjects.

A motor propelled hand cart is in use in Paris for light delivery service. It is fitted with a motorcycle motor with belt transmission to a countershaft with fixed and loose pulleys. Side chains from the countershaft drive the two side wheels of the cart. The belt shifter is operated by a rod on one of the handles of the cart.

MINOR MENTION

An agency for the Middleby car, made by the Middleby Auto Company, Reading, Pa., has been opened in Philadelphia.

The American Motor Company, of Eau Claire, Wis., has filed an amendment changing its name to Burdick Motor Company.

The board of trade of Ludington, Mich., is corresponding with the promoter of an automobile company who plans to locate in that town.

The property of the Dolson Automobile Company, Charlotte, Mich., bankrupt, will be sold at public auction on Monday, December 14, at 10 a. m. on the premises.

Gus Balzer, 1777 Broadway, New York, has placed upon the market a bouquet holder for limousine cars, in various styles, both of domestic manufacture and imported.

The Maxwell-Briscoe Motor Company are planning to establish a technical laboratory in their Tarrytown, N. Y., plant. They have been experimenting with alcohol as a motor fuel for some time.

Fickling & Co., manufacturer of automobile bodies and equipment, have recently leased the large seven story building at 304 and 306 West Forty-ninth street, New York, where several new departments will be added.

The Brown Cotton Gin Company, of New London, Conn., will shortly enter into the business of making automobile parts by contract. A large contract is now being filled for one of the automobile companies in New England.

The Bennett Auto Supply Company, Sioux City, Ia., has been incorporated with a capital stock of $25,000, and will establish an automobile supply store in the Auto Building, 315 Nebraska street. The store will be in charge of Ralph Bennett and S. C Douglass.

Capitalists of Redondo, Cal., have subscribed to 10,000 shares of the stock of the Pacific Motor and Automobile Company, builders of the Clyde Special, an eight cylinder car, who will locate in Redondo. Two one story, 50x100 feet buildings, will be erected.

The 140 idle employees of the Rainier Automobile Company, of Saginaw, Mich., which is in the hands of a receiver, received part of the two weeks' wages due them from the company on Monday last, and were promised the remainder in two more instalments within the next two weeks.

It is not likely that the California Automobile Dealers' Association will hold a show this winter in San Francisco, and it is not likely that one will be held without the sanction of the association, as was done last winter. The dealers may decide on an opening week, keeping open house day and night along "automobile row." The cost would be much less to each dealer, and the salesmen would not be taken away from the salesrooms.

A training school for automobilists has been established at the factory of the Packard Motor Car Company in Detroit. Only private parties attend. The sessions are held once a week. Both the theoretical and practical sides of the automobile are treated by lectures and demonstrations.

A rumor that the Standard Connecting Rod Company, who are located on First avenue, Beaver Falls, Pa., would remove to Koppel, Pa., is denied by Thomas Moltrup, president of the Standard Connecting Rod Company. It is rumored that the Moltrup brothers are planning to manufacture automobiles.

The Farmobile Manufacturing Company, of Columbus, Ohio, whose incorporation is mentioned in another part of this issue, intends to manufacture motor farm machinery and automobiles adapted for farm use. The Farmobile tractor was illustrated and described in THE HORSELESS AGE some months ago.

According to a report from Columbus, Ohio, Lee Frayer, a well known engineer of that city, has recently made a series of experiments with a new invention of his whereby the noise of automobiles is entirely eliminated. Presumably this report refers to the Frayer rotary gasoline engine valve, which was described in our columns some time ago.

Licenses for the manufacture of the Bailey "Won't Slip" tire tread have recently been issued to the North British Rubber Company, Ltd., of Edinburgh, Scotland, and the Hannoversche Gummikamm Compagnie, Actiengellschaft, Hanover, Germany, abroad, and to the Consolidated Rubber Tire Company, of New York city, in this country.

The plant of the Syracuse (N. Y.) Aluminum and Bronze Company was on fire and threatened with total destruction on November 17. However, the fire was promptly subdued and the damage was confined entirely to the office. The foundry was running in the afternoon of the same day, and the next day all the men were at work and have been ever since.

The Forest City Motor Car Company have opened a branch at 2174 to 2180 East Ninth street, Cleveland, Ohio, to be known as the Jewel Motor Car Company, of Cleveland, under the management of O. F. Watts. They have also opened a branch store in New York city at 1662 Broadway, to be known as the Jewel Motor Car Company, of New York, under the management of J. P. Stoltz.

A proposition to hold a world's fair in Indianapolis in 1911 is being considered by the Commercial Club of that city. It is proposed that a fund of $12,000,000 be raised to be used in obtaining the site, erecting the buildings and doing the necessary advertising in this and other countries. So far the plan has not met with much success. Automobile manufacturers of the city have indicated that they do not look favorably on the project, in that it would be of little advantage to them in selling their cars.

The Peerless Motor Car Company has taken title to an "L" shaped parcel of property, with a frontage of 70 feet on Broadway, New York, abutting that of the Baptist Tabernacle of Fifty-sixth street, and 25 feet on Fifty-seventh street. An eight story fireproof building, with every modern convenience, will be erected thereon. Work will begin in the early spring, and the building will be ready for occupancy in time to look after the fall trade of 1909.

The prosecution of twenty year old Otto Winkel, of Milwaukee, Wis., by Dr. H. S. Piggins, on the charge of "borrowing" the doctor's car and wrecking it, brought out the unique defense by Winkel that he had received a blow on the head when a small boy, which caused a pressure on the brain and created a mania for automobiles. He was sent to the Reformatory for one year, despite the plea, and his companion was sent to the State industrial school.

The Breslin Hotel, New York, gave a luncheon to automobile exhibitors at the two New York shows on Tuesday, at which lots were drawn for the privilege of exhibiting cars in the foyer of the Breslin during show weeks. E. W. Headington, representing the Haynes car, will enjoy the privilege during the week of the Madison Square Garden Show, and Emerson Brooks, representing the Pennsylvania, during the week of the Grand Central Palace Show.

Club Notes.

A number of members of the Mercer Co. (N. J.) A. C. have had a section of the road between Trenton and Mercerville, on the route from New York to Philadelphia, oiled at their own expense.

The Albany (N. Y.) A. C. held its annual election on December 1, which resulted as follows: President, M. L. Ryder; vice president, Dr. E. G. Cox; secretary-treasurer, Howard Martin.

The Topeka (Kan.) Motor League was revived at a meeting held at the Commercial Club rooms on November 13. The following board of directors was elected for the coming year: J. M. Padgett, Dr. H. H. Keith, Dr. F. H. Scholle, W. W. Mills, George W. Crane, F. M. Spencer and S. W. Lyman.

The San Francisco Motor Club will offer a handsome silver cup as a prize to the automobile owner who sends in the best story, illustrated by photographs, and comprising details of the condition of the roads, of an outing in his motor car. The idea is to gather valuable information with regard to the roads.

At the annual meeting of the board of directors of the Milwaukee A. C. on November 27 the following officers were elected for the coming year: C. S. Drake, president; W. L. Hibbard, first vice president; F. Prinz, second vice president; J. T. Drought, secretary. No decision was reached by the club on the matter of building a clubhouse, but it is expected that one will be reached shortly, or that the club will have a home of its own by spring.

The New Motor and Country Club has recently been organized at Toronto, Canada, with the object of improving Lorne Park, 14 miles from Toronto, which can be reached either by road or water. The membership will be limited to 300.

The Worcester (Mass.) A. C. expect to hold an endurance and fuel consumption test over the roads in the neighborhood of that city on December 12. There will be five different routes for the test, each being 40 miles in length, the contestants starting from the city and covering a distance of 20 miles out and returning over the same to the city. Tool boxes, etc., will be sealed, and when the test is completed the cars will be examined by the technical committee and the results announced.

Commercial Notes.

A daily automobile service is to be established between Roswell and Alamogordo, N. M., in April next. The distance between the two points is 104 miles. This will reduce the time required to reach El Paso, Tex., from Roswell from thirty-six to twelve hours.

The New Orleans Taxicab Company has been organized to establish a taxicab service in the streets of New Orleans, with a capital stock of $200,000. It is promised to have 100 cabs in service by the 1st of January. A stable property at 622-4 North Rampart street has been leased, and will be converted into a garage. A. E. Woodman is the promoter.

The New York Store, one of the pioneer users of motor commercial vehicles in Indianapolis, has just bought its fourth vehicle of this type. It is a closed gasoline truck, and will be used in the furniture and housefurnishing department. The company also has a large gasoline open truck for furniture and two electric trucks for its dry goods department.

A gasoline truck, to cost not more than $1,600, will be purchased by the Indianapolis Board of Public Safety some time before January 1. It is to be used in the fire alarm and telegraph system of the fire department, displacing the present horse drawn service. The board has looked at several trucks, but has made no decision. A new patrol wagon for the police department will be purchased January 1.

Para Favors Native Rubber Exporters.

A law has just been passed by the two branches of the Legislature of the Province of Para, Brazil, and signed by the Governor, which is bound to work considerable injury to the foreign rubber exporting houses there. The Government of Para has been levying an export duty of 22-24 per cent. ad valorem on all rubber exported from there. Recently a syndicate of native rubber exporters was organized, and now by the above mentioned legislative act the export duty on rubber exported by these native firms has been reduced by about 4 per cent.

According to the *Berliner Börsen-Zeitung*, of the 36,400 tons of crude rubber exported from the Amazon Valley last year, more than 17,000 tons were shipped by German firms, and a large proportion of the remainder by English and American firms, so that only a relatively small percentage of the shipments were made by native exporters. The foreign exporters have already lodged a protest with the Brazilian Government in Rio de Janeiro. They hold that the action of the Government of Para is contrary to the laws of Brazil, which guarantee to foreign merchants resident in the country the same rights as are enjoyed by native merchants, and urge the Central Government to remonstrate promptly with the Government of Para.

Royal Motor Car Company Property Sold.

On December 2 the Royal Motor Car Company, of Cleveland, Ohio, which has been in the hands of a receiver for about a year, transferred its plant, business and good will to the Royal Tourist Car Company, which will continue the manufacture of the Royal Tourist car. The transfer was sanctioned by Judge Taylor, of the United States Supreme Court. The officers of the new company include George J. Dunham, of Boston, president; H. E. Calhoun, of Cleveland, vice president and treasurer; Clifford Fuller, of Cleveland, secretary.

Garage Notes.

A. H. McCutcheon, Milford, Ia., has begun work on a 24x60 foot garage building.

Earl J. Keller has opened a garage and repair shop at the rear of 225 Chestnut street, Reading, Pa.

A new garage and repair shop has been opened on Jones street, Eau Claire, Wis., by the Eau Claire Repair Co.

W. E. Taft and Carl N. Richardson have purchased the Athol Auto Station, located on Main street, Athol, Mass.

A two story garage, 29x61 feet, will shortly be erected by A. R. Raff at Crefeldt and Chestnut avenues, Philadelphia, Pa.

The Wilke Automobile and Machine Co. has opened a shop and garage on Jefferson avenue, near Seventh street, Sheboygan, Wis.

The Genesee Garage Co., of Syracuse, N. Y., has been granted court permission to change its name to the Genesee Motor Co.

The Minneapolis branch of the Winton Motor Carriage Co. have moved to their new building at 18 Eighth street North, that city.

The Pioneer Implement Co., Council Bluffs, Ia., have just completed a cement garage, which is said to be one of the best in the State.

The Bingham-Jordan Auto Co., of Minneapolis, Minn., will occupy their new building at 110 Tenth street South about February 1 next.

The Moore-Carvine Machine Co., distributors of the Elmore car, will shortly take up their quarters at 723 Third avenue, Minneapolis, Minn. The building is 150x50 feet and is modern in every respect.

The Stoddard Garage Co., 35 Washington street, Hornell, N. Y., have recently opened an automobile school in connection with their establishment. A special room is provided for instruction, and lectures are given daily at the convenience of the students. A. G. Kinyon, the instructor, was for a number of years instructor of the International Correspondence Schools, of Scranton, Pa. The instruction in road work is given by A. A. Stoddard.

C. R. Gibson, Salamanca, N. Y., is building a fireproof garage, to be known as the City Garage, which he will lease to F. S. Reed, the local repairer.

S. M. Becker will shortly remove his office from the Iron Block, Wisconsin and East Water streets, Milwaukee, to the Wells Building, Milwaukee and Wisconsin streets.

J. E. Murphy, 830 Hennepin avenue, Minneapolis, Minn., will shortly enlarge the building which they occupy at present for the purpose of accommodating the business.

William Wieland, Marshfield, Wis., will remodel the cabinet shop on East Fourth street, formerly owned by T. Raugh, for the instalation of a machine shop and garage.

Ed F. Laedlein and William A. Best, Williamsport, Pa., have leased a building at 431 West Third street, that city, which they will use as a garage and automobile repair shop.

The Midland Garage, 25-27 West First street, Oklahoma City, Okla., has been purchased by C. T. Cory, who will conduct a livery business therein in connection with the agency for the Midland and Brush cars.

A new garage was opened on December 1 by Loeb & Watts, Junction City, Kan. The garage is located in the Foundry Building on East Sixth street, an addition to which has just been completed, making it 45x100 feet.

F. W. Boettcher, of Aberdeen, S. Dak., has purchased the cars, stock and business of the Aberdeen Automobile Co., formerly operated by Cook & Moorehouse on South Main street, that city. The Buick and Olds will be handled.

The Minneapolis branch of the Maxwell-Briscoe Motor Co. will move from its present quarters at 219 Seventh avenue to a new building at 900 Hennepin avenue. This building will be two stories in height and will measure 50x150 feet.

The Green Motor Car Co., Newark, N. J., have given up the Oldsmobile agency, in consequence of the Olds Motor Works having ceased to be a licensed firm, and will in the future confine themselves to handling the Locomobile line.

A garage has been started in Seguin, Tex., by J. N. Abbott. This is the first garage in the vicinity, and in addition to storing, etc., it is contemplated establishing a regular line of automobiles between San Antonio, Seguin and Austin.

Work will shortly be commenced on an addition to the garage of the Wyoming Valley Motor Car Co. on North Washington street, Wilkes-Barre, Pa., the present building not being sufficiently large to accommodate the increase in business.

An automobile garage and supply house is being erected by E. S. Isenbuth in Redfield, S. Dak. The building will measure 150x54 feet and will be of brick. It is claimed that this building will be the largest and most complete garage in the State.

The Salem Auto Garage Co., of Salem, Ohio, has leased the building on East Main street from the Brooks Estate, and will conduct its business at that place hereafter. It is the intention to enlarge the building and add machinery to the equipment already there.

Peters & Kittell, Hornell, N. Y., are enlarging their garage so as to obtain floor space for sixty cars and a 50x40 foot machine shop, which will be placed in charge of a machinist. The garage is located corner Cass and Union streets. A line of supplies is also carried.

The garage of S. A. Teel & Co. on First street, Bangor, Pa., was burnt down on November 25, with a loss of between $20,000 and $25,000. Ten automobiles belonging to private parties were destroyed, and a number of others belonging to the company badly damaged. The loss is partly covered by insurance.

Fred Gilbert, Jacksonville, Fla., has purchased a building site at the corner of Church and Laura streets, in that city, and will commence work shortly on a four story fireproof garage. Plans are now being prepared for a modern re-enforced concrete structure. Mr. Gilbert will make a specialty of accessories and supplies, which he intends to sell throughout Florida and southern Georgia from his catalogue.

New Incorporations.

B. M. Byrne Garage Co., Lansing, Mich.—Capital, $15,000.

Jewell Motor Car Co. of New York, N. Y.—Capital, $10,000. Directors, J. P. Stoltz, Eli Rowles and W. C. Spenny.

Iroquois Auto Top Co., Utica, N. Y.—Capital, $15,000. Directors, Lee L. Laman, Frederick Widmer and Frank P. Fitch.

Wonder Manufacturing Co., Kansas City, Mo.—Capital, $35,000. Incorporators, C. F. Ettwein, L. A. Ettwein and H. N. Strait.

Phenix Garage, Lexington, Ky.—Capital, $10,000. Incorporators, A. L. Hamilton, V. K. Dodge, E. G. Hamilton and N. W. Dodge.

Wisconsin Auto and Tire Repair Co., Milwaukee, Wis.—Capital, $10,000. Incorporators, John J. Rhode, A. R. Hulick and D. J. Smith.

W. C. Stetson, Seattle, Wash.—Capital, $50,000. Incorporators, W. C. Stetson and George W. Stetson. To deal in automobiles and supplies.

Ligerwood Auto and Machine Co., Ligerwood, N. Dak.—Capital, $10,000. Incorporators, J. C. Herniman, E. A. Movius and J. H. Movius.

Brown-Williams Automobile Co., Des Moines, Ia.—Capital stock, $10,000. Incorporators, W. S. Brown, Ben M. Brown and J. P. Williams.

Perth Amboy Garage Co., Perth Amboy, N. J.—Capital, $50,000. Incorporators, Harry L. Wolff, Max Gibian, Harry Brower and Frank Hilsdorf.

Wheeler & Wuestefeld Co., New Haven, Conn.—Capital, $4,500. Incorporators, Cyrus E. Wheeler, George B. Wuestefeld and Dorothea Wuestefeld.

Unit Coil Co., Jersey City, N. J.—Capital, $10,000. Incorporators, Ernest C. Wilcox, Burton L. Lawton and Richard Varley. To deal in patents.

Farmobile Manufacturing Co., Columbus, Ohio.—Capital, $200,000. Incorporators, E. J. Eastman, J. G. Stewart, M. W. Kouno, W. J. Miller and D. W. Jones.

Savoy Auto and Taximeter Cab Co., Far Rockaway, L. I.—Capital, $30,000. Directors, Max Katz, Louis F. Walter, Jr., and Frederick Fitter, Far Rockaway, N. Y.

Madison Automobile Co., Madison, Mo.—Capital, $10,000. Incorporators, Norwood J. Hitz, Ab. J. Forey and Thos. B. McGregor. To deal in automobiles and bicycles.

Hodgman's European Automobile Tours, New York.—Capital, $15,000. Directors, Frederick P. King, Walter C. Roth and Daniel A. Boyle, 32 Liberty street, New York.

Greater New York and Suburban Transportation Co., New York, N. Y.—Capital, $25,000. Incorporators, Harry Lauterbach, Charles F. Colz and Charles A. Connor. To build taximeters, motor vehicles and engines.

Bradley Tire Protector, Fort Worth, Tex.—Capital stock, $20,000. Incorporators, H. M. Bradley, Carrie T. Douglas, of Fort Worth, and E. M. Bradley, of Houston.

International Automobile Co., Chicago, Ill.—Capital, $20,000. Incorporators, E. C. Haynes, C. E. Hall and J. W. McDaniel. To manufacture automobiles and accessories.

Perth Amboy Garage Company, Perth Amboy, N. J.—General automobile garage. Capital, $50,000. Incorporators, H. L. Wolff, M. Gibian, H. Brower, F. Hilsdorf, Perth Amboy.

Detroit Auto Dealers' Association, Detroit, Mich.—To promote shows, races, etc. Incorporators, George E. Lane, John P. Schneider, Robert K. Davis, J. H. Brady and George Brandt.

Joseph Strauss & Son, Buffalo, N. Y.—Capital stock, $100,000. To deal in bicycles, automobiles, etc., and to manufacture same. Incorporators, J. Strauss, G. C. Strauss, T. Strauss and M. Strauss.

Vermont Motor Co., Burlington, Vt.—Capital stock, $5,000. To buy, sell, deal in and rent automobiles. Incorporators, F. A. Rich, Henry H. Hagar, Russell W. Taft, F. W. Chamberlain and Guy E. Ludon.

International Engineering Co., Jersey City, N. J.—To design, make, deal and operate in all kinds of motors, vehicles and machinery. Capital stock, $10,000. Incorporators, Leland B. Garretson, J. C. Connell and Alex. S. Campbell.

Club Taxi Co., New York.—Capital, $1,000. Directors, Thornton Hopkins, Ninety-seventh street and Marine avenue, Brooklyn; Edward L. Mooney, 236 West Fifty-second street; John J. Robinson, 233 East Nineteenth street, New York.

Club Automobile Co., New York.—Capital, $25,000. Directors, Thornton Hopkins, Ninety-seventh street and Marine avenue, Brooklyn; Edward L. Mooney, 236 West Fifty-second street; John J. Robinson, 233 East Nineteenth street, New York.

Trade Personals.

Charles Clifton, of the George N. Pierce Co., sailed on November 24 to attend the Paris Automobile Show.

W. J. Doherty has disposed of his interests in the Sterling Motor Company, Sterling, Ill., to G. P. Hall, of the Midland Auto Co., of Moline, Ill.

D. W. Gluck, for some years with the Packard Motor Car Co., of New York, as head salesman, has accepted a position as sales manager of Fickling & Co., New York.

J. H. Chadwick has purchased the stock of the Lawrence Street Motorcar Co., of Lawrence, Kan., and will conduct the business in connection with E. H. Marshall and R. M. Sutters hereafter.

David Landau, of the firm of Landau & Golden, sailed on the steamer La Provence November 26 for France, to investigate the manufacture of ball bearings, auto forgings, stampings, gears, etc.

Howard S. Hart has resigned the presidency of the Corbin Motor Vehicle Corporation, of New Britain, Conn., and has been succeeded by Charles Glover, who was elected by the board of directors on November 22.

J. F. Singleton has again resumed his position as advertising manager of the Firestone Tire and Rubber Co., of Akron, Ohio, having completed an inspection tour of the company's agencies and branches during the last eight months.

F. O. Sawyer, of 3010 Olive street, St. Louis, Mo., has disposed of his tire business to the Firestone Tire and Rubber Co., of Akron, Ohio. The business will be conducted as a branch of the company, with John P. Trader as manager.

George A. Crane and several other representatives of the Knox Automobile Co., of Springfield, Mass., are making a business trip from there to Chicago in three of the company's 1909 cars, a touring car, a "tonneauette" and a roadster.

C. Royce Hough, formerly factory manager of the Pope Manufacturing Co., Indianapolis, Ind., and later sales manager of the Motor Car Co., of Washington, D. C., has accepted a position as general manager of Fickling & Co., New York.

J. Elmer Pratt, formerly advertising manager of the Cadillac Motor Car Co., and later with the Buick Motor Co., has been appointed to the newly created office of sales manager for the George N. Pierce Co.

Trade Literature Received.

Barndt-Johnston Auto Supply Co., Columbus, O.—Catalogue of automobile bodies, tops, wind shields, etc.

H. H. Franklin Manufacturing Co., Syracuse, N. Y.—Booklet on the "Growth of the Franklin Company and the Automobile Industry."

Rapid Motor Vehicle Co., Pontiac, Mich.—"Doubting Thomas," pertaining to the work of the Rapid truck in the late Glidden Tour.

Philadelphia Novelty Supply Co., 2031 North Twenty-ninth Street, Philadelphia, Pa.—Descriptive circular of the P. N. S. adjustable contact timer.

New Agencies.

Newark, Ohio.—Denis White, E-M-F.

Appleton, Wis.—F. Wright, Overland.

Baraboo, Wis.—A. S. Lanich, Maxwell.

Parkersburg, W. Va.—S. Dils, Franklin.

Kansas City, Mo.—Moon Car Co., Moon.

Mayville, Wis.—H. F. Mattson, Overland.

Minneapolis, Minn.—J. A. O'Brien, Oakland.

Butte, Mont.—Butte Novelty Works, Franklin.

Oshkosh, Wis.—J. H. Riemer & Co., Overland.

Buffalo, N. Y.—Brunn Automobile Co., Franklin.

Philadelphia, Pa.—Oxford Automobile Co., Brush.

Helena, Mont.—Swendeman Automobile Co., Franklin.

Fort Wayne, Ind.—Ohnhaus Automobile Co., Franklin.

Minneapolis, Minn.—V. Stormquist, Corbin, Stoddard-Dayton.

Harrisburg, Pa.—Central Pennsylvania Automobile Co., Locomobile.

Patents Issued November 24, 1908.

904,508. Carburetor.—William M. Carlin, Indianapolis, Ind. Filed February 19, 1908.

904,556. Gas Engine.—Emil A. Nelson, Detroit, Mich. Filed January 24, 1906.

904,562. Internal Combustion Engine.—Edward Rathbun, Toledo, Ohio. Filed February 21, 1908.

904,570. Supplemental Wheel for Motor Cars.—Milton D. Stocking, Lindenwood, Ill. Filed February 3, 1908.

904,616. Starting Mechanism for Internal Combustion Engines.—Henry C. L. Holden, Blackheath and George K. B. Elphinstone, Lewisham, England. Filed October 28, 1907.

904,624. Device for Reversing the Direction of Rotation of Internal Combustion Engines.—Leon Le Pontois, New Rochelle, N. Y. Filed August 2, 1907.

904,625. Device for Reversing the Direction of Rotation of Internal Combustion Engines.—Leon Le Pontois, New Rochelle, N. Y. Filed August 2, 1907.

904,659. Carburetor.—Edmund J. Thompson, Ottawa, Ont., Canada. Filed February 6, 1908.

904,671. Internal Combustion Motor.—Marius Berliet, Lyon, France. Filed August 16, 1907.

904,687. Motor Vehicle.—William Y. Donahoe, Cascade, Ia. Filed November 19, 1907.

904,721. Motor Wheel for Cycles.—Jules E. Périllard, Geneva, Switzerland. Filed April 1, 1907.

904,743. Automobile Transmission Mechanism.—Milton O. Reeves, Columbus, Ind. Filed October 19, 1907.

904,774. Transmission Gear and Casing for Automobiles.—Edward J. Gulick, Mishawaga, Ind. Filed August 9, 1907.

904,790. Stuffing Box for Engine Valves.—John J. MacMulkin, Huntington, N. Y. Filed March 10, 1908.

904,799. Starting Device.—Arthur E. Nelson, Cohoes, N. Y. Filed September 20, 1907.

904,837. Cushioning Device for Vehicles.—Alexander Carpenter and Charles C. Kissel, Findlay, Ohio. Filed October 30, 1907.

904,855. Carburetor for Internal Combustion Engines.—Giovanni Enrico, Turin, Italy. Filed November 27, 1906.

904,868. Transmission Gear for Motor Vehicles—Hans T. Hansen, Chicago, Ill. Filed December 26, 1907.

904,874. Apparatus for Indicating the Level of Petrol in the Petrol Container of Motor Cars and the Like—Friedrich Huttenlocher, Untertürkheim-Stuttgart, Germany. Filed June 14, 1907.

904,876. Vehicle Wheel.—Max Joachimi, St. Versailles, Mo. Filed June 14, 1907.

904,960. Carburetor and Mixer.—Oscar R. Hukle, Lexington, Ky. Filed March 30, 1908.

904,961. Internal Combustion Engine.—John Hutchings, London, England. Filed January 23, 1907.

904,983. Brake.—Samuel J. Oakes, Boston, Mass. Filed August 14, 1907.

904,998. Self Propelled Vehicle.—Charles Richter, Tampa, Fla. Filed December 26, 1907.

905,001. Canopy for Automobiles.—Edward T. Robinson, St. Louis, Mo. Filed February 11, 1908.

905,012. Carburetor.—Paul Spranger, Mariefelde, near Berlin, Germany. Filed May 28, 1908.

905,058. Auto Sleigh.—Charles W. Dennis, Augusta, Me. Filed April 27, 1908.

The Horseless Age

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Some Conditions and Tendencies.

By F. E. Watts.

The automobile industry is still so new that the conditions each season are entirely different from those of the preceding. Indeed, many subjects which have been lying dormant for some years become live topics for discussion in the course of a few months' time. Probably at no time since the industry became commercially important has history been made more rapidly than in the past eight months, and at no time has there been more going on underneath the surface than at present.

Since anyone who spends most of his time in a single factory finds it difficult to keep in touch with these rapid changes, it has occurred to the writer that there might be some who would be interested in an account of a few of the conditions noted in a recent trip which covered most of the manufacturing cities of the Middle West.

THE OUTLOOK.

On the whole the outlook for the coming season is very good, and seldom has optimism been so general. Few individuals or companies can be found who give expression to what might be called a conservative view of the situation; either everything looks rosy and the sky is without a cloud, or the days are "dark and gloomy," with no hope in sight for the future.

The former view is held by those companies who have had the necessary business ability and the capital to enable them to sell good articles at a reasonable price with a fair margin of profit. The latter opinion is shared by those who for one reason or another are falling behind in the race, and who, while they managed to keep the balance upon the right side of the ledger under the old scale of prices, find that now that the pinch of competition has come they must revise their methods or go into some other business.

Actual sales are very good in many sections, and the prospects for future business seem better than ever before. The importance of the smaller cities and towns appears to be more than ever emphasized. More automobiles are being sold in some of the smaller Western towns than in the largest cities of those States. I do not mean by this more in proportion to the population but more in actual numbers. This is due to the fact that many of these towns are quite largely inhabited by well to do retired farmers, who have both the money to buy and the time to use automobiles. In consequence the sales made there arouse a good deal of local interest and lead to additional sales in the surrounding country.

PRICE REUCTIONS GENERAL.

There is a rather general reduction in prices both for finished cars and accessories. In some accessories and parts these reductions are startlingly large, and show that the profits in former years must have been great or the management shockingly poor. There are lines, however, where we have reached rock bottom prices, which cannot be lowered until present conditions are fundamentally changed.

This season is witnessing the advent of a new style of vehicle, viz., the low priced four and five passenger touring car. While there have been a few models of this type for one or two seasons past, they have not been made in such large numbers as at present, and have attracted little attention. Then, too, the cars which are being offered for late 1908 and early 1909 delivery, at prices ranging from $800 to $1,500, far surpass both in attractiveness and real value any previous type of machine selling at similar prices. As is usual when an attractive type of any article is introduced at a more popular price, these new cars have opened up an entirely new field. They are the style of machine which many people have been waiting for. This introduction of the automobile to a new class means, of course, an increased demand for many kinds of accessories. How strong the appeal of these new machines is may be seen from the fact that many of them are being sold to people who have never had a demonstration, never seen a sample car or anything except a few photographs and specifications. And these statements I make about advance sales are not based upon advertising talk but on actual knowledge.

AUTOS IN THE CAMPAIGN.

The recent political campaign has offered startling proof of the extent to which the automobile is becoming necessary for such work. In conveying speakers from place to place around the cities, in reaching out of the way towns, and in getting voters to the polls for primaries and elections, the automobile has supplanted every other means of conveyance. Next to the persuasive voice and the almighty dollar it is the politicians' most efficient aid. Indeed, in one of the smaller cities the defeated party lamented over the lack of an automobile as the cause of their losing.

But we have more convincing and satisfying proofs than this that for light passenger transportation the automobile is not merely an adjunct to but is actually beginning to supplant the horse. It is found in the attitude of the carriage manufacturers of the country. A falling off in their trade was first felt in the Eastern part of the country; during the past year or so this effect has proceeded farther West. While it has not reached the point where it is driving many carriage manufacturers out of business, it is becoming evident from the dullness in their trade that the increasing tendency of the farmers to buy autos does not augur well for the future of their business. The natural consequence of this is that many have gone into the automobile trade and many others are laying their plans.

CARRIAGE MANUFACTURERS.

Whether it will be finally adopted for manufacture or not, the buggy type of car is usually the first form that the carriage maker experiments with. Being familiar with this type of gear, he appreciates its good points, and only realizes its faults after extended tests.

Naturally, then, the past few months have been active ones in the design of motor buggies. Personally I am inclined to think that this type of machine has not been well named. The name was very descriptive of the earlier models, but it did not take account of the possibilities of development. The consequence is that we are now being offered a crop of machines which we have no name for. Perhaps I should say "will soon be offered," for the machines I am about to mention are not yet on the market. Certainly the name "buggy" does not describe a machine with a wheel base of 122 inches—and I saw a high wheeler the other day with that wheel base and 44 and 48 inch wheels. Neither does it seem an adequate term for a car heavy enough to require a four cylinder, 40 horse power engine; but such a machine with large wheels and solid tires will be exhibited at some of the coming shows.

FAULTS OF THE BUGGY CONSTRUCTION.

Buggy construction has been found inadequate for many of the purposes to which it was put. Many of the crudely made machines which excited so much derision among automobile designers have "fallen down" in service, as was to be expected. As a consequence there are many users who have no further faith in the motor buggy. These failures are in some measure responsible for the better things which are forthcoming. Many of the cars which are being developed deserve the title of "solid tired automobiles," for the principal respect in which they differ from ordinary machines is in the use of somewhat larger wheels with solid tires. These wheels are being made more substantial; larger tire sections are being used, which puts the rubber under less stress, with the result that the user gets more miles of service out of his tires for each dollar he invests. Well made motors and change gears are taking the place of the cheap affairs offered on some of the earlier machines. Wheel bases are increasing considerably, and the centre of gravity of most of the machines will be lower than formerly. It looks as though 36 to 40 inch wheels would be most popular.

THE NEW TYPE.

Small four cylinder, air cooled engines are being tried out to a considerable extent. Apparently little new is being developed in the line of speed changing devices. The shaft drive is taking the place of side chains to a certain extent. Worm gears are sometimes used with the shaft drive, and to all appearances they make a good combination. One well known wagon manufacturer is preparing to market a solid tired car with a worm drive. The axle shaft is in one piece from wheel to wheel, of large diameter in the middle, and tapering toward the ends. The gear housing is mounted at the middle of this shaft, the spring seats are on roller bearings near its ends, and the wheels are mounted on the ends. Each of these parts is entirely separate from the others, except for the connection which the shaft affords. There are no axle tubes, and the shaft carries all the load. Differential action for the wheels is secured by a special form of ratchet in each hub.

THE COMMERCIAL SITUATION.

There has not been any marked change recently in the commercial vehicle situation. Sales have been rather slow for several months past. The depression in business, which has been very marked in many lines during the past summer and fall, has prevented a number of sales. Few companies care to buy during such times. This slackness seems to have had one good effect, however, in that many commercial houses have taken account of all their little sources of waste, and, of course, their trucking has come in for its share of attention. This has served to direct their thoughts to mechanical haulage, and I believe that the prospects for selling trucks were never so good as they promise to be during the coming spring and summer.

There seems to be a general tendency toward larger wheels, wider tires, more rugged construction and slower speeds. While but few trucks have been introduced there seems to be quite a decided increase in the number of light delivery wagons as compared with a year ago. The most noticeable increase, however, is in the use of the tricycle for parcel delivery. For various kinds of light packages the tricycle would appear to be the cheapest carrying medium yet devised. It seems likely that quite a few makers of heavy horse drawn vehicles and heavy machinery may engage in the manufacture of trucks.

The past year has apparently demonstrated that it is possible to sell cars by mail and keep them sold. Quite a few cars have been disposed of by one Western company in this manner, although the practice has attracted little attention among the trade. The largest mail order house in the country is at present on the verge of going into the business on a considerable scale, having its first lot of autos sold and some of them delivered.

TO MORE MODEST QUARTERS.

There is a tendency—though it is not yet very noticeable—to move salesrooms and garages out of the high rent districts to quarters where expenses will be less heavy. For many classes of cars this idea would seem to be correct, though for the expensive car which is meant for an exclusive patronage the best streets will probably furnish the favorite sites for some years.

The taxicab has not yet come into the general use which a few enthusiasts predicted for it some months ago. It may be that the rather dull times retarded its development, but there certainly seems little prospect of its immediate introduction outside of a few of the large cities. The only small city where I have seen them used is in Syracuse, where a few Thomas cabs are employed.

In the design of standard types of cars there is little that is new, except the more common use of pressed steel. Wheel diameters are being generally increased. Several makers are either experimenting with or regularly using 40 inch tires, while one well known company is building a few special cars with 42 inch wheels. The results which are being attained with these large wheels are such that they should receive the consideration of all makers.

Some slight attention is at last being accorded to the relation of engine stroke to engine power, and at least two makers are considering the production of engines with seven inch stroke for 1910.

PROGRESS OF SPECIALTY MANUFACTURE.

Specialization in accessories is bringing improvement, and it is apparent that soon the most fastidious maker will be able to buy certain parts made as well as they could be in his own factory, and sold at a lower price than he can produce them for. This will have a tendency to still further standardize design and reduce the number of types made.

Competition between makers of ball and roller bearings appears to be becoming keener, and on the whole I think that the advocates of the rollers are having a shade the best of it. They are now carrying the war into th eenemy's own camp, having brought out a series of short bearings which are interchangeable with the annular type of ball bearing.

The old question of shaft versus chain drive is still with us. Although shaft driven cars probably outnumber their rivals, especially among the new models which are practically all shaft driven, there are still a great many chain driven cars sold, several popular cars of this type selling to the extent of some thousands every year. The advent of a number of new chain cases, which will be exhibited at the shows, may give an added impetus to the chain driven machines.

EXPERIMENTS CARRIED ON.

Considerable experimentation with fuels is being carried on, alcohol, distillate and heavy oils being used. Many designers appear to have faith in fuel injection, and some do not hesitate to say that they think it very probable that this system will displace the carburetor. The two cycle engine is coming in for a large share of attention. While most of this work is being done by small companies and individuals, there are a number of the larger well known makers experimenting along these lines. Even the hydraulic transmission is coming in for its share of attention.

It will be seen that while there is no lack of experimental work along new lines, there is but little of it which has progressed to a point where it is of commercial importance. The most important changes in the industry at present are in selling and manufacturing methods. But there is this to be considered when looking over the situation, that while manufacturing methods have been improved, because reductions in selling prices were necessary to meet competition, new ideas in design have not been neglected. Many things have been developed which have not been shown to the public. Most makers of reputation have hesitated to put out anything radical this season, but there are many new constructions which are developed and ready for the market, but are being held back until they can be sold to advantage.

The Second Hand Situation in Indianapolis.

Automobile dealers in Indianapolis state that the problem of taking old cars in trade from purchasers of new ones will be a difficult matter next season, owing to the fact that they believe the demand will be largely for medium priced cars. One dealer said that he would be able to do little where a $2,500 car of this season was offered in trade on one of the numerous $1,500 models that have been placed on the market. There has been only a small demand for second hand cars in Indianapolis this season and the dealers are stocked with them. Some of the dealers made a rule this season not to accept any second hand cars as partial payment on a new one, although they offered to make every effort to dispose of the second hand cars for their customers. The demand this season has been for low and medium priced cars, and while dealers have sold many more cars than last season, their business has been less on a dollars and cents basis.

The Practice of Case Hardening Automobile Parts.

By Leon Guillet, D.Sc.

The case hardening process comprises the following separate operations:

1. Preparation of the carbonizing box.
2. Heating of the box.
3. Heat treatment of the carbonized parts.

For the present we will not consider this latter operation, which demands special treatment.

There are three elements which determine the results of the case hardening process, viz., (1) the depth of the carbonized surface layer; (2) the surface hardness of the case hardened part, and (3), the mechanical properties of the core and the surface layer of the finished part. It is especially necessary that the core should not be brittle and that the surface layer should not tend to chip off. These mechanical properties and the hardness do not depend upon the carbonization process but upon the heat treatment that follows it and upon the quality of the steel used.

DEPTH OF CARBONIZED LAYER.

We will therefore consider here only the depth of the carbonized layer. This depth evidently varies with the use to which the part is to be put. It is, however, possible to give some general rules:

1. The depth of the carbonized layer must not exceed one-third of the radius of the part, or, in other words, the carbonized thickness (twice the depth of the layer) must not exceed one-third the minimum thickness of the part. Thus, for instance, a shaft of 9 mm. diameter must not be carbonized to a greater depth than $9/(3\times2) = 1.5$ mm. A part of rectangular cross section, 6×9 mm., must not be carbonized to a greater depth than $6/(3\times2) = 1$ mm. The results given by this rule should even be regarded as the very extreme depth to which the carbonization should be carried.
2. For gears, .8 — 1 mm. (.032 — .040 in.) is a suitable depth, and for shafts 1 — 1.5 mm. (.040 — .060 in.). In the case of ball races there is no danger from a too great depth of carbonization, as these parts are not subjected to shock.

Owing to the fact that, as we have seen, the depth of carbonization depends upon three factors, viz., the cement, the temperature and the time, it is essential that a cement of definitely known chemical composition be used, whose speed of penetration at a given temperature has been definitely determined. The best practice is to use a mixture of 60 parts of carbon and 40 parts of barium carbonate, thoroughly ground and mixed together. We will show later on that some parts must be carbonized at 850° C. (low temperature carbonization), and others at 1,000° C. (high temperature carbonization). It is, therefore, necessary to know the speeds of penetration for these two temperatures. The following figures may be depended upon with the carbon-barium carbonate mixture:

—Penetration.—		Time,	Time,
MM.	Inch.	850° C.	1,000° C.
.3	.012	1 hour	½ hour.
.5	.020	2 hours.	1 hour.
.8	.032	5 hours.	2 hours.
1.0	.040	7 hours.	2½ hours.
1.2	.048	8 hours.	3 hours.
1.5	.060	10 hours.	3½ hours.

The time is here taken from the moment when the outer part of the carbonizing box has attained the carbonizing temperature of 850° or 1,000° C. Now the mass constituted by the carbonizing box, the cement and the parts, requires some time to attain the temperature at which carbonization commences (about 800° C.) and to pass from that temperature to 1,000° C. This time depends upon the furnace, the number of boxes and their size, the thickness of the layer of cement, the size of the parts, etc. It is evident that it is practically impossible to render all of these factors constant. We shall see further on how a number of them can be taken into account. There are two methods which may be made use of in practice: One consists in measuring the temperature outside of the box, and to be guided by former experience under similar conditions (size of parts, mass of cement) to evaluate the time that must elapse before carbonization actually begins. The second method consists in placing test bars of steel into the carbonizing box, which test bars may be easily withdrawn from the box by plugging the cavity in the fire clay lining of the box. The color of this test bar indicates approximately the temperature within the box. This method is to be specially recommended where large parts are to be dealt with. Where only small parts are handled the first method is the simplest. Scientifically, the best method would consist in placing a thermo-electric couple inside the carbonizing box, directly against the parts to be carbonized, and measure the temperature by means of a galvanometer. In practice, however, this method is impossible. The temperature of the box is therefore measured, and by comparison with tests previously made one judges the time which must be allowed to elapse before the carbonization can be considered to begin, from the moment when the outside of the box has attained the desired temperature.

PREPARATION OF THE CARBONIZING BOX.

The parts to be carbonized are placed in a box and surrounded with the cement. It is this assemblage which is to be raised to a suitable temperature, and we must, therefore, be enlightened on the following three points:

What kind of box should be used?
How should the cement be introduced?
How should the parts be arranged?

CARBONIZING BOXES.

The carbonizing boxes may either be of cast iron, cast steel, malleable iron or sheet steel, riveted. In the writer's opinion, cast iron and malleable iron should never be used for the purpose, for the reason that they deteriorate too rapidly, and they may even begin to fuse during the process of high temperature carbonization. There remain cast steel and sheet steel boxes. The latter have given good results. Sheet steel of about 6 mm. (¼ inch) thickness should be used. If a thicker plate is used it takes too much time before the interior of the box arrives at the desired temperature, while if a thinner sheet is used the box will not last long. The disadvantage of this kind of box is the wear of the rivets, which may break and cause the cement to fall out. A repair is easily made, however, and for this purpose rivets with large heads should be used. Cast steel boxes are not always of good quality, as they often contain blow holes.

The form of the carbonizing box may have considerable influence on the rate of penetration. From a theoretical standpoint the best form would be one corresponding exactly to the shape of the parts to be carbonized, leaving a space of uniform width at all points between the surface of the part and the wall of the box, which space would be filled with cement. In practice it is advisable to approach as near to this ideal as possible. Either tubes or rectangular boxes are generally used.

In the case of small parts it is evidently impossible to place each individual part in a separate box. The best practice then is to place the parts symmetrically with respect to the walls of the box, and in successive layers. In this way it is possible to use boxes of considerable size, but they must not be made too big. The cover of the box is simply fastened in place by means of iron wire.

There has been much discussion as to methods of reducing the wear of carbonizing boxes, which constitutes on the whole one of the chief items in the cost of the process. One of the methods suggested is to paint the outside of the boxes. Some tests made by the writer in this connection, especially with a mixture of silicate of soda and asbestos, did not lead to any satisfactory result. Any progress made in this direction should be immediately taken advantage of, as the rapid depreciation of the boxes is a rather serious matter.

The layer of cement must be of sufficient thickness in order that the carbonizing action may take place normally, without diminishing the speed of penetration. On the other hand, it must not be too great, which would unnecessarily prolong the time of heating. With the carbon-barium carbonate mixture the part may generally be surrounded with a layer of cement 4 to 5 centimetres (1.6-2 inches) thick. The aim should be to have the same tickness of cement in every operation as far as possible. If several parts are placed in the same box they must be separated by a layer of cement 1.6-2 inches thick. Any packing of the cement is to be avoided, for the reason, as already explained, that the air filling the spaces between the particles of the cement plays a part in the process, especially with the carbon-barium carbonate cement.

PASTE CEMENTS.

Up to now we have supposed that the part was placed at the middle of the cement. There is another method which is widely used, and which consists in the use of a paste holding the cement in suspension. The part to be carbonized is painted over with this paste, and is then placed in a box lined with charcoal. In this way we may prepare cements with a basis of cyanides or alkaline ferro-cyanides; the substance is reduced to a powder and then mixed with the paste, which will hold it in suspension.

This process possesses one advantage and several disadvantages. The advantage resides in the fact that only small quantities of cements are thus required; the wood charcoal is used solely to prevent the decarbonization of the cement and to create a neutral atmosphere. But this process gives less uniform results than that previously considered. In fact, the so-called "cementing dextrine" which is applied to the part, is not a homogeneous product; the grains of cyanide which it contains are in contact with certain portions of the steel, while other parts of the steel are not in contact with the carbonizing agent, which results in an irregular penetration. Moreover, it is possible that in applying the paste, owing to carelessness or lack of skill, the surface of the part is not completely covered. Finally the cement itself runs off during the operation, accumulating at certain points and exposing certain other points.

All this conduces to non-uniform penetration of the carbon and even to that grave defect known in shop parlance as soft spots, to which we will revert later. In such cases the quenched part will be extremely hard at some parts of its surface, and at other parts as soft as the original steel. The writer, therefore, advises against the use of this process known as the painting process. The economy which it seems to insure is more apparent than real.

ARRANGEMENT OF PARTS.

We have already indicated the arrangement of the parts in the box and the precautions to be observed when several parts are placed in the same box. Another point which should be insisted upon is that test bars should be used. Each box should contain one or more test bars, which may be examined after the operation, to ascertain that nothing unusual has occurred. The test bar should be placed at the centre of the box or near to the part with which it is to be compared. It must be well covered with cement. For the test bars an extra soft steel should be used. In order to be able to recognize the depth of carbonization, the test bar must be quenched. The carbonized layer can then be readily recognized by its very serrated grain. If the test bar was of medium carbon steel, there would be less contrast between the grain of the core and that of the carbonized layer, hence the measurement of the depth of carbonization would be more difficult.

It is not necessary to make the test bar of big diameter—5 mm. ($\frac{3}{16}$ inch) is generally sufficient—it being only necessary that its diameter be greater than twice the depth of the carbonized layer. The smaller the diameter the easier it will be to break for the purpose of examining the section.

PARTIAL CASE HARDENING.

The object of case hardening is to produce a very hard surface, but this hardness necessarily entails brittleness, especially in the case of thin layers. It follows that for certain parts it may be necessary to obtain great hardness at certain portions of the surface and relative softness at the remaining portions. Thus, for instance, in spindles, certain shafts, cams, ball races, etc., only the portions of the surface which are subjected to friction should be carbonized. In the case of gears, only the teeth are carbonized. It will thus be seen that certain pieces require that only certain well defined portions of the surface be carbonized and that the rest of the surface retain its original physical qualities. It is, therefore, necessary to prevent the carbon from penetrating into the surface at these latter points; according to the shop term, these sections must be "protected." There are several means of protection, but they are far from giving similar results.

The most widely used method is that consisting in covering these sections with fire clay. The material chosen for this purpose must satisfy the following requirements: It must be perfectly adherent; it must crack as little as possible during the heating; it must not weld to the part; it must be easy to shape. The best fire clay for the purpose is one which contains only little chalk and iron oxide, wihch components would render it more refractory, and which contains sufficient clay to render it plastic. Often graphite is added to the mixture, I believe, with the object of obtaining a product which cracks less when heated.

The results, however, often leave something to be desired. If the clay protector holds well where there is a cavity, as in the case of a gear, it holds much less satisfactory where it is simply stuck to the metal; it is impossible, for instance, to protect the smooth part of a shaft by means of fire clay and in the case of such parts recourse must be had to other methods.

One of the most extensively used methods consists in using a collar of soft steel. Suppose, for instance, that a cylindrical shaft is to be carbonized for one half of its length and left in its original state for the other half. Over this latter half is placed a collar or sleeve consisting of a tube the interior diameter of which is exactly the same as the outer diameter of the shaft. The tube is heated and thereby expanded, and may then be readily slid over the shaft, upon which it will fit tightly after having cooled down.

This contact between the tube and shaft remains perfect during the carbonization, with the result that only the half of the shaft not thus protected is carbonized, and also, of course, the collar or sleeve. It is evidently necessary that the sleeve be of greater thickness of wall than the depth of carbonization, in order that the expedient may succeed. Nothing is simpler than to separate the sleeve from the shaft after the quenching has been accomplished. The sleeve having been carbonized, is then necessarily very brittle, and a single stroke of the hammer suffices to break it. This "shielding" system is certainly a good one, but unfortunately it can only be applied in the case of simple cylindrical surfaces. There is, however, a system combining the use of sleeves with that of fire clay, the clay being held in place by means of a sleeve. Another method, which is also extensively used with great success, consists in placing a series of parts one against the other, in such a manner as to expose only the surfaces which are to be carbonized. Suppose, for instance, that we have a certain number of identical gears of which only the teeth are to be carbonized. We place these gears one on top of the other in a pile, and draw them tightly together by means of a rod passing through the bores, and two nuts at the ends. The outer faces of the two outside gears are protected by means of plain discs against which the nuts bear.

Another method deserving to be mentioned consists in carbonizing the entire surface of the parts and then removing the surface layer at all points where no hardness is desired—of course, before the quenching. To this end it is necessary to leave a certain amount of finish, about 3 mm., or one-eighth of an inch, which must be machined off between the carbonizing and quenching processes. The best example of the application of this process that may be mentioned is to motor crank shafts. These are first carbonized all over, then the carbonized skin is removed from the crank arms, which have been made of sufficiently larger size, and the shaft is then quenched.

We cannot close this discussion of partial case hardening without referring briefly to a very elegant method, which in practice, however, has not given the results which one was justified to expect from it. It is known that if a piece of steel is quenched in a copper sulphate bath, a layer of copper forms immediately on the surface, which prevents cementation. In practice it seems sufficient to first cleanse the part thoroughly of all grease and then paint it with a solution of copper sulphate, to obtain this protecting coating. While this assumption is correct, there are two objections to this method which have caused it to be abandoned. The first objection is that the coating is very irregular and the least grease spot or the slightest contact with the workman's hand causes an imperfection in the coating. Moreover, if a rather deep carbonization is desired, the part must be heated for a certain length of time. During this time the copper itself enters into solution with the iron, and consequently no longer acts as protector, particularly if the coating was not very heavy, which is practically impossible to secure.

HEATING OF THE CARBONIZING BOX.

After the carbonizing box has been prepared it must be raised to the temperature of carbonization, for which purpose different furnaces may be utilized, to which we shall refer later on. For the moment we will consider the method of heating alone. There are two general methods. The box may either be placed in the furnace while it is cold and the furnace then heated up, or the box may be placed in the furnace already at a high temperature.

The first of these methods is of no practical value, owing to the loss of time which it entails. However, the old process, which is still used in certain machine shops, is based on this method, and it may be of some interest to briefly describe it, even if for no other purpose than to show up its absurdity. It consists in taking a box filled with cement, in which are placed, generally in a haphazard manner, the parts to be treated. The box is of large dimensions; it is placed on the floor of the shop and is surrounded with coke, which is renewed at the rate that it is consumed. From time to time one of the parts in the box is removed to ascertain whether it has already become red; if so, the conclusion is drawn that it has begun to carbonize, and one then allows a certain time to elapse without making the least effort to regulate the temperature. The coke is then removed, and the parts are taken out of the box and quenched. This process, which is still being used by some well known manufacturers, smacks more of alchemistry and the magic of the ancients than of modern science.

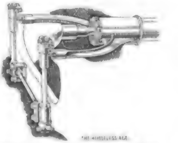
The best practice is to use a furnace already at the temperature of cementation, to introduce the carbonizing boxes into it, and to let the assemblage regain its original temperature. However, with good workmen and with readily regulated gas furnaces it is possible to improve on this method still further. The furnace is brought to a temperature above that selected for the carbonization at 850 degrees, viz., to 1,000 degrees. When this temperature is attained the cold carbonizing boxes are inserted, whereupon the temperature immediately drops below 850 degrees. The furnace is so regulated as to attain the desired temperature as quickly as possible, and the increase in temperature is then stopped. This requires a certain amount of skill, but considerable time is saved and the process is rendered more exact. It is hardly necessary to add that once the proper carbonizing temperature has been attained, it must be maintained as closely as possible.

(To be continued.)

The Olympia Show in London.

By Roy Lindsay.

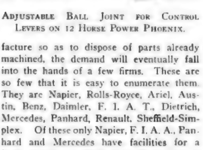
The annual show held by the Society of Motor Manufacturers and Traders at Olympia, London, opened its doors at 10 a. m. on November 13, and closed at 9 p. m. on November 21, with a record attendance of visitors, over 150,000 having paid for admission during the eight days. The Tuesday and Thursday were 75 cent days up to 5 p. m., the admission the other days being 25 cents, yet there was only a difference of 3,000 between the total of the higher price admission and the greatest number attending on the cheap days. These figures are extremely interesting because they prove that the general public want an automobile show and will willingly pay to enter. No free tickets were issued, except to the stand attendants and the press, and about 1,000 half price tickets sold to manufacturers for distribution among their agents.

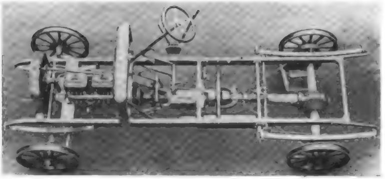

Connection of Torque Rod to Front of Cross Frame Member on 22 Horse Power Minerva.

The decorative scheme for the roof of the hall varied but slightly from last year, but there was a marked alteration on the floor, the ornate and over-elaboration of lighting and color that disfigured most of the stands in previous years being conspicuous by its absence. Exhibitors are beginning to find out that a blaze of light on their own stands effectively displays the vehicles on adjoining stands and leaves their own machines in the shadow, and quite a number of firms did not spend a cent on any extra lighting beyond that given by the overhead arc lamps. This year the show committee selected twenty-five of the principal makers and agents to ballot among themselves for the central spaces, the usual ballot for the other spaces in the main hall and annex taking place among those who had signed the bond not to exhibit elsewhere except with the consent of the society. As the society now includes practically every maker and every agent for a foreign car, and has established sections for local agents throughout England and Wales, it is impossible for any one else to run a show with any chance of success. Sanction has been given to one being held in Edinburgh in January, the Scottish trade unanimously demanding this. By means of a wisely drawn constitution, and permission to freely voice opinions at its various meetings, the society is established on such a firm foundation that its ruling on any question affecting the trade or industry is loyally accepted by all concerned and its influence is continually growing.

TENDENCY OF DESIGN.

In the report of the Olympia Show in these pages twelve months ago the view was expressed that the vogue of the high powered pleasure car was ended, and that a very much smaller vehicle of about 15 horse power would secure more than half the business to be done, with about 35 per cent. in smaller vehicles and the remaining 15 per cent. in costly machines carrying luxurious limousine bodies. The show that closed today provides ample confirmation, for although there were about 400 big cars exhibited, out of the total of 525 complete vehicles and chasses in the hall a large number were only coach builders' exhibits of bodies on chasses similar to those seen on the makers' and agents' stands. It was the writer's duty to make a careful stand to stand inspection of everything in the building, and with but two or three exceptions all these big machines were just the same in every detail as those seen in November, 1907. Stated in plain language there can be no question of doubt that the demand for this type of vehicle has fallen away to such an extent that makers cannot afford to alter the patterns or create fresh designs. While it is probable that those who have hitherto sold costly chasses of over 24 horse power will continue to manufacture so as to dispose of parts already machined, the demand will eventually fall into the hands of a few firms. These are so few that it is easy to enumerate them. They are Napier, Rolls-Royce, Ariel, Austin, Benz, Daimler, F. I. A. T., Dietrich, Mercedes, Panhard, Renault, Sheffield-Simplex. Of these only Napier, F. I. A. A., Panhard and Mercedes have facilities for a large output and of the rest the total sales in a year combined would not reach those of the first three just named. No better illustration of the revolution that has hap-


Adjustable Ball Joint for Control Levers on 12 Horse Power Phoenix.



Chassis of Four Cylinder, 15 Horse Power Rover.

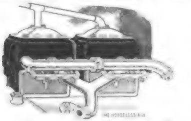
pened could be afforded than by the fact that a world famous firm like Panhard & Levassor showed a two cylinder, 8 horse power model selling for $1,220 and that Napier is also marketing a two cylinder, 10 horse power model selling for $1,350, in each case for the chassis with tires.

MANY SMALL FOUR CYLINDER CARS.

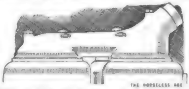
Interest in the show has centred on the large number of entirely new four cylinder, 15 horse power chasses, the majority of these having engines cast "monobloc" fashion, and a few even having the cylinders cast integral with the upper half of the crank chamber, aluminum being only used for the lower half of the crank case. In one instance this lower half, which, by the general employment of suspension of the crank shaft bearings from the upper case, is merely an oil well, is constructed of sheet copper. The lesser cost of cast iron seems to portend the disappearance of aluminum for any part of the engine, and as the total difference of weight between the two metals is so small in comparison with the total weight of the chassis, it is quite on the boards cast iron will also be largely used in future for gear boxes. Mors and Renault were the pioneers of the monobloc four cylinder engine, but their imitators have now gone considerably forward in the elimination of unnecessary pipes. On the Thornycroft, Deasy and quite a few others the valves are all situated on one side, the carburetor being placed at the valveless sides, two branches being taken from the carburetor to points between each pair of cylinders, the inlet valve ports being reached by pipes cast integral with the cylinders straight through the water jackets. This method clears away half the pipes from the front of the valve springs and serves the further purpose of heating and therefore vaporizing the mixture before it enters the cylinders. In order to silence the noise created by the impact of the valve stems on the tappet rods, the system originated by a French firm (Corneille de Saint Beuve) last year, of

ENCLOSING THE VALVE SPRINGS,

stems and tappets in boxes, has been copied by Napier, Deasy, Vauxhall and a number of other firms. For both large and small engines, the tendency is more and more toward placing all the valves on one side and of the large number of newly designed engines in the show only one small two cylinder could be discovered with overhead valves. Valve diameters have been increased, while the amount of lift, particularly for the inlets, has been decreased, the greater suction thus induced enabling a slower engine speed to be attained at small throttle opening, the demand for absolute silence for town work, where vehicles have to be manœuvred slowly among other traffic or stopped frequently outside shops, making buyers of new cars keenly anxious on this point.



Cover Plates to Valve Springs on Four Cylinder, 15 Horse Power Napier.



Water Cap to Cylinders on 20 Horse Power Siddeley.

CARBURETORS.

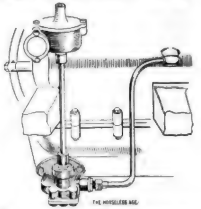
The number of new carburetors is extraordinary, as in addition to at least thirty brought out by car makers, there were about fifteen others displayed on the accessory stands in the gallery, each having some ingenious modification that will give greater range of engine speed and more economical fuel consumption. Perhaps the most remarkable feature of the show has been the adoption of thermo-syphon water circulation by so many manufacturers that, just as the 1906 exhibition was a six cylinder show, so will the 1908 display be historically recorded as the funeral of the water pump. The tentative use of natural water circulation by a few firms for their smaller models this last season has been so successful as to induce them to make the application more general, and the huge six cylinder 60 horse power Renault (the first of so large a power turned out by this French firm) exemplified the possibilities. Latent prejudice has still to be overcome in the minds of purchasers of cars above 20 horse power; consequently, although makers themselves are convinced that the water pump is unnecessary, they prefer to retain it for this season, as they will have quite enough trouble to dispose of the machines without having to guarantee the success of natural convection on the big machines. Another outstanding feature is the fitting of a high tension magneto as standard ignition equipment on every type of machine, even down to the small two cylinder 12 horse power models.

MAGNETOS CHEAPER THAN BATTERIES.

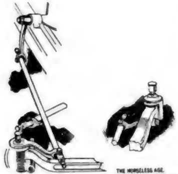
Hitherto the practice has been to charge magneto ignition as an extra, at an added cost of $75 for a four cylinder engine, but the competition for the sale of magnetos has now brought them down to such a reasonable figure that it is actually cheaper to instal them on a car instead of a first quality induction coil and two four volt accumulators. Concurrently with reduced prices there has been a tremendous advance in magneto improvement, makers of these fitments vying with each other as to who shall produce the machine with the most accessible parts. There are now twenty high tension magnetos on the English market, all of proved merit, very much lighter than the patterns of only a twelvemonth ago and most of them capable of producing a big spark when the armature is merely revolved by hand. In fact they are so perfected that the order of things has been reversed, and so rarely do breakdowns occur that a number of car makers will now only fit coil battery ignition as reserve, when specially ordered.

OIL PUMPS ALMOST UNIVERSAL.

Except on very cheap cars splash lubrication has wholly disappeared, an oil pump, driven usually off the cam shagt, being practically universal. Generally this pump is situated in the crank chamber below an oil



Oil Pump Outside Crank Case on Allday's 14 Horse Power Cox.



Fork Steering Joints on B. S. A. Cars.

well into which he oil drops after passing through a gauze filter, the pump forcing up to the crank shaft bearings, then through oil passages drilled along the shaft to the big end bearings, whence it is thrown up to the cylinder walls. In a few cases the connecting rods are drilled through from end to end so as to take the oil up to the wrist pin bearings, or else small gauge copper pipes are attached to the exteriors of the connecting rods for the same purpose. The difficulty of easy access to the oil pump, when placed in the crank chamber base, has, during the past season, shown this position to be unsuitable, and a number of the more enterprising makers, mainly those selling a four cylinder 15 horse power model, place the pump outside the crank case and drive it by a vertical shaft by means of helical gearing off the tail end of the cam shaft.

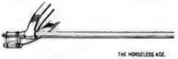
CLUTCH TENDENCIES.

The multiple disc clutch, if the new machines at the show are to be considered as a criterion, is having a pretty severe struggle for existence, for although the advantage of nearly unlimited "slip" is obtainable, the heat engendered spoils the thin lubricating oil that must be employed in this type of clutch and converts it into such a gummy mass that the clutch fails to perform its duty unless frequently rinsed out with kerosene. A patented disc clutch with "V" plates that had a considerable vogue has been dropped by nearly every maker who hastened to adopt it when it was first introduced, as, despite the fitting of plates of dissimilar metals, the grooves quickly wore into holes or else would not separate. The well proved leather faced cone clutch is quite good enough for the English Daimler Company to fit on their six cylinder 57 horse power model, and the majority of other makers, British and Continental, and the fact that of 140 different makes of cars sold in England only 23 have disc clutches is sufficient commentary on the present poscition. Simplification of the clutch fork and its attachment to the clutch pedal, and the use of a coupling joint between clutch and gear box were such usual features on nearly every car with a leather clutch that releathering becomes only a question of a couple of hours' work.

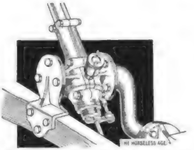
The selective type of gear box controlled from a side lever is now standard construction and no car will sell unless the gear shafts run in ball bearings. Improvement in the design of the box itself has kept pace with other portions of the mechanism, and it was noticeable that the majority of the boxes were cast in one piece, without vertical or horizontal joints, the gear shafts being inserted from the ends and the pairs of spur wheels, integral with their sliding collars, being then placed on the shafts.

GEAR BOX LUBRICATION.

Grease is no longer used for gear box lubrication, thin oil being now the recognized medium, escape of oil past the primary gear shaft bearings being prevented by stuffing boxes and glands of the marine type, large oil tight caps being screwed on to the ends of the boxes where the secondary gear shafts are supported. Although the enclosing of driving chains in dust tight cases was pretty general in 1908 by those makers who favored this form of transmission, purchasers will have nothing to do with them, consequently propeller shaft and live axle transmission is triumphant. The English Daimler, German Daimler, Panhard, F. I. A. T. companies are among those who have been compelled to fall into line with the rest of the trade by adopting the shaft drive. To reduce friction and wear on the universal joints, the propeller shaft is now set practically horizontal and parallel with the ground line when the car is fully loaded with an average number of passengers. To secure this end it has been necessary to redesign the pressed steel frame and the springs, the very latest models having the frame carried close to the front axle and at the rear, sweeping up in front of and then down again behind the rear axle, the springs, both back and front, being very long and quite flat. Exponents of this practice, which will be largely copied in 1910, are the Metallurgique, Sheffield-Simplex and Deasy firms. Freak ideas in universal joints have ceased to appear, the well known Hooke pattern being used by everybody.



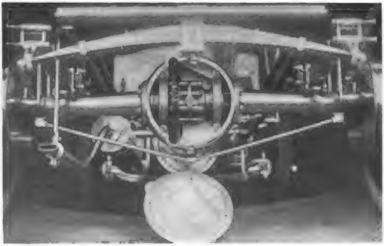
Rear Spring Attachment on Two Cylinder, 10 Horse Power Riley.



Double Bracket Support to Steering Gear Base on Hillman Car.

REMOVABLE DIFFERENTIALS.

There is an increasing tendency to arrange the differential gear so that it can be completely withdrawn by removing the large cap behind the axle casing. Pedal applied internal expansion brakes behind the gear box are considerably fewer than was the case last year, the external calliper type being more satisfactory in respect to quick adjustment for wear. Internal expansion rear hub brakes are found on the cheap as well as high priced models, and it seems safe to assume that fixity of pattern is assumed for these fittings. Here and there the positions of the brakes have been reversed so that the pedal controls the rear brakes while the propeller shaft brake is actuated from the side lever; the contention that less strain is thrown upon the propeller shaft by the regularly used brakes is true enough, but the idea is wrong in practice because it is physically impossible



Sheffield-Simplex Arched Live Axle, With Provisions for Removing Differential Without Taking Axle Apart.

to perfectly balance the action of the two hub brakes when suddenly applied, and this sets up possibilities of dangerous side-slip on a greasy road. The great reductions in the prices of tires this past six months have enabled car makers to supply covers of larger cross section, the standard equipment on cars up to 20 horse power being 32 inch by 4 inch, larger powered vehicles having the same diameter with a five inch section, and a six inch section being used when heavy limousine bodies are fitted.

NO DROP IN PRICES.

The expected drop in prices has not occurred and generally no alterations have been announced in this direction. Rather is it the case that prices are likely to increase to a small extent, because more expensive steel alloys are necessary to produce the lighter chassis demanded, and ball bearings, pump lubrication, better finished bodies and more external finish of the mechanism are considered essential. The very cheap car that a maker hopes to sell because it is cheap has no chance on the British market, and the two or three small powered French chasses of the runabout type that were displayed made such a poor impression as to preclude any further agencies of this character being arranged. In this connection some criticism may be permitted upon the American cars at this 1908 Olympia Show. The new four cylinder 30 horse power Cadillac met with approval, as did also the new White steamer and the new model 10 horse power Stanley steamer. This last machine is a big step forward in design, and although the disposition of the pumps beneath the floor boards is, according to English ideas, of a rough character, those that are running about in this country of the earlier model prove that they do the work required and this is, of course, the main consideration. One make of American cars created a bad impression here because of being fitted with apologies for seats, the so called rear entrance body having no doors of any kind and only a veneer of upholstery without proper padding or springing.

The illustrations are given as typical of general practice adopted by most manufacturers.

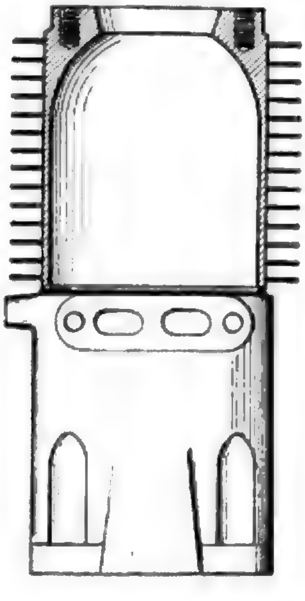
Hoof and Mouth Disease of Cattle Leads to Quarantine Measure Against Automobiles.

Owing to the outbreak of hoof and mouth disease among Michigan cattle a temporary order has been issued by the Canadian Department of Agriculture barring Michigan automobiles from entering Canada. The order was first applied only to motor trucks, but later it was extended to include touring cars, on the ground that they were likely to have been driven through the country districts where the disease was prevalent. These orders were especially directed to stop traffic between Detroit, Mich., and Windsor, Ont. Similar regulations are imposed upon all kinds of horse drawn vehicles.

A Method of Cylinder Manufacture.

The process of manufacture of an air cooled cylinder necessarily differs from that of water cooled cylinders, especially if the cooling flanges are not cast integral with the cylinder. This applies to the cylinders of the Franklin air cooled motors which are machined and finished as follows:

The accompanying drawing shows a finished cylinder consisting of an iron casting with phosphor bronze cooling rings pressed over it. The rough casting as it comes from the foundry is first inspected to see that it is sound, that the cores are of the proper diameter and centrally located, and that all bosses are in their proper positions. It is then sand blasted to remove all core sand, the object being to save the boring tools. The cylinder is then placed on a Gisholt turret lathe, and with a boring bar guided in the head stock, it is rough bored to within .015 inch of its finished diameter. The base is faced off at right angles to the bore and so as to leave the proper distance from the base to the centre of the auxiliary exhaust port. These two operations are done at one chucking.



The cylinder is then filled with compressed air at 80 pounds per square inch pressure and submerged in water to discover any leaks due to porous or unsound places in the casting which may be apparent only after the inside scale has been removed. If any leak shows up the cylinder is scraped; if not, it is then burred and cleaned on the outside and passed to be rough turned and ground. Having been ground to an exact size, it is again tested by compressed air and water for leaks. If no leaks develop it goes to the inspection room to have the outside grinding checked.

During this grinding, and also during the later grinding of the bore, the cylinder is flooded with water which is kept at a temperature of 70 degrees by adding either cold water or heating. It is claimed to be absolutely necessary to thus keep the cylinder at this temperature, else the micrometer measurements of the workman and the inspector will not check. If the water is too cold, after the cylinder has taken the temperature of the room it will be too large; if the water is of a higher temperature than the room, on cooling down the cylinder will be too small.

Having had the outside accurately ground, inspected and passed, the cylinder is ready to have the phosphor bronze rings applied. These are punched in a combination die which produces a complete ring at every stroke of the press. These rings are then accurately bored for a shrink fit. One of the objects of this boring is to obtain as large a contact surface with the cylinder wall as possible. As the blank comes from the press there is a slight shear to the hole, which would not give a contact surface equal to the thickness of the metal. The rings are then heated in an oil bath to the exact temperature previously determined, put on the cylinder and set in their proper places.

After the flanges are thus put on, the remaining work on the cylinder, such as facing bosses, drilling and tapping holes, etc., is completed, except that the concentric valve seat in the dome head is only roughed to within a few thousandths from the final size. The cylinder at this stage is again inspected and if found correct passes again to the grinding room to have the bore ground. For this operation the cylinder is placed on the grinder by fastening it to a large angle plate having a hole the size of the bore through which the wheel enters. It is fastened by the base so that the bore of the cylinder may be absolutely at right angles with the base.

Next the cylinder is sent to a heavy lathe fitted with a special face plate and compound rest, which is used only for finishing the concentric valve seat. This seat having been rough finished it only remains to make the angle of the seat perfectly correct and the surface round and true. This is tested by a hardened taper plug the shape and size of the valve seat, blued with prussian blue which shows readily the least inaccuracy. The cylinder is now ready for its last inspection and if passed is sent to the finished stock room.

The cylinder here taken as an example has a 4¼ inch bore, 14 phosphor-bronze flanges, is 11⅝ inches long over all and weighs 16⅝ pounds. The wall of this cylinder is only 3/16 inch thick. The finish grinding of the bore is done last in order that the compression due to the shrinking on of the phosphor-bronze rings may have no effect on the final finish of the bore. In all this cylinder passes through thirty-two operations.

Owing to the frequency of collisions of motor buses with lamp posts, the London County Council are gradually putting in posts with the lamps on a short arm projecting at right angles therefrom, so that the lamps will be protected.

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The Finances of the American Automobile Association.

For some time past it has been apparent that the American Automobile Association would have to devise new ways and means for raising funds necessary to carry on its work, and at the recent annual meeting in New York a step was taken designed to solve the problem of its finances—we refer to the compact made with the National Association of Automobile Manufacturers whereby this association appointed three members to the board of directors of the A. A. A., and in return for this privilege went to the financial assistance of the A. A. A. This agreement between the A. A. A. and the N. A. A. M. is confirmed in the official report of the meeting of the latter body; no particulars are given, but it is understood that the Manufacturers' Association agreed to contribute $5,000 to the treasury of the A. A. A.

The A. A. A.'s sources of revenue have never yielded any great sums. Up to the present a fair income has been derived from sanctions for races; but inasmuch as the association has decided not to have anything further to do with races on circular horse tracks, and as the report of the secretary showed that the number of sanctions of all kinds issued by the association is on the decline, not much dependence can be placed on revenues from this source for the future. The membership fee of individual members has been raised from $2 to $3, but as only a small proportion of the total membership are individual members this will not affect the total income to any extent. The plan of an increase in the contributions of the member clubs has undoubtedly been considered and discarded as impractical.

As another means of increasing its revenues the A. A. A. has decided to publish an association organ. The need of this, we are assured, has been felt for some time, which we take to refer to the revenue expected from the paper rather than to the paper itself. President Hotchkiss, in his recommendation of the "official paper" scheme, made the suggestion that it should be conducted along the same lines as the *Royal Automobile Club Journal*, of England, which, by the way, is one of the best examples of dessicated automobile literature that is to be found anywhere. However, many of the members clubs of the A. A. A. have their own organs, and why should not the national organization have one, if those who are expected to "pay the freight" will "stand for it"?

By the agreement with the N. A. A. M. the American Automobile Association would seem to have become subservient to the manufacturers' association, as it undoubtedly did to an extent. We do not believe, however, that there is any cause for regret in this, as the interests of the two bodies are largely identical, and we are inclined to believe that the timely assistance of the manufacturers' organization is the only salvation of the A. A. A. We have before this pointed out the difficulties which a national body of motorists must naturally encounter. The two most important lines of work which the A. A. A. has set out for itself are efforts in behalf of favorable legislation and good roads propaganda. Now, both automobile legislation and road building are at present entirely State matters, and the majority of motorists, therefore, do not see how a national association can accomplish much in these directions. Furthermore, the individual motorist, if he is not actually oppressed by harsh local regulations, is not inclined to make any great exertion to secure the passage of better laws or to assist in the building of improved roads. He knows that these matters, although they are of some importance to him, are of vastly greater importance to the manufacturers, and he is inclined, therefore, to depend on them for the defeat of any oppressive measures and for general missionary work in spreading the good roads movement. Also, as the use of the automobile is becoming general, the inducements for its users to combine and to defend their rights are no longer as strong as when the machines were used only by a small class. This statement may seem to be discounted by the rapid growth of the A. A. A. during the past two years, but this is not really so. We know for a certainty that quite a number of the recently admitted Western clubs are dominated by dealers, and the chief consideration in seeking admission to the A. A. A. was the prospect of obtaining sanctions for local races. Disagreement over race sanctions has already led to secessions from the association, and it is to be expected that, now that the A. A. A. has put its ban on track races, more clubs will withdraw.

The work which the A. A. A. has set out to accomplish will benefit the manufacturers in proportion to the measure in which it benefit sthe motorist, and there is therefore nothing strange in the fact that the N. A. A. M. contributed to the treasury of the A. A. A. For the time being the private motorists, as represented by the A. A. A. membership, will continue to bear part of the expenses of lobbying in connection with auto legislation and of the good roads propaganda, but the time will probably come when the cost of these various activities will fall entirely upon the manufacturers, and then the A. A. A. will either cease to exist or be absorbed by the manufacturers' organization.

Freakishness in Special Racing Cars.

The chief claim put forth by the supporters of the great international racing events when called upon to defend them has always been that they are of great technical value in developing points of weakness in existing automobile practice and in trying out, under exceptionally severe conditions, new technical ideas of practical value.

It has repeatedly been pointed out in these columns that, if the cars entered in such contests were of standard design or even closely similar in essential respects with machines used for ordinary service, such a "testing out" as a great race affords might possess a certain technical value. Racing cars have, however, always been of special and even of such freakish design as almost to constitute another kind of machine, the performance of which throws little light upon the art of designing "real" automobiles.

In so far as racers depart from customary motor car design, the technical usefulness of the events in which they figure becomes less and less.

It appears that matters are going from bad to worse, so far as the freakishness of racing cars is concerned.

It will be remembered that in order to put an end to "racing monsters" the cylinder bore of the cars entered in the Grand Prix was limited. The effect was that a brood of motors was brought forth for this event which were in the nature of curiosities. In order to secure the utmost output, with the limited bore, each designer increased his stroke and compression, and in many instances went so far in these directions as to render his motor utterly unfit for ordinary use. Previous to the advent of the limited bore idea the motors of racing cars had differed mainly in their dimensions from the commercially usable type, the general design according, in many essential points, with regular practice. But with the advent of the limited bore restriction, all regard for proportion, as established by long experience, was thrown to the winds and the design subordinated to the one end of obtaining the maximum output, irrespective of all other practical considerations.

The rules of the next Grand Prix include the limited bore idea, but the limit is placed much lower, and this undoubtedly means that the new designs will be still more outlandish than before, as judged by accepted standards, and that the motors produced will be machines quite distinct from the motors of commercially usable cars. It is quite likely that strokes nearly double the new restricted bore will be used and that piston speeds fully twice as high as deemed allowable in regular practice will be adopted.

Admitting the possibility that the performance of these fantastic motors, the children of an arbitrarily imposed restrictive condition, may throw some new light upon the relation of stroke to bore and perhaps upon other points, it is difficult to imagine what good can come to the industry from the trying out to destruction of engines so different from those employed in regular service.

It would seem that restriction of the bore in racing cars has not only failed of its purpose in restricting speed, but has resulted most decidedly in the creation of motors designed purely for racing purposes and further removed than ever from a likeness to the useful commercial type of engine, the testing out of which, under exceptionally severe conditions, might conceivably be of profit to the industry.

Range of Car Speed on High Gear.

The ability to operate at a very low rate of speed in congested traffic without changing from high gear is a characteristic very highly prized. Its desirability is recognized in the advertising matter of many manufacturers by such statements as that their cars can be throttle controlled to speeds of from 4 to 40 miles or from 5 to 50 miles per hour on the direct drive. Assuming the same ratio between the lowest and the highest practicable steady speeds of their motors, the car with a low maximum speed can obviously be made to run regularly at a much slower speed than the very high speed car. The 60 mile an hour vehicle can, for example, only run as low as six miles per hour, while the car with a 30 mile maximum can operate as slowly as three miles per hour. The practical difficulty arising from a too high minimum speed is thus met with particularly in the case of the powerful, high speed car.

It is not to be doubted that the claims put forth by manufacturers as to the minimum speeds attainable by their cars are generally made in good faith, and that, under very favorable conditions of adjustment, these claims are substantiated, but it is nevertheless true that in the hands of users and under everyday conditions the speedometer often gives positive evidence that the lowest practically attainable speed which can be secured without irregular operation of the motor is very considerably in excess of that claimed. Purchasers of cars are very often disappointed by not being able to drive as slowly through traffic as they had expected to be able to do, and by having frequently to resort to a lower gear on this account.

The general adoption of the high tension magneto as an ignition source, while conferring enormous benefits, is responsible for much of this inability to drive, with the motor running smoothly, at the minimum speeds claimed. At very low engine speeds very many of the magnetos now in service fail, sooner or later, to furnish positive ignition, while at the same speeds the battery system secures freedom from missing. The operator who depends upon such a magneto usually finds that he cannot operate nearly as slowly on the high gear as the car is claimed to be capable of running or nearly as slowly as it will actually run if the battery system is resorted to. Rather than switch over to the battery system, such an operator usually prefers to change to a lower gear.

Magnetos are, however, to be had which will spark a motor regularly at as low speed as it is practical for it to run.

The ability of a motor to run regularly at very low speed (and no good operator throttles a motor below its minimum steady running rate) depends very largely upon carburetor action at very small gas demands, upon the tightness of the valves and pistons and the absence of air leaks in the intake system. Changes in carburetor adjustment and the development of leaks in valves and at other points, and other changes in a motor which generally take place progressively with long use, rather tend to increase the minimum speed at which the engine can comfortably be run and hence increase the lowest speed possible on the direct drive.

The general substitution for the two cylinder motor of the four cylinder type—specially referred to in these remarks—opened up great possibilities in the direction of very low speeds on the high gear. These possibilities as to flexibility have not, it is believed, been realized in their fullness for the reason that designers have quite generally chosen to reduce flywheel capacities in order to save weight.

Purchasers of four cylinder cars should realize in advance that they are by no means sure to be able to secure, in extended practice, as low minimum car speeds on the high gear, even under smooth level road conditions, as are claimed for the cars they buy. The regular action of gasoline motors at the lower limit of capacity is so delicate a matter and so dependent upon a properly "tuned" condition as to be uncertain of permanent realization in practice.

It appears that new terms in connection with new industrial developments easily take root in France, even if they are not well chosen. The term automobile, which originated there, is probably one of the happiest of the many to which this industry has given rise. A less fortunate one is that of *poids lourds* (heavy weights), generally applied to commercial vehicles. In a recent contest for light commercial vehicles this class was referred to by some papers as "light heavy-weights," which is ridiculous.

The Single Coil-Distributor System of Ignition.

By the Trouble Man.

Among the devices used by motorists one of the most undeservedly maligned is the high tension distributor system of ignition. By a persistent course of "knocking" administered by persons in the industry, who either do not understand it or who have special reasons for opposing its adoption, the introduction of this excellent ignition system has been rendered very slow. The fact that coil makers can sell but one coil per car if the distributor system is used instead of four or six if the multiple coil arrangement is employed may possibly be a reason why the former system is not popular from a business standpoint with these manufacturers.

Very few coil makers produce high tension distributors for battery use, but very many build timers of their own design. Many of these manufacturers tell me that they have experimented with the distributor system "at great expense," and have found it "no good."

This is decidedly peculiar in one respect, as many of these coil manufacturers have brought out high tension magnetos, and every one of these magnetos carries a high tension distributor identical in principle and general construction with the distributor used with the battery system. If the distributor is a success upon a magneto there is no reason apparently why it should not be so in connection with a battery system.

NO INHERENT DEFECTS.

If, as claimed, the system has proved a failure, the defect can hardly have been in the inherent unfitness of the distributor, but must have been in the coils produced by these experimenters. Until quite recently there were a great many coils upon the market which, if used with a distributor system (or almost any other, in fact), gave no end of trouble. Some of these old types of coil could hardly be induced to vibrate satisfactorily when drawing less than 1 or 1¼ amperes. Their inefficiency was such as to lead to excessive burning at the vibrator points, and even to noticeable internal heating. Such a coil used in connection with a timer system might operate for quite a while without sticking or imperfect contracting of its vibrator, but let it be used on the single unit of a four point distributor system, and let the circuit be closed through it for one-half instead of one-eighth of the time the engine was running, and it would soon go out of service. The solder used to fix the vibrator points in place would melt under the high average current of one-half or five-eighths of an ampere, and, running down, would stick the points together, while the arc due to the breaking of the excessive current drawn would quickly raise a "teat" on one of the plantinum points, rapidly decreasing the area of metallic contact, until finally no contact would be made. The attention required to keep the vibrator of such a coil in operative condition, when used on a distributor system, would prove to be much greater than in direct proportion to the increase of its activity over that to which it would be subjected in a multiple coil system, and the user would finally give up the arrangement in disgust and condemn the distributor system for the shortcomings of the coil.

Fortunately, at the present time, coils are produced by many reputable manufacturers which deliver a most effective spark while drawing a current not exceeding one-half ampere when measured with the engine not turning. Some will operate upon less than this. Such coils will run with the circuit continuously closed for long periods of time, and show remarkably little evidence of such unusual treatment. The condensers are well proportioned, the vibrator points so attached as to prevent sticking, and the waste of energy in the coil is so far reduced as to minimize all destructive effects. A coil of this sort when operated with a four point distributor gives excellent service, for if it will run on continuously closed circuit for long periods of time it certainly may be expected to run well with the circuit closed but one-half the time.

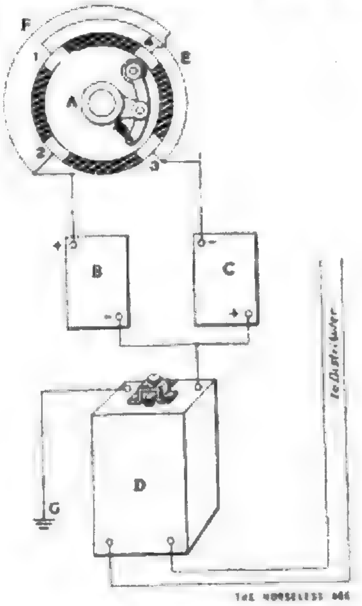

Diagram of Connections.

In adopting a coil for use with a distributor the one should be selected which gives the required spark with the least primary current, and which shows freedom from vibrator trouble and the minimum effect on the points after a continuous closed circuit test of at least ten hours.

PITTING OF CONTACT POINTS.

No coil has been produced which will not in time show some pitting of the vibrator points, especially if the direction of the primary current is always the same. A coil worked from a four point distributor will show a given amount of pitting in rather less than a quarter of the time required to produce the same effect if the coil is one of four coils operated from a timer. It is good judgment to carry a spare coil unit, no matter which system is used, and the spare should be kept in perfect condition and in correct adjustment, so that no time need be lost if a change is required.

In the connecting up of batteries and coils it has generally been recommended that the vibrator screws be made "positive," so that whatever platinum is carried away by the arc may be taken from the screw and deposited upon the contact point of the trembler. The theory is that the screw is cheaper and easier to replace than is the trembler, and that, with this arrangement, the trembler point builds up rather than wears away, requiring only the smoothing off of the extra metal deposited upon it to keep it in perfect conditon. When the screw point is worn away it can be replaced at no very great expense.

REDUCING CONTACT WEAR.

If the motorist is willing to take a little pains he can reduce very greatly the rate of wear of his vibrator points by periodically reversing the direction of current flow through the system.

It is customary with many users to replenish the oil and gasoline supplies before each day's service. If the operator will form a habit of including in this routine the opening of the battery box and the reversing of the two battery wires connecting the one which has gone to the positive pole to the negative, and vice versa, he will find that the wear of his vibrator points is reduced to a minimum.

Considering a period of several weeks, with the battery reversed each day, the mileage covered with the current in one direction is very nearly the same as that traversed with the current flowing in the reverse sense, and a large proportion of the platinum carried from the screw point to the vibrator while the current is in one direction will be returned by the current as soon as it begins to flow in the opposite sense.

In the case of a coil used with a distributor this scheme of a periodical reversal of the current is especially advantageous, as it also is in instances where a master vibrator is used to actuate a number of coils. The slight wear produced upon vibrators operated from non-synchronous alternating current magnetos from which the current is in each direction for one half of the time, in the aggregate, is well known. Some attempts have been made to devise a battery ignition system so arranged that the current through the vibrator shall be in each of the two directions during half the time, thus eliminating the displacement of metal at the points.

AUTOMATIC REVERSING SYSTEM.

The accompanying diagram illustrates one manner in which a distributor system may be operated on the "reversed current" plan. It may at least possess a curious interest for those who are given to the study of ignition connections. A is the four point primary portion of the distributor, the high tension part of which is omitted for the sake of clearness. B and C are two similar storage batteries or two identical groups of dry cells, and D is a single vibrator coil. Instead of all four segments of the primary part of the timer being electrically connected, points 1 and 3 are connected together by means of the metal strip E and points 2 and 4 are united by the strip F. The positive pole of battery B is connected to one of these strips, say F, and the negative pole of battery C to the other strip E. The negative pole of battery B and the positive pole of battery C are united and connected to one primary terminal of the coil D, while the other primary coil terminal is grounded. One high tension terminal of the coil is connected to the rotating arm of the distributor and the other ground in the usual manner. When the primary contact roller is on segments 1 or 3 current passes through the connecting strip E and battery C is drawn upon, battery B being an open circuit. When the primary circuit is closed on segments 2 or 4 current is drawn from battery B, through strip F, with battery C on open circuit; but as B is poled oppositely from C, the current will now flow in the opposite direction. The current flow through the coil vibrator will be alternating in direction. In case one battery, as B, becomes exhausted, it is only necessary to remove the wire from its positive post and connect it to the negative post of B, when the current is all drawn from C in the usual manner.

KEEP DISTRIBUTOR CLEAN.

One matter which should be guarded against in the operation of a distributor is the prevention of any collection of carbon or metal dust in the high tension compartment. If this accumulates uncertain ignition is likely to result. It is very desirable that the distributing arm should make no actual contact with the fixed segments, so that there may be no wear.

Now that the high tension magneto has come into such general use as the regularly employed means of ignition for most cars, the battery system has been relegated to an entirely secondary position. Still, its employment is desirable, in a large proportion of cases, as a reserve. It would seem that the distributor single coil system is the battery system best adapted to present requirements, as it is cheap to install as compared with the multiple coil system.

It seems rather foolish, too, to clutter up the dash with a four unit coil which is used but little, when a small single unit will do the work just as well. Familiarity with the high tension magneto tends to dispel the existing prejudice against the distributor principle, and thus allow this meritorious device to take its proper place in the ignition field

Horse Power Formulæ.

(Concluded.)

It is, though, obviously impossible to include all the factors, or even the important ones, in one formula, or, indeed, to ascertain them, and it seems, therefore, impossible to obtain a completely satisfactory competition horse power formula, or anything like it.

In considering a nominal horse power formula for touring cars, the case is entirely different. The basis of such a formula is not what can be done with an engine, but what is done. It has nothing to do with future possibilities, because it can be changed to keep pace with progress, but only with actual results. And the formula should be derived from actual results, not from theoretical considerations, even though these may have empirical foundations.

The discovery of the best formula presents no difficulty; it only requires that British makers in 1909 should afford the same facilities as were willingly afforded by the French manufacturers in 1906. If a large number of engines that are recognized as good engines were tested and their maxihorse powers ascertained, it would be easy to discover what factors, among those which can practically be taken into account, influence the horse power in a regular manner. Curves can be drawn representing the average variation of horse power with these factors, and a formula can then be obtained which fits the curves as closely as may be desired.

I have done this for the engines measured by the French Club, not with any idea of suggesting the formula derived from them as being one to adopt, but as giving some criterion for estimating the value of the D^2n and proposed formulæ, and as affording some check on certain of the conclusions arrived at by the Society of Motor Manufacturers' and Traders' committee on theoretical considerations. Any measurements serving as a basis for a British formula should be made on more modern engines than those of the French Club, and should certainly not be on foreign engines only.

One factor to which a large portion of the Society of Motor Manufacturers and Traders' report is devoted is the variation of piston speed for maximum horse power with r, the ratio of stroke to bore, and an equation representing this formula is deduced from theoretical considerations, and subsequently serves as basis or part basis for the proposed formula. The figures obtained by the French Club enable this equation to be checked.

Each point in Fig. 2[*] refers to one of the engines, its ordinate being the maximum horse power and its abscissa the ratio of stroke to bore. The line drawn across the figure represents the equation adopted in the Society of Motor Manufacturers and Traders' report. This figure shows that piston speed does not vary with r according to any really regular law. What little regularity there is shows a variation in the opposite sense to the theoretical variation given by the equation. The deviation here shown between fact and theory is chiefly due to insufficient attention having been paid in the Society of Motor Manufacturers and Traders' report to Mr. Lanchester's premisses.

Regular variations that may be found in the measurements are:

For a given bore, the maximum horse power diminishes with increase of r, but only to a negligible amount in ordinary sizes.

For a given bore, the maximum horse power increases with the engine speed at which the maximum horse power occurs. The increase is roughly proportional.

The piston speed for maximum horse power increases slightly, and not very regularly, with increase of bore. Of the three quantities, bore, stroke and ratio of stroke to bore, the bore is the only one that varies appreciably with the maximum horse power.

In Fig. 3 each point represents one of the engines measured by the French Club, the ordinates being the horse power of a four cylinder engine, and the abscissæ the bore in millimetres. The full line curve represents the average of these points, taken by finding the mean horse power of all engines of the same bore, and plotting the points so obtained and then drawing the curve most closely corresponding to these mean points. The other curves show the horse powers given by $\frac{4\,d^2}{2.5}$, d being in inches, and by .00525 $d^{1.8}$, d being in millimetres, the formula proposed by M. Faroux and recommended by the technical committee of the French Club.

The horse power given by the d^2 formula does not increase rapidly enough with increase of bore, but the formula has the very great merit of extreme simplicity. The $d^{1.8}$ formula is given a constant which makes it represent the maximum of the maximum horse powers, and follows these very closely, but a formula which requires logarithms to calculate the horse power would never be willingly accepted. Nor is an odd exponent at all necessary. Any curve of the nature of the average curve shown can be represented closely enough by a d^2 formula with two constants. For the average curve shown I have worked out the formula $\frac{1}{2}(d - 2.6)^2$, d being in centimetres, which does not deviate from it anywhere by more than 3 per cent. from bores of 80 to 150 millimetres. By taking more elaborate constants the average curve can be approached more closely.

This formula is nearly as simple as the $\frac{d^2}{2.5}$ formula, and there is no doubt that if an average curve were got out for up to date engines, an equally simple formula could be found to represent it as closely.

As the Society of Motor Manufacturers and Traders' proposed formula contains d and r, it cannot be shown on Fig. 3, but I have shown it on Fig. 4, in which the horse powers of the engines are varied, as indicated by the formula, so as to give the equivalent horse powers for a ratio of 1.1. The horse powers adjusted according to the formula vary far more than when not adjusted for the ratio, and the formula curve does not represent them particularly well The average percentage error of 61 engines between bores of 80 and 150 millimetres is with the proposed Society of Motor Manufacturers' and Traders' formula 13.1 per cent., while with the formula with bore only the average error is only 10.3 per cent. The constants of both formulæ are just right for the 1906 engines of average size, which, if the constant chosen by the Society of Motor Manufacturers and Traders' committee is right for present day engines, shows that the horse power of touring car engines has not increased appreciably since 1906. The presence of the $(r+2)$ term in the proposed formula of the Society of Motor Manufacturers and Traders is chiefly responsible for its greater errors.

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[*] These figures are not reproduced.

This is sufficient to show that, given the experimental data, it is easy to deduce a simple horse power formula giving the horse power of touring car engines with fair accuracy, and if only people would come forward to facilitate the work of collecting the data we should require no more discussions or theories, but should have a formula that was without question the best possible at that time.

The data, of course, actually do exist; each maker of engines must know the horse power of his own engines. All that is wanted is to collect this knowledge, and with some assurance that the different makers have measured the horse power under similar conditions. I would then make this suggestion to the commission: That a small committee independent of all trade influences, such as could be formed from the technical committee of the Royal Automobile Club, should prescribe conditions for testing the normal maximum horse power of an engine, and that the different makers should supply the results of their tests on new types or sizes of engines put on the market. The results would have to be treated as confidential by the committee, otherwise it might be difficult to insure getting the figures of normal engines. The committee might then, at the beginning of each year, issue a nominal horse power formula, based on these results.

Furnishing the necessary data would mean very little work for a maker who already tests his engine, and I do not think he could have any objection to supply the figures in confidence to a committee.

For competitions it is impossible to devise a "completely satisfactory formula," or even a reasonably satisfactory formula, on the lines indicated in the Society of Motor Manufacturers and Traders' report, and I think that if any formula be advised for competitions it should be put forward with a clear statement of the limitations it must necessarily have. After all, the excellence of a formula for competitions should be judged not by its scientific correctness, or, indeed, by the accuracy with which it gives horse power, but only by the degree of interest and usefulness it lends to the competitions; and it should be borne in mind that the Four Inch Race, based on what has been alleged in various quarters to be a most unsatisfactory formula, has been one of the most successful and instructive competitions ever held.

The "Efficiency" Run of the Brush Runabouts.

This run started on August 1 from Detroit, the home city of the Brush cars. It was participated in by four runabouts and a delivery car. Each of the runabouts carried two people, a driver and an observer, and about 150 pounds of baggage. The delivery car had a 500 pound load besides the driver and observer. The routes of the different cars were as follows: No. 1, Toledo, Buffalo, Albany, New York, New Haven, Springfield, Boston. No. 2, Toledo, Columbus, Ohio; Akron; Wheeling, W. Va.; Pittsburg, Philadelphia, Washington, D. C. No. 3, Adrian, Mich.; Cincinnati, Terre Haute, St. Louis, Kansas City, Pike's Peak, Denver. No. 4, Kalmazoo, South Bend, Indianapolis, Peoria, Ill.; Chicago, Minneapolis. Delivery wagon, Chicago, Milwaukee, and return. The above are, of course, only a few of the principal cities visited.

The following table, which shows the gasoline, oil and repair costs, was furnished us by the manufacturers:

Car.	Total Mileage.	Miles per Gallon Gasoline.	Miles per Quart Oil.	Time, Days.	Miles per Day.	Repair Cost (Not Including Tires).
No. 1	1,378.5	28.7	106	15	92	$0.25
No. 2	1,190	23.8	99	16	74.4	.50
No. 3	2,275	21.7	93	24	94.8	.10
No. 4	1,744	10.5	120.3	25	70	4.95
Average	1,646.9	22.5	103	20	82.3	1.45
Delivery wagon	921	13.7	68	..	76.7	.25

It will be seen that the car which had the best roads used the least gasoline, and made next to the best record in oil consumption. The outlay for repairs to No. 4 was caused by replacing a wheel spindle which was bent by skidding against a hitching post. Taking the cost of gasoline as 14 cents per gallon, and that of oil as 50 cents per gallon, the average cost per mile is 0.62 cent a mile for gasoline and 0.12 cent for oil. The delivery wagon, being more heavily loaded, equipped with solid tires and geared lower than the others, did not make nearly as good a showing.

These averages seem to show that, as would be expected, a small single cylinder runabout is economical of oil and fuel even over rough roads. In considering the figures it should be remembered that the cars were new and not worn to their best running condition when they started, and that the four runabouts had wheels only 28 inches in diameter, which are much too small for heavy country travel.

N. A. A. M. Meeting.

At the regular monthly meeting of the executive committee of the National Association of Automobile Manufacturers, Inc., held on Wednesday, December 2, the Waverley Company, of Indianapolis, was elected to membership. At the request of the American Automobile Association a committee composed of Messrs. H. O. Smith, W. E. Metzger and S. A. Miles was appointed to serve on the executive committee of that body. The same gentlemen were appointed a committee to confer with the contest board of the American Automobile Association relative to the tour in 1909. C. G. Stoddard, of the Dayton Motor Car Company, was elected to membership of the executive committee. The annual meeting of the association will take place on Wednesday, January 20, 1909, probably at the Victoria Hotel.

The executive committee adopted a resolution to the effect that in its opinion control of racing events in this country should be retained by the American Automobile Association. This action, however, had no bearing on the resolution recently adopted by the American Automobile Association declining hereafter to recognize races on one-mile circular tracks. The executive committee promised its financial support to certain projects outlined by President Hotchkiss, of the American Automobile Association, who addressed the meeting at some length.

The traffic department of the association has recently arranged important changes affecting the transportation of automobiles to the South and West. While in the West recently Mr. Marvin, manager of the department, held meetings with the traffic managers of the various factories in and near Indianapolis, Detroit, Chicago and Cleveland. In each place a permanent committee was formed, which committee will hold meetings at regular intervals to discuss traffic details and take suitable action in relation thereto. It is expected that uniformity of opinion and closer co-operation between the factories and the traffic department will result and that a great deal of benefit will be derived therefrom. Further meetings of these committees were held last week. In due course the traffic managers of Eastern factories will be similarly organized.

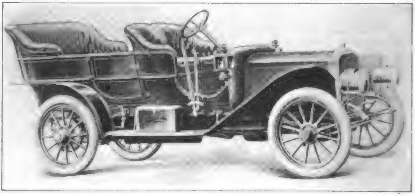
At a meeting of the Board of Managers of the A. L. A. M., held in New York on December 3, E. P. Chalfant, who has been assistant general manager of the association for some months, was elected general manager.

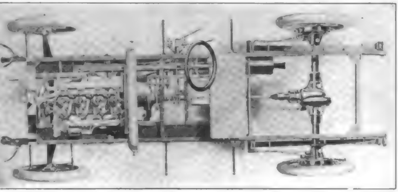
NEW VEHICLES AND PARTS

The Mitchell 1909 Models.

The Mitchell Motor Car Company, of Racine, Wis., will make three models during the season. These cars will closely resemble their predecessors in mechanical features, but their appearance has been considerably improved by the adoption of a new radiator design.

Model J is the smallest car. It has a 92 inch wheel base, standard tread, and 32x3½ inch wheels. The motor is a 4x4 inch four cylinder, water cooled one, rated at 20 horse power. Like previous Mitchell motors, it has a five bearing crank shaft, individually cast cylinders, inlet valves inside pockets, and exhaust valves in the heads. The standard ignition equipment is quadruple coil and storage battery; but the engine is designed so that a magneto can be attached. The change gear is of the selective type, which is a new departure for the Mitchell Company, their previous models having been fitted with the progressive type of gear.


Mitchell Model J.


Mitchell Model K Chassis.

The model K is a popular priced five passenger touring car. Its motor is a four-cylinder, 4¼x4½ inch, rated at 28-30 horse power. The wheel base is 105 inches, the tread standard, and the wheels are 32x4 inches. Magneto ignition is employed, with dry cells in reserve. The other details of construction are similar to those of the smaller car.

The seven passenger Mitchell has a 4¾x5 inch four cylinder motor, rated at 35-40 horse power. Its wheel base is 117 inches, the tread being standard. The wheels are 34 inches in diameter and are regularly fitted with a four inch tire; 4½ inch tires are furnished at an extra cost. The construction of the engine and change gear is similar to that used in the other models. The rear axle is of the floating type, however, and the rear springs are of the platform variety, while on the smaller cars semi-elliptic springs are used all around.

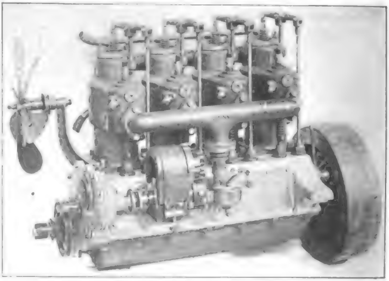
All three models have both seats of brakes on the rear wheels, I section front axles, aproned mud guards, and pressed steel dashes, running boards, battery and tool boxes. These latter are given a finish of baked enamel. The Mitchell Company is continuing its policy of producing medium powered cars in large quantities at popular prices.

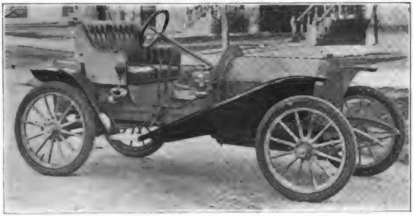
The Hupmobile.

This runabout is manufactured by the recently organized Hupp Motor Car Company of Detroit. It is a rather small car, of the shaft driven, four cylinder type, but its body design closely resembles that of some of the high powered runabouts.

The engine is rated at 16 to 20 horse power. It has a bore of 3¼ inches and a stroke of 3⅜ inches. The cylinders are cast in pairs with their valves in pockets on the left side. The crank case is of the barrel type, but has a large removable cover, which joins the case in the centre plane of the valve push rods, so all the valve parts are easily reached and removed. The crank shaft is drop forged and has three bearings; it is offset three-eighth inch. A vertical tube radiator is employed, through which the air is circulated by a fan spoked flywheel, placed at the front of the engine. Ignition is by jump spark, a Bosch magneto being used to furnish the current. This magneto greatly simplifies the wiring, and, since a fixed spark advance is used, makes the control easier. The fuel tank is at the rear of car, feed being by gravity. The carburetor is carried low to give head even on steep grades.

The change gear case is bolted to the rear of the crank case. It contains the metal to metal cone clutch, which is engaged by a spring and thrown out by a pedal in the


The Mitchell Motor.



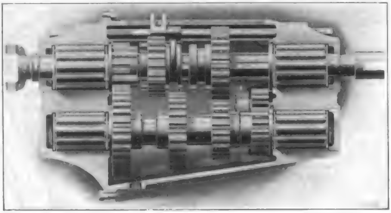
The Hupmobile.

usual manner. The two forward speeds are obtained upon the sliding system, while the reverse is by a swinging gear operated by a sidewise movement of the hand lever.

The drive to the rear axle is through an enclosed propeller shaft with a single universal joint. Centering with this joint is a globe secured to the forward end of the propeller shaft housing. It swivels in a socket formed in the rear end of the change gear case. The lubricant from the case oils the shaft bearings and joints.

The axle shafts run in Hyatt ball and roller bearings. The front wheels are ball bearing. The front axle is of the tubular type, and is dropped outside the spring seats. This drop, taken in connection with the unique spring suspension, allows of the body of the car being hung unusually low without resorting to a dropped frame.

The car is suspended upon three semi-elliptic springs. The front springs follow conventional lines, while that at the rear is placed crosswise of the car to the rear of the axle. Its ends slide on a round bar, which connects the spring brackets, and are held central by helical springs which surround this bar. The middle of the spring is connected to the body by a ball and socket joint. It will be seen from the illustration that the seat is well back, so that this spring carries most of the passenger weight. Since it connects with the body only at one point the passengers are raised only about half as high as usual when one rear wheel passes over an obstruction, and are not tipped sidewise at all.



Mitchell Change Gear.

Steering is by a rack and pinion gear, cross connected to the left knuckle. Throttle control is by a small finger lever under the wheel. A foot accelerator is also fitted.

Two pairs of enclosed expanding brakes act on the rear wheel drums. Both are faced with Raybestos, and all the shoes are interchangeable. The wheel base is 86 inches. Wheels are 30 inches in diameter, fitted with 3 inch tires. A photograph of the car in shown herewith, which gives a good idea of its general appearance. It will be noted that the front fenders connect to the frame, preventing all splashing of mud.

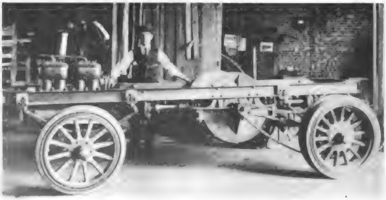
The Pittsburg 2 1-2 to 3 Ton Friction Driven Truck.

The Parr Wagon Company, of Pittsburg and Greensburg, Pa., having been in the wagon business for twenty years, have recently had designed and built a 2½ to 3 ton motor truck, with friction transmission and without differential gear.

The frame is made from a single piece of channel steel suitably bent at the corners and re-inforced; it is 32 inches wide inside and rests on semi-elliptic springs on the front and platform springs in the rear. Both front and rear axle are fitted with Timken roller bearings. The wheels are 34 inches and 36 inches in diameter in front and rear respectively, the front tires being four inches wide, and double 3½ inch tires being carried in the rear. The wheel base is 111 inches and the tread 60 inches.

The truck is fitted with a transmission brake of the expanding ring type, which is operated by the right hand pedal, and also with emergency brakes of the expanding ring type acting on the hubs of the rear wheel and operated by means of a hand lever. It is stated that the combined brake surface is almost six square feet. In addition to these two distinct brakes, the reverse motion may also be used for braking purposes, without injury to it. The truck has a speed range of from two to four miles per hour on the low gear and five to nine miles per hour on the high. The weight of the chassis complete is 4,300 pounds. The standard body has a platform area of 6x10 feet.

The feature of the truck is the friction transmission. Instead of being in the form of discs, working at right angles to each other, the friction members are in form of leather fibre cones, coming in contact with a bevel cast iron wheel, on a jack shaft, the other end of shaft carrying the



The Pittsburg Truck Chassis.

sprockets and chains for transmission to the rear wheels. The accompanying sketch shows the arrangement.

The shaft from the engine is connected by an Oldham coupling to a shaft extending into the gear case. This case contains a set of gears constantly in mesh, which impart opposite motion to two parallel shafts, running lengthwise of the frame and carrying each three friction cones. The front cone gives the reverse motion to the truck, the intermediate cone the high speed and the rear cone the slow speed.

These cones act in pairs, being thrown in and out of contact by means of an equalizing bar, which is controlled by a lever from the driver's seat. Two levers are employed for this purpose. One, a foot lever, controls the reverse and a brake, and the other, a hand lever, the high and low speeds forward. The latter is so arranged that high and low cannot be thrown in at one time.

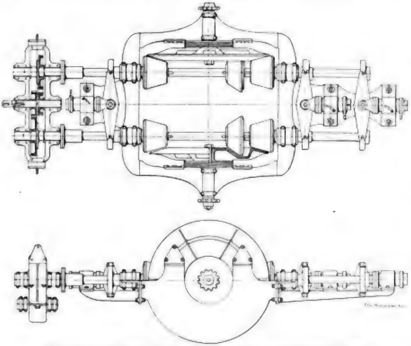
It is claimed for this transmission that it cannot become a source of worry nor of expensive repair bills in the hands of an unskilled driver. There are no gears to strip nor shafts to bend, and shocks and jars of transmission cannot be imparted to the car.

In taking care of the work the cones slip some at first, but gradually pick up and carry the load and with comparatively light pressure—a very slight pressure by the hand or foot suffices, it is claimed. In rounding corners, this same slippage occurs, one bevel slipping forward, slightly ahead of its cone, and the other slipping a little behind.

We are informed that the first truck of this form has been purchased by James A. McAteer & Sons, Inc., a wholesale grocery firm of Pittsburg, who at present employ eight to ten double teams, and whose hauling extends to a radius of ten or twelve miles from their warehouse. Pittsburg is a very hilly city, grades of 8 to 10 per cent. being common, so that the truck and particularly its transmission will receive a very severe test there.

THE PITTSBURG FRICTION CONE DRIVE

The Parr Wagon Company expect to start work on a lighter model—a 2,000 pound capacity wagon—as soon as design can be finished. They are also commissioned to proceed on two more trucks of three ton capacity for James A. McAteer & Sons, Inc. The Parr Wagon Company control the patents covering this friction transmission and expect to build buses as well as delivery wagons and trucks.



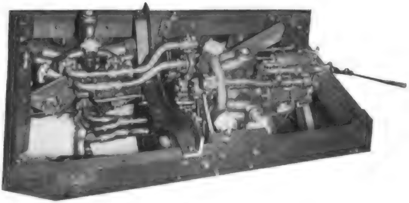
ELEVATION AND PLAN VIEW OF FRICTION DRIVE OF PITTSBURG TRUCK

The Manly Hydraulic Drive.

The Manly Drive Company, Whitehall Building, New York city, have brought out a hydraulic drive for commercial automobiles. The inventor, C. M. Manly, has been working on the problem of a hydraulic drive for nearly three years, and has constructed several such drives during that period. The present form has been given a tryout for some time on a truck with a permanent load of 8,800 pounds. The accompanying illustrations show a 48 horse power model intended for service upon a five ton truck.

The main parts of the Manly drive are a pump and one or more motors. The car engine operates the pump and the fluid under pressure is sent from this latter to the motor, and after having done its work there it is returned to the pump and used over again. In previous hydraulic transmissions rotary pumps, by-passes or auxiliary receivers were used, which are claimed to be wasters of power, and the greatest difficulty with systems incorporating such devices is said to have been lack of sufficient pressure for starting, pulling out of holes, etc. This difficulty is claimed to have been eliminated in the Manly drive, where pressures as high as 2,000 pounds and over are claimed to have been attained in actual road service.

Referring to the illustration, the pump X consists of five cylinders B, B, B, arranged at equal angular distances around the main casing A, and the valve box C. A shaft driven by the engine runs within the casing A and is provided with a short stub or prolongation which can be moved out of centre with regard to the axis of the shaft. Upon this prolongation are fas-



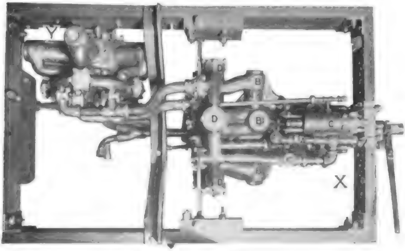
Manly Hydraulic Drive.

tened five connecting rods attached to pistons working in the cylinders B, B, B. Each cylinder is provided with a piston valve working in a chamber D which controls the admission to and exhaust of oil from the cylinder, as in steam engine practice. The chambers containing these piston valves are united by suitable piping and communicate with the leads from the pump to the motor or motors. The valve box, which is placed on top of the main casing, contains a reversing valve, by means of which the flow of the fluid may be reversed in direction, enabling the reversal of the motors, and consequently of the car or truck to which the drive is fitted. A mechanism operated by pressure for varying the eccentricity of the stub and a safety valve complete the fittings within the valve box C.

The motors Y, only one of which is shown connected up in the illustration, will be seen to be nearly identical with the pump externally, but the fluid forced from the pump acts upon the pistons within the five equally spaced cylinders and drives the shaft upon which they act. This shaft in actual practice projects below the truck main frame and is fitted with a sprocket at its outer end which drives the corresponding road wheel by a chain. The crank upon which the motor connecting rods act has a constant throw, instead of a variable throw, as the pump crank. The motor is likewise fitted with piston valves working in chambers similar to those provided for the pump.

The forward and reverse movements of the motor are governed by the direction of the flow of the fluid within the pump, piping, etc., the fluid used in this case being oil. The mechanism for varying the eccentricity of the stub, and consequently the throw of the pumps, is controlled by the movement of a single lever, seen at the right of the pump in the photograph. A linkage connected to this lever enables the reversing valve to operate when the lever is moved beyond a certain point. The safety valve is set at 2,000 pounds and relieves into the main casing, which is half full of oil at a low pressure, the oil being used as a lubricating bath for the rotating parts and also as a reservoir from which oil for transmitting is taken. A similar arrangement is made in each motor. The correct level is maintained in the main casing A by a gear pump, which draws off any surplus oil and pumps it to the valve box by means of a small lead seen entering the box at the left hand side. This pump is located on the end of the casing and is driven from the end of the main shaft.

The car engine is run continuously and revolves the main shaft of the pump. The throw of the pistons in the five pump cylinders is nil when the car is at rest. The oil, which fills the cylinders, the piping and leads of the pump and the corresponding parts of the motors, is at rest, and having no outlet, acts as a brake on the motors. This position of the pump control lever is known as the "braking position," the lever being then at the centre of its arc of motion. As the control lever is moved away from this position the throw of the pistons is varied and the pump pistons start pumping, drawing the oil from the piping and sending it to the motors which it drives. The greatest torque is exerted when the throw of the pumps is almost zero, which corresponds to the starting position, and the least when the throw is a maximum. As the pistons pump the oil, lubrication is provided for by leakage past the pistons, the oil dropping to the interior of the main casing. The oil returns from the motors to the pump at a lower pressure and is used again. The car is stopped by reducing the stroke of the pump pistons to zero, when the circulation ceases. When the control lever is moved into the reversing position, the reversing valve acts, changing the direction of the oil flow to the motor, which then runs in the reverse direction. The motors may be reversed while the truck is moving forward, but it is said that no great strains are put upon the drive nor upon the truck by so doing. Certain details of the valve mechanism, reversing valve and other parts have not been made public by the company.



Manly Hydraulic Drive.

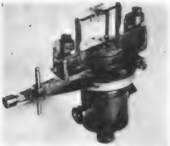
A representative of The Horseless Age was given a short ride upon a truck fitted with the Manly drive, and loaded with 8,800 pounds of dirt and stone. The passage from one speed to another and from full speed to the neutral or braking position was accomplished with great ease and without shock, although the strain on the running gear must have been considerable. The driver was able to follow another vehicle for a considerable distance, keeping the truck very close up and regulating its pace to suit that of the first. The movement of the control lever was easy and the truck responded quickly. The truck engine was run at a regular speed which was only varied twice, when it was desirable to pass another vehicle previous to entering upon a narrow street. Braking was done entirely through the drive and sidechains. The company claim that a truck or car fitted with the Manly drive can be handled with great ease by an ordinary truck horse driver, which tends to lower operating cost.

The Horseless Age

The Parish & Bingham Pressed Steel Running Board.

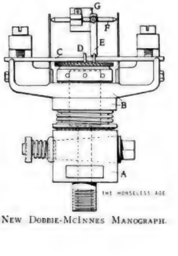
The Hopkinson Flashlight Indicator.

A new form of flashlight indicator for explosion engines has been placed on the market in England, by means of which either optical or permanent diagrams can be obtained. This apparatus employs a projected beam of light for indicating the diagrams, similar to the Hospitalier and Schultze indicators. As shown in the illustration, block A is a screw plug, which is screwed into the regular indicator pole of the engine cylinder. The upper end of this plug is bored to receive a piston. Yoke B is free to rotate on A and is fitted with a sufficient clearance to allow for any unequal expansion; it is held up by the helical spring between the ends of which are interposed ball thrust bearings to permit of the free rotation of B. To the outer ends of B is secured the spring C and to the centre of the latter is secured the piston of the indicator by hook D. To spring C is also secured spindle F, to which is secured the mirror G, by the spring E, in such a manner that any vertical movement of E rocks G in a vertical plane.

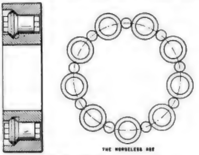


Dobbie-McInnes Manograph.

The operation is as follows: The pressure in the engine cylinder pushes the indicator piston upward. This vertical movement is communicated to the spring C and in turn to the mirror G. In this manner a beam of light, obtained from a four-volt electric lamp placed behind a narrow slit through which the light is thrown onto the mirror, is projected in a vertical plane, according to the pressures within the engine cylinder. To give to the mirror G the relative piston movement in synchronism with its cylinder pressure movement, B is secured to a reciprocating part of the engine in such a manner as to rotate it in a horizontal plane around the axis of A, and the beam of light traces the diagram on a suitable screen. Where a permanent record is desired a special camera is secured to A and on its sensitized plate the diagram is traced, or a ground glass screen can be used and an optical diagram obtained. A special telescope is made, however, for optical diagrams. With the indicator is supplied one concave mirror for use with the camera, one flat mirror for use with the telescope, a collar for securing B to the reducing motion, two springs and three pistons and liners. These pistons bear to each other the ratio of 1:2:4 and are used with liners in the bore of A. The maximum pressures which may be recorded with the different pistons are: large, 218 pounds; medium, 437 pounds; small, 875 pounds. This indicator was designed by Prof. P. Hopkinson, of Cambridge University, England, and is being manufactured by Dobbie-McInnes, Limited, 57 Bothwell street, Glasgow, Scotland.



New Dobbie-McInnes Manograph.



Bower Roller Bearing.

The Bower Roller Bearings.

Besides a wide variety of other sizes the Bower Roller Bearing Company, of Dayton, O., are manufacturing a line of bearings which are interchangeable with the standard types of annular ball bearings. That is, they have the same diameters, inside and outside, and the same lengths. These bearings are similar in construction to their longer types.

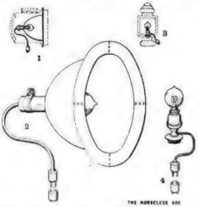
The main part of the rollers is cylindrical, but their ends have a conical enlargement one side of which bears against the outer race while the other side makes contact with the inner race. This latter takes the end thrust. It will be seen that while the bearing provides for thrust in one direction it is not adapted to take pressure the other way, so when there is thrust in both directions the bearings must be used in pairs.

The rollers are maintained in their proper positions by a cage composed of two flat rings held together by round cross pieces riveted in place. One of these rings is notched on its circumference, the notches reaching in to the holes for the rollers, so that a roller may be replaced should one of the projections on its end be broken. It is stated, however, that no case of breakage has occurred up to the present time. Rollers and races are made from alloy steel, carefully ground. Indeed, in a bearing of this design very careful workmanship is imperative.

The Parish & Bingham Pressed Steel Running Board.

The Parish & Bingham Company, of Cleveland, Ohio, are supplying the type of running boards shown in the sketch for a considerable number of 1909 cars. The metal is about one-eighth inch thick and is turned down one-half inch along each edge, which adds to the stiffness and appearance. The main surface of the metal is punched full of diamond shaped holes, which make the board light and give the appearance of latticework. Those portions of the board which are used as steps are roughened with a prick punch.

These running boards are light, neat and sanitary. On account of their being per-



Figs 1 and 2.—Electric Headlight Attachment.

Figs. 3 and 4.—Electric Side Light Attachment.

forated only little mud adheres to them. They are made to exact size, so that they are easy to apply to the car. A neat connection may be made with the fenders in any of several ways. Since the boards are complete in themselves, and do not require any matting or binding, they save enough in assembling so that when in place on the finished car they probably cost less than the old type of wood boards.

The Willard Electric Lighting Attachments.

The attachments shown by the accompanying figures are made by the Willard Storage Battery Company, of Cleveland, to be placed in the ordinary acetylene lights. They can be readily installed by any good workman.

As will be seen by referring to Figs. 1 and 2, the headlight attachment consists of a parabolic reflector made of polished metal and its rear end is furnished with a socket for the small tungsten lamp. Suitable cable and connectors complete the equipment. The reflector is soldered or bolted in place, whichever is most convenient, according to the style of lamp to which it is attached.

For side and tail lamps the equipment consists of suitable sockets, which screw into the base in place of the oil burners, cables and connectors. The tail lamp may be wired in series with a detector lamp on the dash, so that the driver is instantly warned if the tail light goes out.

On account of the use of the parabolic reflector, which, as is well known, is very efficient, these headlights are claimed to compare very favorably with gas headlights in the amount of light they project. Since the incandescent bulbs do not give off any fumes, and are comparatively cool, these reflectors do not require frequent polishing.

The low voltage tungsten lamps used have a short, comparatively thick filament, supported at the ends and at the middle. These filaments are said to stand vibration very well. The design is entirely different from that of the ordinary tungsten lamps of higher voltage and was developed by Mr. Willard by a long series of experiments. Electric current for these lights is, of course, supplied from a storage battery, which may also be used to supply ignition current.

NADALL DETACHABLE RIM.

The Nadall Demountable Rim.

This rim is unique among its class in that it does not differ markedly in appearance from standard non-demountable rims, and that it can be applied to existing wheels and tires of any type.

The wheel felloe is furnished with a flat steel band. Surrounding this with a clearance of one-eighth inch or less is an ordinary rim of either the clincher, quick detachable or other type. Several large keyways, similar to those for a Woodruff key but flatter, are milled in the outer rim. The inner rim is provided with suitable pockets in which these keys nest when the tire rim is to be removed. When it is in place the keys may be forced into the corresponding keyways as tightly as need be by turning a screw lug, which resembles an ordinary lug in appearance. These screw lugs are absolutely locked in any position, and they hold the tire rim firmly against any side play. It is held from creeping by two large pins, one on each side of the valve stem, which fit in sockets in the inner rim. This rim has the advantages over many demountables of being lighter and of using standard rims, casings and tubes. All parts which might rust are amply protected and grease packed.

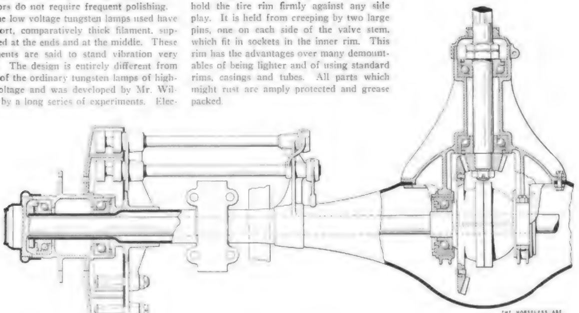
The McCue Rear Axle.

The pressed steel housing made by the McCue Company, of Hartford, Conn., for their floating type axle is a novel construction. The housing is rolled up out of a piece of sheet steel having a longitudinal weld in front for its entire length. It is different from other steel housings in that it has no cross sectional welds. It is so shaped that it is a truss in itself, making a truss rod wholly unnecessary. From the line cut it can be seen that the housing tapers from centre to ends, thus presenting a symmetrisal appearance, and at the same time prividing great strength.

The longitudinal weld is made by the autogenous process, and is said to be from 75 to 90 per cent. as strong as the solid metal. This housing is similar in construction and manufacture to a rolled tube, and is claimed to be strong enough, so far as carrying capacity is concerned, to be used without welding, as it is firmly held in shape by the brake spiders, spring seats and brake rod brackets, but to make it perfectly oil tight it is necessary to weld it.

Aside from the new housing the McCue axle has some other interesting features. It will be noticed that the floating axles are integral with the hub clutches. These driving shafts are made of .45 per cent. carbon steel. The clutches are correctly milled and hardened, and engage the outer ends of the hubs close up to the bearings, making their grip positive, with no tendency to twist, and at the same time permitting the hub end to be covered with a short hub cap.

The differential is of the bevel pinion type and is securely held in place to the gear case cover, and the latter is securely held to the axle housing by twelve bolts.



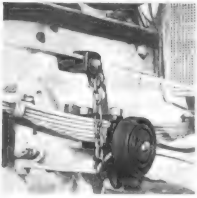
McCUE REAR AXLE.

The gear case cover is made with six ribs and with or without torsion rod brackets.

Large ball bearings are used throughout. The brake drums are of pressed steel, 10 and 14 inches in diameter. The brakes are expanding, and both have asbestos lining. The pedal can be connected to the large drum, giving the maximum wearing and braking surface to the brake which is constantly used. The brake rods extend inside of the frame, permitting of the connections being made under the car and doing away with long brake rods running along the side of the car.

The Recoil Check.

This new shock absorbing device is manufactured by the Spring Strap Company, of 3 Huron street, Chicago. It consists of a good sized spiral spring which is clamped to the regular spring near its centre. The outer end of the spiral is fastened to the clamp, while to its inner end is secured the lever which connects to the frame by the chain. Fastening to the frame is by a wedge clamp drawn up by a through bolt. This device effectually prevents excessive rebound of the springs, and it is given sufficient tension so the chain is always taut, even when the frame of the car is lowest. It is easily applied, as there are no holes to drill whatever.



Recoil Check.

This company also makes a rebound strap for axles which has a compression spring in each side, and a spring for bonnet straps which keeps them under a constant tension so that the bonnet will not rattle.

Grangers Adopt Resolutions Regarding Automobile Speeds.

The Oneida Pomona Grange, at a meeting held in Rome, N. Y., on December 3, adopted the following resolution:

"Whereas, The automobiles are ruining our good roads by traveling at an excessive rate of speed, thereby endangering life and property,

"Therefore be it resolved, That we request the board of supervisors to use their influence to enforce the law regarding the speed limit of 20 miles an hour and not to exceed 4 miles wheen meeting or passing teams, by a penalty of thirty days' imprisonment for the first offense and sixty days' imprisonment for second offense."—George B. Smith, master; Olin B. Lawton, secretary.

At a meeting of Floyd Grange No. 665, held November 28, the following resolutions were adopted:

"Whereas, The automobiles are ruining our good roads by traveling at an excessive rate of speed, thereby endangering life and property, therefore be it

"Resolved, That we request the board of supervisors to use their influence with the Legislature to enact a law reducing the speed limit not to exceed 15 miles an hour and not to exceed 4 miles an hour in passing or meeting a team, with a penalty of thirty days' imprisonment for the first offense and sixty days' imprisonment for the second offense."

The Denver Show.

The first annual automobile show of the Denver Motor Club will be held at the Auditorium, Denver, on Tuesday, Wednesday and Thursday, February 16, 17 and 18, 1909. The show will be under the direct management of the show committee, consisting of Ralph W. Smith, chairman; C. P. Allen, Dr. E. F. Dean, George E. Turner and Dr. W. H. Sharpley.

The committee will mail application blanks and floor plans December 1. It is stated that applications already on file will take up the major portion of the 16,000 square feet of available floor space. The main floor will be reserved for the exhibit of complete automobiles. On the Curtis street side of the main floor there will be two elevated platforms called the Terraces. These and the larger boxes will house the motor cycles and the parts and accessories dealers.

A. A. A. Membership.

The report of Secretary Elliott, of the A. A. A., presented at the recent annual meeting, showed that during the past year only twenty-four sanctions for track meets were granted by the racing board as against fifty-two in 1907; while on the other hand twenty sanctions were granted for hill climbs as against five the preceding year. In the matter of membership the national body now has twenty-five State associations as against sixteen a year ago, and 187 clubs as against 132 then, while the official membership of its present clubs was then about 17,000 and is now upwards of 20,000.

Virginia Automobile Clubs Favor Taxation for Road Building Purposes.

The suggestion made by owners of automobiles that a tax of $10 per annum be placed upon each machine within the State, and the sum thus obtained by the Commonwealth be expended in improving the country roads, is meeting with great favor everywhere, and it is probable that a bill will be introduced and passed by the next General Assembly attaining this end.

Special effort is being made to secure the building of a highway between Richmond, Petersburg and Norfolk, and the automobile clubs of all three of these cities are much interested in the movement. Even farmers along the route are being seen by the motorists, and up to the present they have been found to be heartily in favor of the movement, not only because of the convenience good roads will be to them personally, but also because of the inevitable increase in the value of property along the route. It has been shown that in Mecklenburg County, N. C., property values have increased 60 per cent. since good roads were built throughout that county, and it is maintained that in Virginia values will increase in the same proportion when the roads are made more passable.

Curious Cases of Rattle and Knock.

A real estate man after having driven his car for some time noticed that when starting off or running on first speed just before "changing up" a rattling noise came from the car, apparently from under foot. He accordingly removed the footboards to investigate, but could find nothing that seemed loose but the brake pedal, which was capable of a slight motion sideways. Upon putting on the footboards and starting up the rattle commenced again, but, as in the former case, it did not keep up after the car was well under way. Upon investigation it was found that the slot in the footboard in which the pedal worked was quite narrow at the point where the pedal rested when the clutch was in, and when the motor was speeded up the vibration caused the pedal to tap the sides of the slot, causing the rattle. Widening the slot and fixing the pedal more rigidly prevented the recurrence of the noise.

Probably the last place in which a motorist would look for a knock would be the muffler, yet such a thing occurred recently. This knocking also occurred when the motor was speeded up, with the clutch out or when changing gears. Every part of the car was examined in an endeavor to locate the knock, until at last the muffler was taken apart. It was made up of a series of baffle plates, pierced with holes and placed close together. One of these had become loose and struck against the adjacent one when set in vibration by the rapidly turning motor. The plate was fixed in place by riveting a flange on it and fastening the flange to the muffler casing.

Electric Vehicle Company Business to Be Continued.

Judge Lanning, in the United States Circuit Court, at Trenton on November 30, signed an order authorizing Halsey M. Barrett, of this city, and Henry W. Nuckols, receivers for the Electric Vehicle Company, automobile manufacturers at Hartford, Conn., to continue the business of that corporation after December 31.

COMMUNICATIONS

The Pump Circulation Oiling System.

Editor Horseless Age:

I read with a great deal of interest the article on "The Engine Lubrication Problem," by Herbert H. Rice, in your issue of October 14. Having now in use my third car in which the oiling system referred to by him is employed, I think I am in position to speak with some knowledge concerning it.

It is generally conceded that the lubrication is the factor which has perhaps the greatest influence on the wear and tear and the durability of the engine, and it is indeed strange that automobile engineers generally should have so long neglected it, or should be satisfied to use the rather uncertain devices in general use. I have been a constant reader of your valuable paper for the past eight years, and can recall many editorials by you on this subject. It is a fact that most motor repairs are occasioned by the failure of the lubrication system to work at a time when most needed. This statement can be verified by a visit to almost any repair shop. I bought my first car (with air-cooled motor) in 1904. I drove this machine about twenty miles in two years and sold it. This motor was equipped with the pump circulation oiling system, and in all this time the motor never had a single hot bearing. I had other motor troubles such as are common to all motors, but never any trouble whatever from the lubrication system.

In 1906 I bought another air-cooled car of the same make, of increased horse power and larger carrying capacity, having the same lubrication system. I kept this car for two years, selling it this spring and buying another of the same make, water cooled this time, but of still greater horse power and capacity. This latter car also had the same oiling system as the 1904 model. I consider this system more economical in the use of oil than any other system in use at the present time. E. C. A.

Insurance That Does Not Insure.

Editor Horseless Age:

The Court of Appeals of the State of New York has recently enunciated an opinion of some importance to owners of motor cars who think they have some insurance. The case is Preston vs. Ætna Insurance Company, decided October 13, 1908. The standard insurance policies of this State covering automobiles contain a clause reading: "It is understood and agreed that this policy does not cover loss or damage caused by fire originating within the vehicle."

In the decision referred to the court held in a case where gasoline escaped from the tank and was fired after it escaped, that the fire originated within the vehicle, and that the word "within" was used as the antithesis of "without," and that to make the insurance company liable the word "interior" should have been used.

It may be that the standard forms of policies in other States contain the same clause.

This decision substantially avoids all insurance in such cases, and it is useless for automobile owners to pay insurance premiums. Myron T. Bly.

Concerning Calcium Carbide.

Editor Horseless Age:

I have read the article on "Statistics of Rare Minerals," by Morris A. Hall, in your last issue. Mr. Hall's remarks concerning other "rare minerals" may be quite accurate, but he is evidently out of his legitimate sphere in his remarks concerning calcium carbide. As he says this is a "soft, bluish-gray powder," it would indicate that when Mr. Hall gathered his information he looked into the wrong end of a generator, and sampled the spent lime in mistake for the carbide. Anyone who has tried to break up with a hammer and anvil the big heavy lumps of carbide, as used in the large commercial generators, and afterward nursed his bruised fingers, will smile at Mr. Hall's conception of a "soft bluish-gray powder."

Mr. Hall also says that "formerly this gas was generated in special generators, the user buying his own carbide," and that now the "accepted method is to buy the gas in storage tanks." Mr. Hall may be a heavy stockholder in some storage tank company, but he is away off on his views, for, while a great many gas tanks are in use, by far the larger portion of automobiles are equipped with generators, the output this year being probably over 10,000 generators in this country alone. Far from being the accepted method, it has been demonstrated conclusively that the pressure tank is of altogether too limited capacity, and the expense and annoyance of renewals is too great, and for cars equipped with the largest size headlights required for frequent long runs, generators of the best type are much more reliable than storage tanks. They give the gas at constant pressure from start to finish, whereas the pressure tank requires constant readjustment of reducing valve as the pressure falls.

Common carbide may now be had anywhere in the country at from 3¼ to 7 cents per pound, and even at the higher retail price the gas is produced at a mere fraction of the cost of the storage gas. Many people suppose that the pressure tank requires less labor than the generator, but on actual observation the total expenditure of time in attaching the tanks, making pipe connections, continually walking back and forth between the lamps and reducing valve to keep the flames at the right height, figures up fully twice the number of minutes required for recharging, lighting and extinguishing the lamps where proper sized generators are used. A man will spend $30 for a gas tank weighing 40 pounds and will then compare it with a $12 generator weighing 13 pounds, and complain that the generator requires too frequent charging. Let him fit his car with a properly constructed generator of ample size and the "accepted method" with him thereafter will not involve a pressure tank.

S. W. Rushmore.

Explosion Engine Queries.

Editor Horseless Age:

Will you kindly inform me through your paper what should be the dimensions of valves and flywheels for 3x3½, 90 degree twink cylinder motor, and how many revolutions per minute should motor be run at to develop the most power? Flywheels to be enclosed in aluminum case.

F. W. Collett.

[The valves should be of 1⅛ inches or 1¼ inches clear diameter and lift five-sixteenths of an inch. The motor would probably operate to best advantage at about 1,800 revolutions per minute, although the maximum power will probably be obtained at a somewhat higher speed.—Ed.]

Speed Limits in New York State.

Editor Horseless Age:

One of your subscribers was stopped near Echo Lake, Westchester County, New York, and his driver fined for exceeding 4 miles an hour on the curves and bridges south of the lake. As no one I have related this circumstance to had any idea that such a ridiculous law existed, I would feel thankful if you would publish the legal speed limits, so as to warn the ignorant.

An Old Subscriber.

[The speed limits are 20 m. p. h. on unobstructed country roads, 15 m. p. h. in the outskirts of towns and cities, 10 m. p. h. in closely built up sections, and 4 m. p. h. on curves, bridges and steep descents.—Ed.]

Chase Commercial Vehicles to Be Built on Larger Scale.

The Chase Motor Vehicle Company, of Syracuse, N. Y., who about a year ago purchased the former Sweet steel mills in South West street, have recently developed plans for largely increasing their output the coming year. W. D. Durphy, of Ithaca, secretary of the company, will take charge of the selling and advertising departments. The company now employs about fifty men, but will begin to increase its force at once. They will confine themselves entirely to commercial vehicles, including delivery wagons, trucks and road rollers. A company is to be organized in New York city for handling the Chase vehicles there.

The Austrian A. C. is completing arrangements with a large foreign insurance company which will enable it to offer members accident insurance, as required under the new Austrian motorists' liability law, at premiums 40 per cent. lower than those fixed by the associated Austrian insurance companies.

LEGISLATIVE and LEGAL

Auto Homicides—Preventives and Remedies.

By Xenophon P. Huddy, LL.B.

The large number of deaths recently caused by automobiles is engaging the serious attention of the public authorities and automobile associations. The situation is one of *extremis*, and is justly alarming to the public and automobilists. An effort is being made to devise ways and means to stop this distruction of human life, but will anything be accomplished?

Officers of automobile clubs are holding meetings in star chambers, high public officers are making investigations, and the automobile regulations of France have been suggested for adoption in the United States as a remedy for the evil. Counsel of the American Automobile Association publicly asserts that the present motor vehicle law of New York is sufficient if enforced. I am compelled to differ with this gentleman, notwithstanding his extensive experience in automobile legislation and legal matters. The present automobile regulations in the State of New York are entirely inadequate for the protection of the public, and because other State laws have been framed after the New York statute they, too, are radically defective from the standpoint of present needs. Before automobilists seek to procure additional rights and privileges, it would be well to cure the existing evils.

What is the matter with the New York law and other similar State motor vehicle laws? It has many defects. First, the registration system in New York is nugatory. Cars need not be registered and numbers need not be carried. We have no legal identification system in this State, because the motor vehicle law fails to make a violation of the registration requirements a crime. The fine to be imposed in such cases can only be collected by a civil suit brought at the instance of the Attorney General. Eliminating the registration regulations of this law and all dependent provisions, we have very little left except the speed limitations. These limitations will not be obeyed unless they are known and respected by automobile drivers. The New York law does not restrict the granting of drivers' licenses in any way; anybody may obtain one, without respect to qualifications. This is certainly a most unhealthy condition of affairs, yet we hear it asserted that the motor vehicle law "is all right"!

Our automobile legislation is all wrong. We should require a qualification test of the driver, no matter whether he is an owner or a chauffeur. There should be three distinct subjects of examination for drivers; namely, physical fitness, road management and mechanical ability. Eyesight, hearing and heart action should be covered by the first qualification, the rules of the road and knowledge of the regulations by the second, and by the third mechanical training. We should have a motor vehicle commission composed of men who understand their duties and the requirements should be real instead of formal as they are in New Jersey today, in which State there is now, in many respects, a fairly good law, but the provisions thereof are devoid of any real worth because of the *pro forma* compliance therewith. Proper legislation can be framed if the right parties undertake the task, but it cannot be expected that we will ever have efficient automobile regulations if they are put through by enthusiastically blind automobile men who will not or cannot look the situation squarely in the face and see what is needed, not only for their own benefit but for the good of the public. Eliminate the star chamber deliberations and the circulation of public safety circulars, and let us hold a mass meeting for all concerned, and let us hear from the judges, police officials and automobilists who know what can be done. Carnegie Hall would hardly hold all who would attend such a meeting, and it is more than likely that resolutions passed at a meeting of this kind would be respected at Albany during the coming legislative session.

Test Case Against Taxicabs.

Police Commissioner Smith, of Detroit, Mich., on December 5 brought a complaint against Irvin S. Scrimger, manager of the recently established Detroit taxicab service, for violating the cab ordinance. The action is said to have been taken at the instigation of the horse cab drivers, who objected to the new vehicles not having licenses and occupying stands in front of cafés while they are compelled to stand at the city hall and pay a license. The taxicab company informed the corporation counsel and the commissioner that they couldn't comply with this ordinance, which prescribes fares under which they could not afford to operate. At the same time it was maintained they were demanded by the people as a modern necessity. The commissioner and counsel could not see any way out of the observance unless the ordinance was amended, or a new one drawn up covering the taxicabs, and it was decided to institute a test case.

At a conference with the commissioner Thursday of last week Ransom G. George, attorney for the taxicab company, said the machines would be withdrawn from the streets until the matter was settled. They were taken off for one day, reappearing again Friday night, hence the action referred to.

Legal Notes.

The city of Chicago has brought suit against 130 more automobile owners who have failed to pay their wheel tax. The police of the city are also stopping all drivers who are not displaying the tag showing that the tax has been paid, and notifying them that unless they pay within forty-eight hours suit will be brought against them.

Frank C. Chambers, a motorist of Spokane, Wash., is suing the city for $15,000 damages, as the result of an automobile accident sustained by him on Ide avenue recently, which he claims to have been due to the unsafe condition of the avenue. His car on that occasion plunged down a steep bluff, killing one woman and injuring two others.

A verdict of $12,000 was given last week to the administrator of the estate of Ben Waller, Nashville, Tenn., against the Nashville Motor Car Company, James Baird and Duncan R. Dorris. Waller lost his life as the result of being run over by Fred Johnson, a negro chauffeur in the employ of the Nashville Motor Company, who drove Baird's car. Johnson was convicted of manslaughter and sentenced to four years in the penitentiary.

H. Bradford Lewis has secured a preliminary injunction restraining Reginald De M. Wentworth from receiving, drawing or transferring any money or stock due him from the Taxicab Service Company of Boston. Lewis shared with Wentworth in the promotion of the company, and says that he spent about three months last spring introducing Wentworth to capitalists, for which service Wentworth agreed to share the profits with him, which, however, he has failed to do. Lewis claims that twenty shares of stock in the Taxicab Company, which were transferred from Wentworth to Harlan W. Whipple, of Andover, should have been transferred to him.

New Jersey Club Expels E. R. Thomas.

The New Jersey Automobile and Motor Club, of Newark, N. J., after postponing the hearing on the matter a number of times, on Monday, December 7, decided to expel E. R. Thomas, the New York turfman, for reckless driving of his car at Long Branch on August 14. Thomas is still suffering from the accident which occurred at that time. An eye witness of the accident, named Cohen, testified before the club's board of trustees that Thomas was driving at between 80 and 90 miles per hour at the time. The board held a star chamber meeting lasting from 8:30 p. m. till 1 p. m., at which Thomas was represented by Charles I. McBurney, a New York lawyer. The club is to be congratulated on its action.

According to a German consular report, there has been an appreciable increase in the import of automobiles into Russia during 1907. A Russian automobile industry does not as yet exist. The imports of pleasure cars seating four or more persons doubled as compared with 1906, and the imports of motor trucks increased from 17 in 1906 to 147 in 1907. It may thus be seen that there is quite a demand in Russia for commercial vehicles. The majority of the pleasure cars imported were of French manufacture.

Commercial Applications.

Commercial Notes.

N. P. Collins, Olean, N. Y., is operating a motor bus line between the depot and local hotels. A fare of 10 cents is charged.

The city of New York now owns 231 automobiles, which are used by officials and in the work of the various departments.

The city of Milwaukee has decided on the purchase of a 40 horse power Locomobile for its police department, at a cost of $4,600, fully equipped. There were a score of bids.

C. F. LeBrock, R. F. D. carrier No. 14, Burlington, Ia., has recently begun covering his route with an automobile. The roads on the outskirts of Burlington are said to be generally in fair condition.

An automobile service is planned between Brady and Menardvile, Cal., by Daniel Benchoff and Joe Decker, both of Menardville. They will use a six passenger car and make daily round trips, beginning at Christmas.

City Clerk Trotter, of Pomona, Cal., has advertised for bids on a motor truck of 50 horse power, with 120 inch wheel base and 36 inch wheels, and capable of carrying a load of 3,000 pounds at a speed of 35 miles per hour. The truck is intended for a combination hose wagon and chemical engine. Bids must be submitted at once.

A motor express service is shortly to be inaugurated between Detroit and Trenton, Mich. Three trips will be made per day. The promoters plan to establish depots in Detroit and in the various suburban towns to be connected, and figure especially on the patronage of tradesmen in these various towns who receive their goods from Detroit.

The Indianapolis Parcel Delivery Company, Indianapolis, has purchsed a second gasoline delivery wagon for the delivery of small packages. The company delivers considerable express matter in districts not reached by the express company wagons, and contemplates purchasing several additional motor vehicles in the near future.

The Board of Police Commissioners of Richmond, Va., at a recent meeting awarded the contract for a motor patrol for the First District to the American Locomotive Automobile Company, which offered a nominal $6,500 car for $3,500. Offers were also received from the H. H. Franklin Manufacturing Company and the Rapid Motor Car Company representatives.

An automobile service between Phoenix, Tempe and Mesa, Cal., is being promoted by Harry J. Bennett, who has recently secured the co-operation of Dr. J. M. Ford, of Los Angeles, Cal. The road is to cost about $250,000, and it is stated that $65,000 of the stock has already been subscribed for. A special bridge is to be built across the Salt River at Tempe.

A consultation was recently held between a delegation of Woodland, Cal., citizens, Senator Marshall Diggs and Passenger Agent J. H. Stone of the Southern Pacific Railroad, with the object of inducing the railroad company to establish a motor car service between Woodland and Sacramento. The population of Woodland desires a service of two round trips per day.

Postmaster David C. Owen, of Milwaukee, has just returned from a trip to Washington, D. C., where he conferred with the Post Office Department's heads regarding an extension of the motor mail distributing and collecting service now in operation in Milwaukee. It is intended to give West Allis and other big manufacturing suburbs three or four deliveries daily.

As an instance of the use of solid tires on a vehicle of very high speed ability, the Swinehart Clincher Tire and Rubber Company, of Akron, Ohio, inform us that they have just accepted an order for two sets of their solid cushion tires for the motor propelled fire combination wagons of the Vancouver, B. C., department, and have given a guarantee that these tires will give satisfactory service at a speed of 35 miles per hour.

The new automobile for the collection of mail from boxes in the outlying districts of Indianapolis, which has been building at the works of the Overland Auto Company for some months, will shortly be placed in service. A contract will be made with the automobile company for furnishing a driver for the car, and the collection of the mail will be attended to by the regular carrier.

William V. Moore, fire commissioner of Detroit, is trying to induce the council to pass an ordinance forbidding the use of siren horns on automobiles. It is claimed that the sound of these horns is so similar to that of the whistles used by the fire department that people are not clearing the way for the fire apparatus as well as they did before the horns were introduced. Several serious accidents are laid to this cause.

Bids of $1,650 each have been received by the Indianapolis Board of Public Safety for a truck to be used by the fire alarm system of the fire department. There are four bids, three from manufacturers of gasoline trucks, the other from the manufacturers of an electric truck. So far the three board members have been hopelessly divided on the question, except that they have decided they do not want an electric truck. Each member is in favor of a truck of a different make.

According to figures presented at a recent council meeting in Leavenworth, Kan., it cost that city $1.80 a day to keep a three horse team for fire wagons, as compared with an expense of $6.48 for fuel and oil for a motor fire engine for the period from November 6 to December 1. This, of course, does not show the comparative total cost of horse and motor traction, as repairs are to be considered, but we understand that the consensus of opinion in Leavenworth is that the difference in favor of motor traction shown by the above figures is sufficient to pay for considerable repair work.

An automobile service is to be established between Ephrata and Soap Lake, Wash., to supplant a horse stage now operating there.

The recently organized company which will operate a taxicab service in Denver, Col., has placed an order for twelve cabs, which are expected to be delivered December 15.

The mails between Stockton and Lodi, and between Stockton and Sacramento, Cal., will hereafter be carried by the gasoline motor cars running between these places. The evening car to Sacramento will catch the eastbound overland trains to Nevada, Oregon and Washington, and branch stations, such as Clements, Valley Springs, Wallace and other places in the foothills will enjoy better mail service. Stockton merchants will now be able to compete in a field that formerly was open only to Sacramento merchants, and will gain commercially.

Motor Vehicles in California.

According to the monthly report of the Secretary of State of California, the number of motor vehicles registered in that State since the law regulating the operation of motor vehicles went into effect in 1905 to the 1st of November, 1908, is 18,698. Some of these have been destroyed and some have been brought into California from other States; but, valued at $2,000 each, it may fairly be considered that they represent $37,000,000. The number of motor vehicles registered at the end of 1905 was 4,727. During the great fire of 1906 in San Francisco many motor cars were destroyed, and at the end of 1906 the number was 3,764. In 1907 the number of registered cars was 5,241. During the first ten months of 1908 there were 4,693 registrations; so it may be expected that there will be about 5,600 registered at the close of the year 1908 for the twelve months preceding.

Coming Events.

December 22 to 29—Paris Commercial Vehicle Show.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 1 and 2—Endurance Run from Philadelphia to Wilkes-Barre and return, Quaker City Motor Club, Philadelphia, Pa.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 23 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 15—Detroit, Mich., Automobile Show, Casino.

February 15—St. Louis, Mo., Automobile Show.

February 16 to 18—Denver, Colo., Automobile Show, Auditorium.

February 22—Cleveland (Ohio) Automobile Show.

March 6 to 13—Boston Automobile Show, Mechanics' Building.

March 27 to April 3—Pittsburg Automobile Show.

GARAGE ITEMS

Chauffeurs' Commissions.

In the garage business in large cities competition has become extremely brisk, so much so that unusual methods are frequently employed to obtain business, some of which methods are illegal and dishonest. In talking with garage men the question of paying "commissions" to chauffeurs for storing and repairing the cars belonging to their employers seems to be a burning one. The garage men, on the whole, regret that such a condition exists, and look to its abolishment, but in quite a large number of cases they are unable to get cars on storage or for repair in any other manner than by paying the chauffeurs. A few of those interviewed did not pay commissions, and consequently did but little business, unless they were so situated as to have what might be called a monopoly in the section in which they were located, either by reason of accessibility or of superior facilities.

That this commission paying is nearly universal may be inferred from the fact that there is a fixed scale covering all repair operations on a car, on storage charges and on work brought in from outside. The following is an abstract from the scale in force in New York city and Philadelphia:

	Per Cent.
Storage	10
Repairing or replacements other than tires.	10
Tire repairs	5
Accessories	10
Repair work from outside	10 to 20
For selling cars for or through garage man	10

It will be noticed that a uniform charge of 10 per cent. is made on everything except tire and outside repairing. This was doubtless decided upon as a "fair" percentage, besides being easier to figure out than 12½ per cent. or 6 per cent., for instance. Tire repairing being supposed to be done by the chauffeur himself in most cases, the repair man must keep his charges moderately low. This particular item has been the subject of much talk, and was only reduced to 5 per cent. in the last eighteen months by reason of owners expecting the chauffeurs to attend to all tire work. As to repairs brought in from outside, the agreement as to percentage is made as soon as the work is started upon. On experimental work the full 20 per cent. is usually charged!

Looking at the matter in an impartial manner, the exactions of commissions by chauffeurs is neither more nor less than extortion. Here we have a fixed scale of charges made in a "stand and deliver" manner. Furthermore, should the charges not be paid, the garage will be boycotted, and endeavors will be made to draw away such trade as it already has. Here we have two illegal practices, extortion and unlawful conspiracy, both of which are covered by the criminal codes of all States.

But the system seems to sometimes work to the financial benefit of the garage man as well. To earn the commissions the chauffeur must bring in the cars or work, and the garage man benefits accordingly. Knowing this, and also that a boycott may be put upon their business if they refuse to pay commissions, it is no wonder that the majority pay, and so increase their profits. Let us take the actual case of a garage that has a good list of customers and does business at a fair profit. The number of cars on storage is twenty-five, but accommodations are sufficient for fifty. No commissions are paid. Should the manager decide to pay commissions and increase the number of cars to fifty he could not discriminate against the twenty-five chauffeurs whose cars are already in the garage, and thus would have to pay fifty commissions on storage alone. Additional hands would be needed to care for the increased number of cars. On the other hand, the increase in repairs and in the sale of accessories, as well as outside work, would, with careful adjustment, more than balance the money paid out for commissions and leave a very good profit. The temptation is great, and certainly no premium is put on honesty.

There are two methods of paying these commissions which are in about equally extensive use. One is to pay the commission on receipt of the price of the repair or storage charge, and the other is to pay a monthly "salary" to the chauffeur, adding the extra money for charges on accessories, etc., to the corresponding monthly "salary." This latter method is much favored by both chauffeur and garage man, insuring the first a regular income and rendering the bookkeeping easier for the latter, the chauffeurs being carried on the books as regular employees working on salary and commission. Some garages have a "yellow dog" account, to which all commissions, etc., are charged, and which would not show up in case of an investigation of accounts. A third method, which is considered the safest of all, is to declare a dividend regularly, these dividends being pooled and the commissions paid therefrom. The chauffeurs, standing together, have the upper hand in the situation, and only the union of all, or a great majority, of the garage men in one locality can break down their power and lead to the establishment of legitimate business methods. The owners are really responsible for this condition of affairs, being either ignorant of or indifferent to the facts. If they refused to employ a chauffeur who took commissions the practice would soon be stopped. Associations on the part of owners to prevent grafting have been formed, but unfortunately most of them never got beyond the paper stage, and their effect has been inappreciable. Again, the owners do not realize that this "graft" works more injury to them than to the garage man, as unnecessary repairs are sometimes made for the sake of the commission, which the owner, of course, pays for. If there was no commission there would not be so much repairing.

As to the legality of taking commissions, there are various opinions. All, however, agree that the secret paying or receiving of commissions is "graft," and as such is a criminal offense, in the State of New York at least. The open paying or receiving of considerations is looked upon by some as perfectly good business practice, while others condemn it as wrongful, but not necessarily illegal.

Since little or nothing is being done to curb this evil practice, the garage man, who does not want to submit to the exactions, can only confine himself to caring for cars which are driven by their owners or by non-grafting chauffeurs. Here the element of graft is absent, but the income is not so great. Most garages would rather store and care for 100 small runabouts, on which no graft needs to be paid, than for fifty large cars, although the income on the latter is a trifle greater. However, the public garage has not yet reached the stage where the graft-encumbered trade is refused. The present situation obliges the proprietors to take in every kind of pleasure car, public service or commercial vehicle, in order to make a living, and in most cases the owner pays the "commissions" and is thankful.

Indiana Implement Dealers Take on Automobiles.

It is reported that a large number of Indiana farm implement and machinery dealers are preparing to sell automobiles for the first time next season, but that they do not expect to sell motor buggies, believing the demand will be for medium priced runabouts and touring cars. This news is rather disconcerting for the manufacturers of motor buggies who have expected to sell much of their product through the implement dealers. There will be sixteen companies in Indiana next year manufacturing motor buggies, but so far as known only two or three of these will be represented in Indianapolis.

Glidden Tour Route Prospects.

It is being rumored in the West that the A. A. A. has practically decided to hold the 1909 Glidden Tour in the West, between Chicago and Denver. That this is the intention was revealed the other day in a letter from a prominent official of the association to a Kansas City, Mo., motorist, in which information was asked about roads between Kansas City and St. Louis. The letter added that the route through Missouri was being considered for the Glidden Tour. If this plan is adhered to the motorists will run through Illinois to St. Louis, thence across Missouri to Kansas City, thence across Kansas and the eastern section of Colorado to Denver. Returning it is probable that the cars will take the route through Nebraska to Omaha and thence to Chicago.

OUR FOREIGN EXCHANGES

Next Year Prince Henry Contest—A New Horse Power Formula.

Representatives of the German Royal A. C. and of the German Automobile Manufacturers' Association met at Berlin on November 21 to discuss the proposed light car trials and the Prince Henry cup contest for 1909. With respect to the Prince Henry cup contest it was decided to fix the minimum cylinder capacity of cars eligible for competition at 1.6 litres, or 100 cubic inches. In order to prevent the construction of special vehicles for this contest and to encourage the participation of private owners, a new horse power formula was adopted for use in the speed trials. In the past all horse power formulas for contests have been based either on the bore or on the cylinder volume. The experience has been that if the horse power is calculated from the bore the manufacturers will make the stroke abnormally long, and so obtain more power from their motor than the formula intended they should; if, on the other hand, the horse power is calculated from the cylinder volume, they will make the stroke very short, so as to get a maximum power from the fixed maximum volume. The formula which has now been adopted is designed to exactly represent the dependence of the horse power upon both the bore and the stroke; it is as follows: $N = .013\, i\, d^2\, s^{0.6}$, in which N represents the horse power, *i* the number of cylinders, *d* the bore in centimetres and *s* the stroke in centimetres. The horse power is consequently proportional to the square of the bore and to the two-thirds power of the stroke. It was decided that the weight of cars with 1.6 litres cylinder volume must not be less than 750 kg. (1,650 pounds), of which weight at least 15 per cent. must be in the bodywork. There is to be no hill climb incorporated in the contest this time, but instead there are to be two level races. There is another peculiar rule designed to attract the amateur driver. It is to the effect that drivers who have not won any plate or cash prizes for themselves or the owner of the vehicle in any officially recognized contest anywhere since January 1, 1905, will be given three credit points at the conclusion of the trials, but these credit points will not neutralize any penalty points except those for tire renewals and tire repairs.

The small car trials will probably take place August 20-September 23, and will be in the nature of an international contest. There will be admitted to these trials all cars with up to 6 h. p. motors, according to the German automobile tax formula. There will be no speed trials in this contest. Every factory desiring to participate will be required to enter and start three cars. The start will probably take place from the Tempelhof military grounds, near Berlin.

H Slot Gear Lever Sector Patents in England.

As is well known, the selective type of sliding change gear was introduced by the Daimler Motor Company, of Germany, and the various features of this gear are patented to Messrs. Daimler and Maybach, the company's engineers. Since the time that the Mercedes car was at the height of its popularity, about 1903, this type of gear and the accompanying form of H slot gear lever sector have been adopted by many other makers, and are now in almost universal use on large cars. Some three years ago it was rumored in England that infringement suits were about to be brought under the patents there, but nothing was done then. The rumors of contemplated proceedings were renewed at the recent Olympia show, and the owners of the patents have now confirmed the report that it is their intention to enforce their rights under these patents.

The first firm in England to adopt the so called gate change for the gear lever was the Daimler Motor Company, of Coventry. Their arrangement was not identical with that of the Daimler Motor Company, of Germany, however, differing in that the gear lever, instead of having a sliding lateral motion, had a pivotal motion in a lateral plane, yet it evidently comes within the claims of the Daimler patents. However, as the English Daimler Company at one time had certain relations with the German Daimler Company, they may have a right to use this form of change gear sector.

The *Autocar*, in discussing the situation, says that the new English patent law, while it has altered the situation to a certain extent, does not affect the case of an infringement. "It might be assumed that because the Mercedes car was made in Germany the owners of the British patent could not take action for infringement without the risk of their patent being revoked upon the ground that it was being made abroad. While it is quite true that the Society of Motor Manufacturers, or some maker or combination of makers, might deem it advisable to try to force the owners of the gate patent to manufacture it in this country, this would be an entirely separate and independent action, and would have nothing to do with the action for infringement, except that it might be taken as a sort of retaliation."

Dugald Clerk on Horse Power Formulæ.

The work done in the last three and a half years has by no means simplified the problem. On the contrary, the introduction of better materials for crank shafts, connecting rods and other parts, and light steel pistons, has made it possible to greatly increase the piston speed without approaching improper stresses. It has also been found that engine designers and manufacturers vary very much in their ideas as to what are permissible stresses. If uniform conditions as to maximum permissible stress could be agreed upon between different makers, then it would be doubtless possible to evolve a rating formula which would be approximately correct, but in the absence of any such agreement it is impossible to reason accurately from data obtained in the ordinary way by brake tests made on the bench. Many of such tests claiming very high powers have been made for too short a time to enable legitimate results to be deduced. If an engine could maintain its piston speed, and the mean pressure for five hours continuously under these conditions, it could legitimately be cited as an engine of the particular brake power determined. If a considerable number of such brake tests were available it would, in my view, be possible to deduce an approximate formula, but in the absence of exact knowledge of the nature of the brake tests compared, it is quite evident, as is seen from the experiments cited by the S. M. M. T., that no general law whatever can be obtained.

Many factors affect mean pressure and make it practically impossible to enunciate any rule which shall truly determine the mean pressure given by all engines of given dimensions. Piston speed, again, depends on the limit due to inertia, and the strength of the materials employed, and for equal reciprocating weights and strength of materials higher piston speeds are theoretically attainable with long stroke than with short stroke engines. From the point of view of maximum power that engine is best which permits of the highest piston speed for a given stress. The numerical value of this piston speed is not yet known.

In view of the numerous uncertainties entering into the problem it is not surprising that many differences of opinion should exist as to both the purpose and the accuracy of a rating rule.

Before concluding I would say that I consider the R. A. C. rating has served a very useful purpose, and I do not share in the dissatisfaction which has been expressed so freely in the public press. The R. A. C. rating assumed a certain piston speed and a certain mean presure, and this assumption has proved in the great majority of cases of ordinary touring engines to be very closely in agreement with fact. It is only when special precautions are taken—as for a great race—that the rule has failed. I agree, however, that it is undoubtedly desirable to revise the R. A. C., and, indeed, any other rating formula, from time to time, although I cannot feel that the experimental data placed before us in the report of the S. M. M. T. rating subcommittee is sufficient to enable us to effect this revision. I have read the S. M. M. T. report with great interest, and wish to express my indebtedness to the subcommittee for the very valuable addition they have made to the discussion of this important and difficult subject.—*Automotor Journal.*

Hearing on the Tariff Question.

Another hearing on the proposed revision of the duty on automobiles was given the joint committee of the N. A. A. M., the A. L. A. M. and the A. M. C. M. A. by the Ways and Means Committee at Washington on Monday, December 7 The members of the joint committee who attended the hearing were A. L. Riker, of the Locomobile Company of America; L. H. Kittredge, of the Peerless Motor Car Company; H. B. Joy, of the Packard Motor Car Company; G. H. Stillwell, of the H. H. Franklin Manufacturing Company; Thomas Henderson, of the Winton Motor Carriage Company; Benjamin Briscoe, of the Maxwell-Briscoe Motor Company, and Al Reeves, manager of the American Motor Car Manufacturers' Association.

Owing to the fact that the opening of Congress occurred on this day the hearing was cut short. Mr. Briscoe told the Ways and Means Commitee that the manufacturers' commitee desired two weeks more time to prepare data before definitely presenting their case. Another hearing was tentatively fixed for December 19.

In their plea for the reduction of the tariff to 30 per cent. the importers made the assertion that the automobile business in this country was controlled by a trust and that 100 per cent. profit was being made on automobiles here. The joint committee of the American manufacturers has been busily engaged since in gathering data to refute these assertions and to show that wages paid to workmen in the automobile industry are much higher here than in Europe. They refer to the statistics gathered by the German Government, which were published in a recent issue of The Horseless Age, according to which the average annual earnings of workmen in the German automobile industry are $306; of commercial employees, $529, and of technical employees, $602.50. This is contrasted with the average earnings of the personnel of eight American factories employing 11,400 men. In these factories the average annual earnings are as follows: Workmen, $755.05; commercial employees, $876.07; technical employees, $1,202.41. It will thus be seen that the average annual earnings of men employed in the automobile industry are from two to two and a half times as great in this country as abroad.

The following is from a circular issued by the Association of Licensed Automobile Manufacturers bearing on the same subject:

"American automobile manufacturers have not made exorbitant profits, and a relatively small number of them have made profits at all. The manufacture of automobiles first began to assume the proportions of an important industry in 1902.

"Following is a table of the vital statistics of the trade:

In 1902—		
51	Concerns in business.	
18	Discontinued that year.	
	Concerns carried over into 1903	33
In 1903—		
71	New concerns started up.	
30	Discontinued the same year.	
	Concerns carried over into 1904	41
In 1904—		
54	New concerns started.	
40	Discontinued.	
	Concerns carried over into 1905	14
In 1905—		
51	New concerns.	
38	Discontinued that year.	
	Carried over into 1906	13
In 1906—		
43	New concerns.	
29	Discontinued that year.	
	Carried over into 1907	41
In 1907—		
51	New concerns	51
		166

Note.—Of the fifty-one concerns in business in 1902 only twenty-one survive and are in business today.

"The foregoing picture of the vicissitudes of individual concerns is keenly and understandingly appreciated by the manufacturers, who themselves recognize the uncertainty of prolonged success.

"The foregoing record shows:

	Concerns.
In business in 1902	51
Started from 1902 to 1906, inclusive	270
Total	321
Discontinued during five years	155
In business December 31, 1906	166

"There are now listed 253 makers of automobiles in this country, of whom about 100 are turning out cars in fair quantity.

"It is safe to say that not 10 per cent. of the American automobile manufacturers are making money. A great deal of the manufacturers' money goes for experimentation. The large amount of capital required and the character of the business eat into the profits of the business very materially. Clearly the industry deserves proper protection from the normal producton and the overproduction of the European factories, with their cheap labor, low rate of taxes and preferential rates on manufacturing machinery. In this country the cost of labor is two and one-half times what it is abroad. Materials abroad are cheaper, ground rent is less, the cost of living is less, the industry is taxed less, and all machinery imported for use in a new industry is admitted duty free or at a preferential tariff.

"When making the statement that 60 per cent. of the imported cars arrived in the shape of the naked chassis, it was apparently forgotten that just a little more than 40 per cent. of the cars imported during the last twelve months were complete with bodies, and that bodies for the remaining 60 per cent. (by no means all of them minus bodies) would not keep busy for more than a portion of the year even one of the two carriage makers whom Mr. Sherrill mentions as having been kept alive by the business of the importers, whereas all the carriage makers outside the metropolitan district probably do not collectively get a dozen bodies to manufacture in a year for imported cars.

"Tariff rates must afford ample protection to American made goods, and provide a customs duty on imports equal to the difference in cost of production here and abroad."

New Incorporations.

Twin City Motor Co., Houghton, Mich.—Capital, $30,000.

Day County Auto and Supply Co., Webster, S. Dak.—Capital, $20,000.

Crescent Motor Co., Detroit, Mich.—Capital stock increased from $55,000 to $125,000.

Somerset Automobile Co., Somerset, Pa.—Capital, $10,000. Incorporator: J. S. Picking, Jr.

Plaza Garage Co., Brooklyn, N. Y.—Capital, $5,000. Incorporators: Justin Bloch, Maurice Defrenois and John J. Haley.

Rantz Motor Sales Co., Bridgeport, Conn.—Capital, $10,000. Incorporators: Erwin M. Jennings, F. A. Rantz and Fred D. Unwin.

Brown Emergency Tire Co., Minneapolis, Minn.—Capital, $100,000. Incorporators: Henry W. Nath, Lewis N. Klove and Theodore H. Brown.

General Auto Co., Cleveland, Ohio.—Capital, $10,000. W. E. Crittenden, Charles F. Laughlin, F. A. Bishop, C. D. Stone and J. Stevwright.

M. F. D. Motor Parts Co. (under Delaware laws).—Capital, $25,000. Incorporators: Martin F. Minogue, John de Angell and Arthur C. Fetters.

Grabowsky Power Wagon Co., Buffalo, N. Y.—Capital, $25,000. Incorporators: J. D. McDonald, J. F. Valley and J. Moore. To manufacture automobiles, power wagons, motor boats, etc.

Self Loading Wagon Co., New York, N. Y.—Capital, $25,000. Incorporators: M. Kotraschek, A. M. Bremer and D. W. Leonard. To manufacture motors, engines, machines cars, carriages, wagons, boats, etc.

New Agencies.

Atlantic, Ia.—F. A. Thurman, Buick.
Mankato, Minn.—H. G. Detlap, Bendix.
Mankato, Minn.—Perrin & Son, Maxwell.
Des Moines, Ia.—Buck Auto Co., E-M-F.
Mankato, Minn.—Cummins & Son, E-M-F.
Cleveland, Ohio.—Harry S. Moore, Brush.
Mankato, Minn.—J. H. Lewis & Son, Mitchell.
Chicago, Ill.—Racine Boat Mfg. Co., Richmond.
Seattle, Wash.—Seattle Automobile Co., Apperson.
Detroit, Mich.—Racine Boat Mfg. Co., Richmond.
New York City, N. Y.—Racine Boat Mfg. Co., Richmond.
Traverse City, Mich.—Queen City Garage, Culman & Goode, Buick.
Atlanta, Ga.—Alexander-Seewald Co., 54-56 North Pryor street, Franklin.

Wisconsin Registration.

Motor vehicles to the number of 2,016 were licensed in the office of the Secretary of State at Madison during the year which ended December 1. The increase over the previous year is substantial. Since the license law went into effect July 1, 1905, the numbers of cars recorded each year have been as follows:

	Number.	Increase (Annually).
August 15, 1906	2,418	....
December 1, 1906	2,640	222
December 1, 1907	4,121	1,481
December 1, 1908	6,137	2,016

Since the law has been in force transfers have been granted for 1,102 cars. The increase of transfers the past year was about 20 per cent. The license fee is $1. Cars from other States having license laws are permitted to enter Wisconsin temporarily under a reciprocity clause.

List of Exhibitors, Chicago Automobile Show, February 6 to 13, 1909.

ACCESSORIES.

Coliseum Gallery.

Motor and Accessory Mfrs., Inc., Union Bldg., Newark, N. J.
The Sprague Umbrella Co., Norwalk, Ohio.
Cook Standard Tool Co., Kalamazoo, Mich.
A. O. Smith Co., Milwaukee, Wis.
Imperial Brass Mfg. Co., 2455 South Jefferson St., Chicago.
Hartford Suspension Co., 150 Bay St., Jersey City, N. J.
C. A. Shaler Co., Waupun, Wis.
Valentine & Co., 257 Broadway, New York.
The Republic Rubber Co., Youngstown, Ohio.
Auto Improvement Co., 316 Hudson St., New York.
American Electrical Novelty & Mfg. Co., 304 Hudson St., New York.
Hancock Mfg. Co., Charlotte, Mich.
Atwater Kent Mfg. Works, 42 North Sixth St., Philadelphia, Pa.
Warner Instrument Co., Beloit, Wis.
N. Y. & N. J. Lubricant Co., 14 Church St., New York.
F. H. Wheeler, P. O. Box 276, Indianapolis, Ind.
Whitney Mfg. Co., Hartford, Conn.
Motsinger Device Mfg. Co., Pendleton, Ind.
A. W. Harris Oil Co., Providence, R. I.
Morgan & Wright, Detroit, Mich.
R. E. Dietz Co., 60 Laight St., New York.
Timken Roller Bearing Axle Co., Canton, Ohio.
The Hartford Rubber Works Co., Hartford, Cinn.
McCord Mfg. Co., Detroit, Mich.
Chicago Battery Co., Chicago, Ill.
The Diamond Rubber Co., Akron, Ohio.
Brown-Lipe Gear Co., Syracuse, N. Y.
Spicer Universal Joint Mfg. Co., Plainfield, N. J.
The Veeder Mfg. Co., Hartford, Conn.
Gray & Davis, Amesbury, Mass.
G & J Tire Co., Indianapolis, Ind.
National Carbon Co., Cleveland, Ohio.
The B. F. Goodrich Co., Akron, Ohio.
C. F. Splitdorf, 265 Walton Ave., New York.
Gabriel Horn Mfg. Co., Cleveland, Ohio.
Goodyear Tire & Rubber Co., Akron, Ohio.
Long Mfg. Co., 119 Michigan St., Chicago.
Swinehart Clincher Tire & Rubber Co., Akron, O.
Jones Speedometer, 127 West Thirty-second St., New York.
R. E. Hardy Co., 86 Watts St., New York.
Warner Gear Co., Muncie, Ind.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
The Electric Storage Battery Co., Philadelphia, Pa.
Pennsylvania Rubber Co., Jeannette, Pa.
Heinze Electric Co., Lowell, Mass.
Baldwin Chain & Mfg. Co., Worcester, Mass.
Remy Electric Co., Anderson, Ind.
Duff Mfg. Co., Pittsburg, Pa.
Firestone Tire & Rubber Co., Akron, Ohio.
M. & A. M., Inc., office.
Never-Miss Spark Plug Co., Lansing, Mich.
Oliver Mfg. Co., 203 S. Desplaines St., Chicago.
S. F. Bowser & Co., Inc., Fort Wayne, Ind.
The Edmunds & Jones Mfg. Co., Detroit, Mich.
Kokomo Electric Co., Kokomo, Ind.
Byrne-Kingston & Co., Kokomo, Ind.
Weed Chain Tire Grip Co., 28 Moore St., New York.
The Pantasote Co., 11 Broadway, New York.

Coliseum Annex, Second Floor.

Stewart & Clark Mfg. Co., 502 Diversey boulevard, Chicago.
C. T. Ham Mfg. Co., Rochester, N. Y.
Gray-Hawley Mfg. Co., 605 Fort St., Detroit, Mich.
J. H. Sager Co., Rochester, N. Y.
Ajax-Grieb Rubber Co., 1776 Broadway, New York.
Joseph Dixon Crucible Co., Jersey City, N. J.
Ross Gear & Tool Co., Lafayette, Ind.
National Coil Co., Lansing, Mich.
Adam Cook's Sons, 313 West St., New York.
Continental Caoutchouc Co., 43 Warren St., New York.
Leather Tire Goods Co., Newton Upper Falls, Mass.
Conn. Telephone & Electric Co., Meriden, Conn.
Witherbee Igniter Co., 591 West Forty-third St., New York.
Motz Clincher Tire & Rubber Co., Akron, Ohio.
Whiteley Steel Co., Muncie, Ind.
National Battery Co., Buffalo, N. Y.
L. C. Chase Co., 89 Franklin St., Boston, Mass.
Michelin Tire Co., Milltown, N. J.
The Globe Machine & Stamping Co., Cleveland, O.
The Hoffecker Co., Motor Mart, Boston, Mass.
Fox Metallic Tire Belt Co., 15 Murray St., New York.
The Randall Faichney Co., Boston, Mass.
Avery Portable Lighting Co., Milwaukee, Wis.
Pittsfield Spark Coil Co., Dalton, Mass.
Limousine Carriage Mfg. Co., 3515 Michigan Ave., Chicago.
Empire Automobile Tire Co., Trenton, N. J.

First Regiment Armory Gallery.

London Auto Supply Co., 1220 Michigan Ave., Chicago.
Austro-American Separator Co., Cleveland, Ohio.
Edward Neely & Co., 244 Wells St., Chicago.
Motor, 2 Duane St., New York.
Cycle and Auto Trade Journal, Forty-ninth and Market Sts., Philadelphia, Pa.
Metal Stamping Co., 40 Hubert St., New York.
Central Rubber Co., 82 Lake St., Chicago, Ill.
Vivax Storage Battery Co., 2224 Michigan Ave., Chicago, Ill.
Commercial Battery Electric Co., 204 Michigan St., Chicago.
Automobile Topics, Inc., 103 Park Ave., New York.
Morrison-Ricker Mfg. Co., Grinnell, Ia.
S. Breakstone, 900 Fisher Building, Chicago.
American Thermo-Ware Co., 16 Warren St., New York.
Stromberg Motor Devices Co., 1253 Michigan Ave., Chicago.
The Horseless Age, 9 Murray St., New York.
Standard Varnish Works, 2620 Armour Ave., Chicago, Ill.
McCanna Mfg. Co., 56 North Jefferson St., Chicago, Ill.
Monitor Mfg. Co., 1425 Washington St., Boston, Mass.
Eugene Arnstein, Thirty-fifth and Shields Ave., Chicago.
The Class Journal Co., 231 West Thirty-ninth St., New York.
Excelsior Supply Co., 233 Randolph St., Chicago, Ill.
Quincy, Manchester, Sargent Co., Plainfield, N. J.
Ennis Rubber Mfg. Co., Newark, N. J.
Fred W. Smith, Aberdeen, S. Dak.
High Frequency Ignition Co., 2309 South Main St., Los Angeles, Cal.
Westinghouse Co., Pub. Dept., Pittsburg, Pa.
Goshen Rubber Works, Goshen, Ind.
Elite Mfg. Co., Ashland, Ohio.
Universal Tire Protector Co., Angola, Ind.
Dayton Rubber Co., Dayton, Ohio.

Coliseum Basement.

Duplex Coil Co., Fond du Lac, Wis.
Norton Co., Worcester, Mass.
Chicago Recometre Co., 1251 Michigan Ave., Chicago.
Pfanstiehl Electrical Laboratory, North Chicago, Ill.
Triple Action Spring Co., 67 East Twenty-first St., Chicago.
Garage Equipment Co., 201 Twenty-second St., Milwaukee, Wis.
Ernst Flentje, 1643 Cambridge St., Cambridge, Mass.
Fulton & Zinke, 1256 Michigan Ave., Chicago, Ill.
F. E. Sparks, 1337 Michigan boulevard, Chicago.
The Troy Carriage Sun Shade Co., Troy, Ohio.
Chicago Wind Shield Co., 235 Johnson St., Chicago.
Vehicle Top & Supply Co., 900 Cass Ave., St. Louis, Mo.
Longdin-Brugger Co., Fond du Lac, Wis.
High Wheel Auto Parts Co., Muncie, Ind.
Champion Ignition Co., Flint, Mich.
E. T. Burrowes Co., 70 Free St., Portland, Me.
Vanguard Mfg. Co., Joliet, Ill.
Royal Equipment Co., Bridgeport, Conn.
Bosch Magneto Co., 1253 Michigan Ave., Chicago, Ill.
The Buda Foundry & Mfg. Co., Railway Exchange Bldg., Chicago.
Nadall Mfg. Co., 1430 Michigan Ave., Chicago.

Coliseum, Main Floor.

Winton Motor Carriage Co., Cleveland, Ohio.
Pope Mfg. Co., Hartford, Conn.
E. R. Thomas Motor Co., Buffalo, N. Y.
Stevens-Duryea Co., Chicopee Falls, Mass.
Peerless Motor Car Co., Cleveland, Ohio.
Elmore Mfg. Co., Clyde, Ohio.
Woods Motor Vehicle Co., Chicago, Ill.
Thomas B. Jeffery & Co., Kenosha, Wis.
Babcock Electric Carriage Co., Buffalo, N. Y.
Baker Motor Vehicle Co., Cleveland, Ohio.
F. B. Stearns Co., Cleveland, Ohio.
Reo Motor Car Co., Lansing, Mich.
Packard Motor Car Co., Detroit, Mich.
Everitt-Metzger-Flanders Co., Detroit, Mich.
Premier Motor Mfg. Co., Indianapolis, Ind.
Studebaker Automobile Co., South Bend, Ind.
National Motor Vehicle Co., Indianapolis, Ind.
Haynes Automobile Co., Kokomo, Ind.
The White Company, Cleveland, Ohio.
Dayton Motor Car Co., Dayton, Ohio.
Cadillac Motor Car Co., Detroit, Mich.
Maxwell-Briscoe Motor Co., Tarrytown, N. Y.
Locomobile Co. of America, Bridgeport, Conn.
H. H. Franklin Mfg. Co., Syracuse, N. Y.
Apperson Bros. Auto. Co., Kokomo, Ind.
Buick Motor Co., Flint, Mich.
Holsman Automobile Co., Chicago, Ill.
Pope Motor Car Co. (Toledo), Hartford, Conn.
American Locomotive Co., New York.
George N. Pierce Co., Buffalo, N. Y.
Olds Motor Works, Lansing, Mich.
Corbin Motor Vehicle Corporation, New Britain, Conn.
Matheson Motor Car Co., Wilkes-Barre, Pa.
Knox Automobile Co., Springfield, Mass.
The Bartholomew Co., Peoria, Ill.
Lozier Motor Co., New York.
DeLuxe Motor Car Co., Detroit, Mich.
Mitchell Motor Car Co., Racine, Wis.
Ricketts Auto Works, South Bend, Ind.

Coliseum Annex, First Floor.

Chalmers-Detroit Co., Detroit, Mich.
Simplex Motor Car Co., Mishawaka, Ind.
York Motor Car Co., York, Pa.
Austin Automobile Co., Grand Rapids, Mich.
Oakland Motor Car Co., Pontiac, Mich.
Pennsylvania Auto Motor Co., Bryn Mawr, Pa.
Midland Motor Co., Moline, Ill.
Welch Motor Car Co., Pontiac, Mich.

First Regiment Armory, Main Floor.

Kissel Motor Car Co., Hartford, Wis.
Speedwell Motor Car Co., Dayton, Ohio.
Buckeye Mfg. Co., Anderson, Ind.
Jackson Automobile Co., Jackson, Mich.
Columbus Buggy Co., Columbus, Ohio.
Moon Motor Car Co., St. Louis, Mo.
Atlas Motor Car Co., Springfield, Mass.
Dorris Motor Car Co., St. Louis, Mo.
Overland Automobile Co., Indianapolis, Ind.
Cartercar Co., Detroit, Mich.
The Waverley Co., Indianapolis, Ind.
W. H. Kiblinger Co., Auburn, Ind.
Mora Motor Car Co., Newark, N. Y.
Nordyke & Marmon Co., Indianapolis, Ind.
Moline Automobile Co., East Moline, Ill.
Auburn Automobile Co., Auburn, Ind.
Anderson Carriage Mfg. Co., Anderson, Ind.
Chicago Coach & Carriage Co., Chicago, Ill.
Rapid Motor Vehicle Co., Pontiac, Mich.
Black Mfg. Co., Chicago, Ill.
Meteor Motor Car Co., Bettendorf, Ia.
Streator Motor Car Co., Streator, Ill.
Staver Carriage Co., Chicago, Ill.
Anderson Carriage Co., Detroit, Mich.
Model Automobile Co., Peru, Ind.
J. V. Lindsley & Co., Dowagiac, Mich.
Ft. Pitt Motor Mfg. Co., New Kensington, Pa.
Wayne Works, Richmond, Ind.
Gaeth Automobile Co., Cleveland, Ohio.
Berliet Import Co., Chicago, Ill.
Rauch & Lang Carriage Co., Cleveland, Ohio.
C. P. Kimball & Co., Chicago, Ill.

Coliseum Basement.

Zimmerman Mfg. Co., Auburn, Ind.
Joseph Devore, Chicago, Ill.
Schacht Mfg. Co., Cincinnati, Ohio.
Randolph Motor Car Co., Chicago, Ill.
The Rider-Lewis Motor Car Co., Muncie, Ind.
Interstate Automobile Co., Muncie, Ind.
The Bendix Co., Chicago, Ill.
E. R. Thomas Motor Co., Buffalo, N. Y.
Owen Thomas Motor Car Co., Janesville, Wis.
Grabowsky Power Wagon Co., Detroit, Mich.
Twentieth Century Motor Car Co., South Bend, Ind.
Clark-Hatfield Auto Co., Oshkosh, Wis.
Mier Carriage & Buggy Co., Ligonier, Ind.
The Cameron Car Co., Beverly, Mass.
The Fellwock Auto & Mfg. Co., Evansville, Ind.

MOTORCYCLE SECTION.

Coliseum Annex, Second Floor.

Minneapolis Motorcycle Co., Minneapolis, Minn.
The Pierce Cycle Co., Buffalo, N. Y.
Merkel-Light Motor Co., Pottstown, Pa.
Reading Standard Co., Reading, Pa.
Hornecker Motor Mfg. Co., Geneseo, Ill.
Armac Motor Co., Chicago, Ill.
New Era Gas Engine Co., Dayton, Ohio.
Bicycling World, New York.
Magnet Motor Co., Chicago, Ill.
Motorcycle Illustrated, New York.
Hendee Mfg. Co., Springfield, Mass.
Harley-Davidson Motor Co., Chicago, Ill.
Excelsior Motor & Mfg. Co., Chicago, Ill.
Wagner Motorcycle Co., St. Paul, Minn.
Consolidated Mfg. Co., Toledo, Ohio.
Ovington Motor Co., New York.
Aurora Automatic Machinery Co., Aurora, Ill.
Thiem Mfg. Co., Minneapolis, Minn.
The Auto-Bi Co., Buffalo, N. Y.
American Motor Co., Brockton, Mass.
N. S. U. Motor Co., New York.

Trade Literature Received.

Northern Electrical Mfg. Co., Madison, Wis.—"Northern Type of Motors."

Rochford Mfg. Co., Chicago.—Circular of folding and one part wind shield.

Thomas E. O'Connor, Saratoga Springs, N. Y.—Circular of the Tonneau heater.

Brush Runabout Co., Detroit, Mich.—"The Brush Runabout Great Efficiency Run."

Premier Motor Mfg. Co., Indianapolis, Ind.—Early catalogue of Premier cars for 1909.

Packard Motor Car Co., Detroit, Mich.—Folder pertaining to "Packard Trucks in Express Work."

Leather Tire Goods Co., Newton Upper Falls, Mass.—Circular of the Woodworth self adjusting tread.

Standard Connecting Rod Co., Beaver Falls, Pa.—Catalogue of finished crank shafts and connecting rods.

The Carpenter Steel Company, Reading, Pa.—"The Vanderbilt Cup Race from the Steel Makers' Standpoint."

Sidney, Straker & Squire, Ltd., 75-77 Shaftesbury avenue, London, W.—Catalogue of the 15-16 Straker-Squire car.

Peerless Motor Car Co., Cleveland, Ohio.—"With the Peerless Old Glory Team 1908," an account of the part of the Peerless cars in the Glidden Tour of this year.

MINOR MENTION

The Hayes Wheel Company, Jackson, Wis., are said to be turning out 800 wheels a day and employing 150 men at present.

It is reported that the Four Traction Auto Company, Mankato, Minn., will increase its working capital and output next season.

The Matheson Motor Car Company, Wilkes-Barre, Pa., have recently completed a six cylinder shaft driven model, which is to sell at $3.000.

Harry S. Houpt, who handles the Thomas car in New York city, has contracted to take the entire output of the Herreshoff Motor Company, of Detroit, for 1909.

The Packard Motor Car Company inform us that their Chicago agents, the Chicago Motor Car Company, sold the last one of their alotment of 1909 cars the day before Thanksgiving.

It is reported that J. Pierpont Morgan, the largest stockholder of the Madison Square Garden Company, has expressed himself to the effect that the Garden will not be torn down.

The Midland Motor Car Company, Moline, Ill., has recently increased its capital stock from $100.000 to $150,000. The company is planning to turn out 300 cars during the coming season.

In the advertisement of the H. H. Franklin Manufacturing Company in our issue of November 21 the price of their Model D touring car was erroneously given as $2.700 instead of $2,800.

We learn that the Brush Runabout Company's transcontinental car arrived at San Francisco November 11. The trip was made from Detroit in six weeks. The mileage covered was 4,414; the upkeep expense was $4.95.

The Southern Motor Car Company, of Houston, Tex., will bring out a new model for 1908, viz., a seven passenger touring car. The company completed a lot of four cars and has another lot of six under construction.

The Ohio State Automobile Department has turned over to the State Highway Commissioner the sum of $36,309.60, which represents the surplus of the automobile department for the last five months of the fiscal year.

J. M. Pitney, of the Shipyard office force, Loraine, Ohio, has invented a mounting for automobile headlights, which causes the lights to turn with the steering gear, thus throwing the beam of light always in the direction the car is traveling.

C. F. and L. A. Ettwein and H. N. Strait have leased a brick building in Kansas City for the purpose of installing equipment for a small automobile factory. The new company has been incorporated under the name the Wonder Manufacturing Company, and has a capital of $35,000, which will be increased later. The output to begin with will be light cars at a low price for the rural trade in Missouri and Kansas.

The former employees of the defunct Auto Transit Company, of Philadelphia, on December 2 appointed a committee of three to confer with the receivers of the company regarding the payment of wages due to 150 motormen, conductors and laborers.

The Packard Motor Car Company inform us that of the 1,159 automobiles which stopped at the Mount Washington Garage, Bretton Woods, N. H., the past season, and which included 86 different makes, no less than 231, or 20 per cent. were Packards.

As another proof of a selling agreement between the Olds Motor Works and the Buick Motor Company, which was hinted at in one of our recent issues, it is reported from Kansas City that Buick literature has been sent out by the Oldsmobile Company.

It is reported that B. C. Stevens, an automobile promoter of St. Louis, has secured an option on a tract of land with railroad facilities near Brentwood, St. Louis County, for an automobile factory to cost $500,000. The land is said to be valued at $2,000.

The Automobile Association of England will have a stand at the coming Madison Square Garden Show in New York city to acquaint American tourists with its work, which consists mainly in breaking up police traps. It is understood that Stenson Cooke, the secretary of the organization, will attend the show.

In the advertisement of the Oakland Motor Car Company in our issue of November 25 it was erroneously stated that the four cylinder cars of the company would be equipped with 32 inch wheels. As a matter of fact the wheels will be 34 inches in diameter, and will be fitted with 4 inch tires, both front and rear.

The Mora Motor Car Company has approached the Board of Trade of Newark, N. Y., with a proposition to float an issue of bonds to the amount of $50,000, of which the directors of the company have taken up one-half. If the bonds can be sold the company will increase its working force to 200 and get 350 cars ready by next spring.

One of the novelties seen at the recent Olympia Show consisted of what is described as a lever spring shackle. It is in the form of a clock spring and intended to take the place of the four outer shackles of the front and rear springs. The device is evidently a counterpart to the well known supplementary spiral springs marketed in this country.

The Herreshoff Motor Company, of Detroit, are getting out four model cars, which they expect to have on the road by the middle of the month. This new car will sell for $1,500. It has double igniton, by Bosch magneto, coil and storage battery. Its wheel base will be about 100 inches, and the weight is stated to be in the neighborhood of 1,400 pounds. It will be furnished with runabout, touring and town car bodies. We expect to print a complete description when the models are completed.

A suit has been filed in Cincinnati against Sidney Black, C. J. Neare and the Sid Black Automobile Company, to foreclose a lien upon the leasehold to the premises on Walnut street, near Seventh, occupied by the company. The lien is claimed upon $1,225, due for rents since last July, the lease given by the property owners reserving the right to such a lien to secure the rent. A receiver is also asked for in the suit.

The schedules in bankruptcy of Max Wineburgh, who traded as the American Automart, automobile supply store and garage, 1621 Broadway, New York, show $14,181 liabilities and nominal assets of $6,950, consisting of stock, $6,000; note, $750, and goods at police headquarters, $200. He also has some outstanding accounts, but the amount of these is unknown, as his books were removed by (he says) unknown persons.

The New Jersey Grange, at its meeting in Atlantic City on December 3, passed a resolution in favor of a law requiring the observation of the road rules by all drivers and providing heavy penalties for violation. The Grange especially denounced the driving of automobiles by drunken men and demanded that a heavy penalty be imposed on such offenses. It is also opposed to any increase in the speed limit fixed by the present New Jersey automobile law.

The Moon Motor Car Company, of St. Louis, has brought out a car with a new self starting arrangement, consisting of a Bosch high tension magento, the armature of which can be disengaged from the crank shaft and spun by the pressure of the foot, so as to produce a spark for igniting the residual charge remaining in one of the cylinders from the previous operation. As soon as one explosion has taken place the magneto automatically drops into gear again.

Regarding the recent rumors concerning the absorption of the Garford Company by the Studebaker Automobile Company, A. L. Garford has issued a statement according to which not a share of Garford stock has changed hands in the recent transactions. However, the two distributing companies, the Garford Motor Car Company, of New York, and the Garford Motor Car Company, of Cleveland, were sold to the Studebaker Automobile Company. Hereafter the Studebaker Company will sell the entire output of the Garford factory under one name.

The Kelsey-Herbert Company, 277 Monroe avenue, Detroit, Mich., have received an order for 100 sets of their spring wheels from the New York Taxicab Company. This is the first large lot of these wheels to be placed in commercial service, so naturally their performance will be watched with interest. One set of these wheels has been in use on a taxicab in New York for some time. These wheels consists of ordinary wood wheel with large diameter, short hollow hub, suspended between two discs, which turn on wheel spindle by a set of helical springs.

The Hoyt Electrical Instrument Works, Penacook, N. H., have opened an office at 161 Summer street, Boston, Mass., for their New England trade. The office will be in charge of F. H. Kellogg, and a complete stock of instruments will be carried.

The Apperson Brothers Automobile Company, Kokomo, Ind., recently made their first shipment of taxicabs, sending four machines to the H. O. Harrison Company, Los Angeles, Cal. The chassis is the regular Apperson 30 horse power, four cylinder Model O, while the body is of the landaulet type, upholstered in leather and with broadcloth head lining. The top may be pushed back, all windows concealed in the body work and the frames folded down in fair weather.

The Society of Professional Automobile Engineers of United States, Incorporated, 1947 Broadway, New York, inform us that they have elected the following officers for the ensuing year; President, Edward Traphagen; first vice president, Robert J. Dobson; second vice president, John McClarity; treasurer, Eugene Massoy; recording secretary, George Strobridge; financial secretary, Henry J. Ritzel; chairman examining board, Otto Zimmerelli; board of directors, Robert J. Dobson, Henry J. Ritzel, Philip A. Hagel and Otto Zimmerelli.

George J. Dunham, the new president of the Royal Tourist Car Company, of Cleveland, successors to the Royal Motor Car Company, was formerly Boston agent for the Royal car. In a statement issued by Mr. Dunham he says that the company will start their fiscal year without any indebtedness. The company has completed a new model, known as Model M, of which samples will shortly be delivered to agents. Among the changes over the former Royal design may be mentioned an increase in the size of the motor, a change in the design of the change speed gear, simplification of the rear axle, improvements in the brakes and greater accessibility.

Club Notes.

The International Automobile Association of Cuba recently requested the Automobile Club of America to take charge of the race which it was planned to hold in the vicinity of Havana some time before February 1, when Governor Magoon quits office. The A. C. A. declined to accept the offer, and in consequence it is likely that no race will be held in Cuba this year.

At a meeting of the board of directors and committees of the Connecticut A. A., held at Hartford on December 4, plans for a legislative compaign to uphold the present State law were submitted. The association is endeavoring to induce the motorists of Meriden, Middletown, Waterbury, New London and other cities to join it in the coming legislative fight.

The A. C. A. last week distributed $8,000 in cash prizes to the drivers who secured the first five places in the recent Savannah gold cup race. Of this amount $4,000 went to the winner of the race, Louis Wagner; $2,000 to Victor Hemery and $1,000 to Felice Nazzaro.

The Iowa A. C. held a hill climb on West Grand avenue, Des Moines, on Wednesday afternoon, December 2. Police were on hand to guard the course. At a council meeting on the Monday previous to the day of the contest the matter of granting the privilege for the event was discussed and led to a lively tilt between the superintendent of the department of public safety and other members.

The Worcester A. C. plans to hold a 200 mile reliability and endurance contest on Saturday, December 12. A technical committee has been appointed consisting of Charles M. Allen, professor of experimental engineering; D. L. Gallup, instructor in gas engineering, and J. C. Harvey, instructor in mechanical engineering, all of the Worcester Polytechnic Institute. It is said that fifteen cars have been promised for the contest.

Garage Notes.

C. L. Pound, Owatonna, Minn., will handle some car next year.

Rudolph Hartman, of Milwaukee, is building a reinforced concrete private garage, 25x30 feet.

Moreland & Dubohn, 121 North Main street, Austin, Minn., will take an agency next season.

The American Motor Car Co., Des Moines, Ia., has moved into its new building at 916 Walnut street.

The Puerner-Heid Automobile Co. has been organized at Jefferson, Wis., to take the agency for the Buick line.

Ray Noonan, Paris, Ill., is having a one story, 40x80 foot brick garage erected adjacent to his present location, at a cost of $2,500.

J. F. MacWilliams, Liberal, Kan., has sold his automobile repair shop to Amos and Fred Eidson, who had been employed at the shops for some time.

The Schafer Engine Co., of Berlin, Wis., who recently moved there from Ripon, Wis., have decided to erect a storage warehouse and a garage and automobile repair shop.

The Standard Motor Car Co., Scranton, Pa., plan to build a garage on Dupont court, between Mulberry and Linden streets. It will be a two story brick and concrete structure, 90x58 feet, and will be ready for occupancy January 15.

The firm of Ogden & Gant, which had been conducting an automobile garage and repair business in Columbus, Ind., was dissolved on December 1, John Gant selling out his interest in the business to his partner, Dore Ogden, who will continue it.

The Buick Motor Co. has established a branch in St. Louis at the corner of Twelfth and Locust streets, opposite the Jefferson Hotel. The branch will be in charge of H. M. Blake, who was formerly president of the Implement, Vehicle and Hardware Association.

The Albert Lea Motor Co., Albert Lea, Minn. have applied for a charter to open a garage to be known as the Motor Inn. The building will be of concrete, 30x80 feet. P. S. Kingston, at present foreman of the Fawkes Auto Co., of Minneapolis, will be manager.

The Capital Auto Co., Des Moines, Ia., have let the contract for the erection of a 33x112 foot brick garage at 417 West Eighth street. The building will have a cement floor and steel roof, and the remainder of the lot not occupied by the building will also be laid out with cement. The company has the agency for Maxwell and Rapid commercial cars.

The Northwestern Automobile Co., 113 West Seventh street, Mason City, Ia., will soon be organized to take the Cadillac agency. A repair shop will also be run in connection with the agency.

In order to make more room for their 1909 stock, the Buick-Losey Company, at Indianapolis, have leased a three story building in the rear of its building fronting on East New York street. A tunnel large enough to drive an automobile through it has been built connecting the two buildings. The main building is also being remodeled with a new plate glass front and the first floor will be used exclusively for a display room.

A large motor mart building is to be erected on Tenth street and First avenue in Minneapolis, Minn., in the near future. It will be constructed of white enameled brick and have large plate glass windows on two sides. The salesrooms will have hardwood floors, while the garage will be fitted with every modern equipment. It is intended to rent space in this building to automobile and supply dealers.

The Interstate Auto and Supply Co., of Sioux City, Ia., which was formerly located at 609 Pierce street, and moved to 313 Nebraska street last spring, is moving back to its old location, where an addition is being put up which will add 6,000 square feet to the available floor space. H. P. Groves is president of the company and Eugene Gnehm shop foreman. The company recently increased its capital stock to $25,000.

Trade Personals.

B. N. Crockett has joined the staff of the Studebaker Co.'s Boston branch.

Charles Kenan has recently become factory superintendent of the Matheson Motor Car Co., Wilkes-Barre, Pa., succeeding Charles R. Greuter.

C. E. Hadley has resigned as general manager of the Garford Company's plant, Elyria, Ohio. F. E. Lytle, his assistant, has also resigned from his position.

J. B. Russell, of Wilkes-Barre, Pa., was elected a director of the Matheson Motor Car Co. at a recent stockholders' meeting of the company, to succeed C. E. Stegmaier.

Harry W. Ford, until recently advertising manager of the Sheldon School, of Chicago, has accepted a similar position with the Chalmers-Detroit Motor Co., of Detroit.

Herbert Lytle, the well known automobile driver of Toledo, Ohio, is suffering from an attack of typhoid fever, complicated by pneumonia, and is reported to be very low.

Harry C. Bacon, formerly with the Buffalo Buick agency, has identified himself with Mason B. Hatch, in the sale of Chalmers-Detroit automobiles, at 729 Main street, Buffalo, N. Y.

Herbert Harold, of Bridgeport, Conn., mechanical expert of the Locomobile Co.'s factory, has joined the Wisconsin general agency for the Locomobile, the Schrieber Motor Car Co., Milwaukee, as superintendent of the repair and mechanical departments. He succeeds "Bob" Drach.

J. Mitchell Lewis, president of the Mitchell Motor Car Co., of Racine, Wis., and J. W. Hilson, sales manager of the same firm, recently visited Jacksonville, Fla., with the object of establishing a distributing branch in that city for the Southeastern territory and the West Indies.

Bertram Bailey, engineer of the Bailey Automobile Co., of Springfield, Mass., has accepted a position as engineer with the Four-Traction Auto Co., of Mankato, Minn., manufacturers of commercial vehicles. The Bailey Automobile Co. is turning out four cylinder, two cycle cars of the speedster and roadster type.

J. V. Lindsley, an automobile manufacturer of Dowagiac, Mich., disappeared from his home about three weeks ago, and the affairs of the Lindsley Automobile Manufacturing Co., of which he was president, are being wound up by his father, John A. Lindsley, a former lumberman. Young Lindsley recently secured a $6,000 bonus from the Board of Trade of Seymour, Ind., and intended to move there. He is twenty-eight years old and married, and his wife disappeared with him. About thirty men were employed at the factory at the time of Lindsley's disappearance.

MOTOR VEHICLE PATENTS

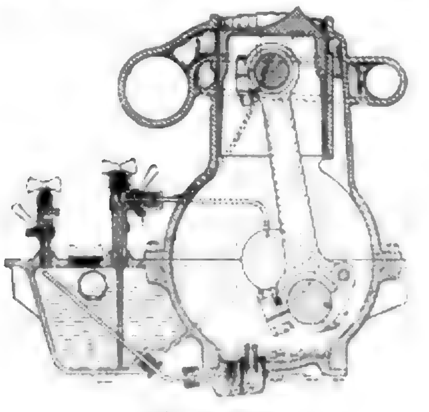
Reviews of Specifications.

904,132. Motor Oiling System.—Kirk G. Johnston, of New York, N. Y. November 17, 1908. Filed March 5, 1908.

This relates to a pressure oiling system for two stroke motors, the pressure being derived from the motor crank case. In the base of the crank case is fitted a hollow adjustable standpipe which permits communication of the crank case pressure to an oil tank (shown integral with the chamber in the accompanying cut) by means of a pipe. A check valve is placed in this pipe, preventing the oil from flowing back. There are two outlets to the oil tank, consisting of "combination cocks" incorporating a ball check valve and a three way valve each. One of these "combination cocks" has its three way valve interposed between the tank and the ball valve, which latter is spring retained and acts as a guard against excess pressure, regulation being obtained by means of a wing nut and screw. The three way valve in this case is used only for relieving the pressure in the tank. The other "combination cock" has its ball valve nearest the tank, the lift of the ball being limited by a screw and wing nut, and thus regulating the flow of oil. Piping from this cock leads to such bearings or surfaces which are to be lubricated. The three way valve in this case acts as a "tell tale" on the flow of the oil, the rate of flow being shown at the nozzle when the valve is opened. The tank is fitted with a filler and purging device. Lubrication of the piston, etc., is by oil mist, a scoop on the connecting rod throwing the oil as in ordinary practice. The height of the stand pipe regulates the depth of oil in the crank case and prevents over-lubrication, the excess of oil being forced to the tank when the level set by the standpipe is exceeded.

904,163. Indicator for Radiators.—Harry Vissering, of Chicago, Ill. November 17, 1908. Filed April 29, 1907.

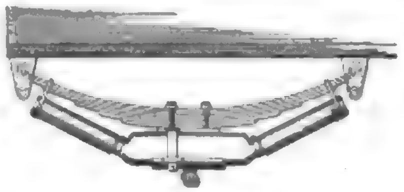
This refers to an optical indicator for showing the condition of the water in automobile radiators. A cylindrical casing comprising a sight glass and vented cap is put on the radiator in place of the filler ordinarily used. When the radiator is to be filled the vented cap is removed and water is poured in until it shows in the sight glass. As the water is circulated it indicates the height in a similar manner as in an ordinary gauge. When, however, the water becomes low, the fact is indicated by the formation of vapor or bubbles of steam, which can be seen by the operator. The form and location of the indicator prevent the formation of steam pockets and occlusion by dirt, etc.



No. 904,132.

904,352. Pneumatic Spring.—William C. McCullough, of Bucyrus, Ohio. November 17, 1908. Filed November 25, 1907.

A pneumatic bag or cushion is combined with two cylinders for the purpose of taking up heavy jolts encountered in running a vehicle upon rough roads. The bag is fastened to the vehicle spring by means of plates which are mounted so as to allow a receding and approaching motion with reference to each other upon the axle of the vehicle. Compressed air is put in the bag, which communicates at each of its ends with a cylinder, as shown. A jolt tends to flatten the bag, compressing the air within and forcing it into the cylinders, which in their turn force the air so compressed back again into the bag, causing it to resume its normal shape when the force of the jolt is spent. The mode of application to a vehicle is shown in the figure.



No. 904,352.

Patents Issued December 1, 1908.

905,135. Controlling Device.—Alberto Balloco, Turin, Italy. Filed April 16, 1907.

905,154. Automatic Vehicle Box and Frame Lift.—Henry C. De Weese, Portland, Ore. Filed June 18, 1908.

905,156. Clutch.—John F. Dornfeld, Chicago, Ill. Filed February 20, 1908.

905,175. Adjustable Steering Mast Support.—Emil Gruenfeldt, Cleveland, Ohio. Filed November 15, 1907.

905,176. Device for Suspending Battery Cradles—Emil Gruenfeldt, Cleveland, Ohio. Filed January 23, 1908.

905,190. Machine for Surfacing Roads, Pavements, Etc.—Colin M. Ingersoll, New York, N. Y. Filed April 21, 1908.

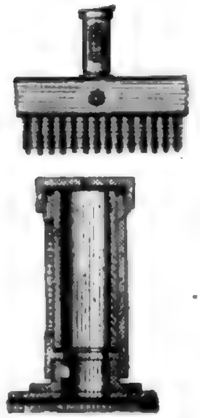
905,209. Clutch.—Oliver R. Mitchell, Boston, Mass. Filed October 8, 1906.

905,226. Transmission Gearing for Motor Vehicles.—Kral Probst, Columbus, Ohio. Filed January 11, 1908.

905,230. Elastic or Pneumatic Tire for Road Vehicles.—Henry J. Scott, Clerkenwell, London, England. Filed November 8, 1907.

905,244. Driving Mechanism for Automobiles.—Richard F. Stewart, Pocantico Hills, N. Y. Filed September 9, 1905.

905,251. Motor Propelled Sleigh.—Math Trunt, Monticello, Minn. Filed May 7, 1907.



No. 904,163.

905,257. Pneumatic Tire.—Louis J. Westness, Milwaukee, Wis. Filed July 2, 1906.

905,389. Explosive Engine.—Alton F. Towle, Colorado Springs, Col. Filed August 23, 1907.

905,405. Traction Wheel and Runner for Vehicles.—Willis N. Britton, Rochester, N. Y. Filed June 18, 1908.

905,438. Shock Absorber.—Wellington P. Kidder, Jamaica Plain, Mass. Filed September 13, 1907.

905,446. Clutch and Clutch Operating Mechanism.—Jonathan D. Maxwell, Tarrytown, N. Y. Filed June 3, 1907; renewed September 19, 1908.

905,462. Motor Vehicle.—Ernst Rosenberger, Mankato, Minn. Filed January 7, 1908.

905,481. Traction Engine.—Daniel T. Timberlake, Baileyville, Kan. Filed April 25, 1907.

905,540. Spring Retarding Device.—Cadwallader W. Kelsey, Philadelphia, Pa. Filed November 15, 1905.

905,555. Tire Armor.—William A. Mix, Walla Walla, Wash. Filed October 14, 1907.

905,607. Controlling Device for Motor Vehicles.—William C. Van Buren, Chicago, Ill. Filed March 2, 1908.

905,611. Starting Mechanism for Explosive Engines.—William R. Webster, Philadelphia, Pa. Filed October 24, 1906.

905,625. Explosion Engine.—Elmer Apperson, Kokomo, Ind. Filed July 3, 1906.

905,637. Speed Changing Mechanism.—Bernhard Beskow, San Francisco, Cal. Filed April 5, 1906.

905,677. Transmission Gear.—Powell Evans, Philadelphia, Pa. Filed Nov. 17, 1905; renewed June 30, 1908.

905,678. Transmission Gear.—Powell Evans, Philadelphia, Pa. Filed April 5,1906; renewed June 30, 1908.

905,713. Self Regulating Electrically Propelled Vehicle with Limited Variations in Intensity.—Louis Krieger, Paris, France. Filed January 10, 1906.

905,727. Explosive Engine.—Richard A. Maples, Clinton, Ia.—Filed April 29, 1907.

905,730. Cushion Tire for Vehicle Wheels.—Gilbert O. Maulsby, Birmingham, Ala. Filed October 1, 1907.

905,733. Internal Combustion Engine.—Arthur J. Miller, Grand Rapids, Mich. Filed April 27, 1908.

905,769. Speed Indicator.—Archibald Turner, Leicester, England. Filed May 14, 1907.

905,778. Pressure Indicator for Pneumatic Tires.—Frank O. Wolff, Windsor, near Melbourne, Victoria, Australia. Filed July 11, 1907.

905,822. Explosive Engine.—Richard A. Maples, Clinton, Ia. Filed July 23, 1907.

The Marion-Overland Automobile Co. have leased the two story building at 118 West Fiftieth street, New York.

Ford & Miller, Waterloo, Ia., have leased the first floor of the building which is to be erected by Dr. E. E. Peek and J. W. Rath on Fifth street between Lafayette and Sycamore streets. Ford & Miller handle the Sutdebaker car.

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The Paris Show.

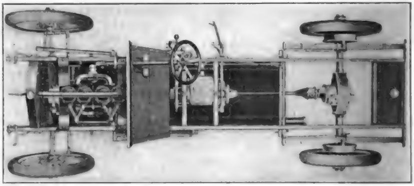
By a Correspondent.

On entering the Grand Palais on the morning of the opening day and standing beneath the central dome, I am astounded at the inexplicable change in the appearance of the display since the last previous event just fifty weeks ago. What has happened? All the renowned firms of France are massed as usual in the positions along the grand aisle, polished chasses are more in evidence than ever, anl yet, as the spectator's eyes glance up and down the wide gangways, it can almost be imagined that a show of five or six years ago is in progress. Slowly, after the first general impression fades away and the details become fixed, does one realize that the theatrical spectacle has disappeared. The elaborate hammered iron, repoussé copper and shining brass sign erections above each stand, newly designed each year and contrived with effect for each maker to outvie his neighbor, have to be searched for, and in their place stand unpretentious wood signboards—artistic, it is true, but not costing a fraction of what was previously expended in this direction. Where incandescent lamps were scattered profusely by the thousand, a modest hundred suffices for any extra light on the larger stands after darkness sets in. Nor is economy confined to the exhibitions, for the Show committee have cut down expense in every possible direction. The unique electric lighting of the vast curves of steel supporting the central dome and glass roofs over the main avenues is entirely suppressed, and one of the sights of Paris for the time the Show lasted last year, that drew thousands each night to applaud as each section was switched into circuit, has become a thing of the past. The exterior lighting of the building at nightfall has been reduced to a modest scale, only a few of the main architectural details being outlined, while the ordinary arc lamps in the streets are no longer supplemented by those festoons and variegated designs in colored incandescents that last year stretched away from the main building and along the bridge over the Seine to the temporary building where the commercial vehicles were housed.

Considered as an international display, the 1908 Paris Salon is far behind the London Show of this year, for with their best market in England the Continental constructors outside France could see no good reason for making a second appropriation for show expenses within a month. In the case of those Italian and German firms which did exhibit in Paris, it was easily to be seen that polished chasses and finished cars had been transferred bodily from London. With the Olympia Show forestalling their home display by a fortnight, the native makers had for their own protection to adopt the same policy. Hence to those whose duties had compelled them to closely scan each stand at the English show, it was soon apparent that new designs or improvements would only be found among the smaller French makers, who could not afford the expense of sending their show machines across the Channel or had not arranged for British agencies.

As was the case at Olympia, practically every maker was satisfied with the old patterns in high powered machines, leaving it to the body builders to attract attention by luxury of interior fitting. Firms who for years past have looked with contempt upon anything smaller than four cylinders of 24 horse power have produced single and two cylinder models up to 10 horse power. Generally the prices of these small machines, fitted with the phaeton or "straight across" type of two seated body, range round about $1,000, including equal size tires to all wheels, usually 28x3 inch, and a small kit of tools, lamps and horns being charged as an extra. Almost all these small cars have propeller shaft and live axle transmission, perhaps the only prominent exception to this rule being the 9 horse power made by Peugeot Frères and known as the Lion-Peugeot. Here and there one could detect some attempt at originality on the part of the small firms, who thus hoped to draw attention to their goods from visitors who would otherwise not waste a moment on these stands. Such departures from regular design were in the nature of suspension of the gear box, freak carburetors or weird universal joints to the propeller shaft. Otherwise increased accessibility can be said to mark the arrangement of engine and the surrounding fitments, and this has been made possible by the general adoption of high tension magneto ignition (with a consequent discarding of the low tension contact maker and its accompanying bunch of wires), thermo-siphon water circulation, and the placing of the magneto in front of the engine and on top of the cam gear case. The large manufacturers, like Panhard, Mors, Clement, etc., who have rushed back into the low powered car business, employ a water pump and belt driven fan behind a honeycomb radiator, but the lesser known firms have been able to take advantage of the experience gained in the various small car races run off in France this last three years, and rely for engine cooling entirely upon a vertical flanged tube radiator, fitting a metal under-shield below the engine, and casting the flywheel with small fan-bladed arms. In this respect Renault still stands pre-eminent and none of the other makers yet approach this firm in the completeness with which the flywheel and engine are encased, so that as long as the flywheel is revolving air at atmospheric temperature must be drawn past the radiator tubes. The unit construction of engine flywheel and gear box finds but few supporters, and the reason for this is perfectly obvious. The people who buy these small machines cannot afford to requisition the services of the local repair shop unless for something of a serious nature, and they stipulate for devices that will permit of any organ of the mechanism being separately dismounted without disturbance of adjoining portions. They cannot be cajoled into buying by mere talking points concerning "alignment of all driving shafts," "reduced power losses." It is to the credit of the majority of the French manufacturers that they are smart enough to build what the public demand and not what designers think ought to be purchased; so we find large leather faced cone clutches, simple coupling joint between clutch and gear box, the old fashioned pattern of Panhard gear box controlled from a side lever working in a quadrant with progressive slots, gear shafts on ball bearings and plain type of universal joint at each end of the propeller shaft. The reversion to the Panhard gear box is due to two causes, the prime one, of course, being that it is very much cheaper to construct than the selective type and much cheaper to install. The second reason is that the German Daimler Company are instituting a campaign for the collection of royalties throughout the world on the patents they undoubtedly hold for the gate charge. A royalty of $25, which it is rumored will be the likely charge for using this fitment, would eat too much into the profits on small cars, and so the producers are preparing for the fight.

One of the very few machines with any points of novelty is the four cylinder, 25 horse power Henriod, the cylinders being



De Luca (Italian Daimler) 22 Horse Power 1909 Model Chassis.

air cooled by two gear driven fans on the exhaust side that are placed very close up to the extremely thin radiating flanges cast integral with the cylinders. The flanges are peculiar, running up gradually to nearly a right angle at the side of the engine farthest away from the fans. This same Henriod car has something unusual in a French machine, viz., a two forward speed and reverse planetary gear ingeniously arranged in a short rearward extension of the flywheel, the final transmission being through a propeller shaft whose front end is supported in a large ball bearing bolted down to a cross frame member. (In this connection it is rather interesting to note that Henriod is the inventor of the combined gear box and rear axle introduced by Darracq at the last show and used in the New York taxicabs, and which is omitted from the list of Darracq cars to be sold in 1909.)

NEW PANHARD SIX CYLINDER.

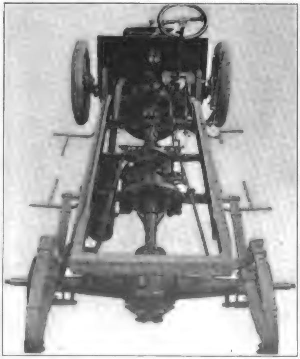
In addition to the two cylinder, 10 horse power machine that was shown at Olympia and a new four cylinder, 15 horse power, Panhard & Levassor have brought out a new six cylinder design materially different from the one they showed in 1906. The engine at first sight appears to be a monobloc casting, but the cylinders are actually cast separately, with the adjacent sides of the water jackets left open, the joints being made by machine faced edges drawn up against each other by four long bolts extending the whole length of the six cylinders. The idea is to simplify the water piping, and while this is attained it is at the expense of power production, because the water passes from the pump to the first and then on to the succeeding cylinders in turn at the exhaust side, then round the last cylinder back again to the first, and so to the radiator.

Aeroplane engines are receiving a great deal of attention, several eight cylinder types with fixed central shaft and radially rotating cylinders being shown by Pelterie, Gnome, Aine, etc. Something extraordinary is the eight cylinder Gobron-Brillié, made up in the form of a double cross, each cylinder containing two pistons. The aeroplane display is to be made at the Commercial Show opening the middle of December.

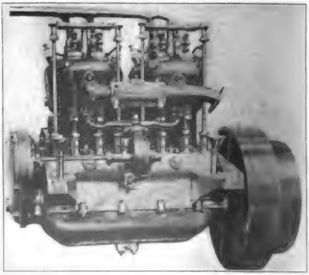
The photos on the opposite page give a good idea of the type of stands which characterize this year's Salon. The upper view shows the extremely plain Westinghouse stand, while the lower shows a number of stands more in keeping with the standard set at previous shows.

Vienna Show Plans.

Another automobile show will probably be held in Vienna during the latter half of March next. It will be remembered that last winter no show was held there. At a recent meeting between representatives of the Austrian A. C. and of the automobile and tire manufacturers the holding of a show was decided upon in principle. A temporary structure is to be erected on the Stubenring, where next year a building is to be erected for the War Department. It is to have about 60,000 square feet of floor space. The show management will see to the equipment of the stands and will also furnish the decorations and signs, which will be uniform, according to American custom. The show will be held under the auspices of the Austrian A. C., and in case any surplus results it will be rebated to the exhibitors who were established in Vienna before January 1, 1909, on a pro rata basis. On the other hand, in case the show should result in a deficit the dealers would have to meet this on the same basis.



Fifteen Horse Power New Model Panhard (Paris Show).



Fourteen Horse Power Rapid Motor, Exhaust Side (Paris Show).

WESTINGHOUSE
IMULA
PICCARD-PICTE

DARRACQ

The Practice of Case Hardening Automobile Parts—II.

By Leon Guillet, D.Sc.

THE NECESSITY OF QUENCHING.

When the part is withdrawn from the carbonizing box the surface layer does not possess the required hardness; the carbonizing process has only increased the carbon content of the surface layer (we shall refer to certain exceptions in connection with special steels later on). The surface of the part can only be given the requisite hardness by quenching the part. The surface layer, which, as we have seen, is rich in carbon, will then become very hard, while the core of the part, with its small carbon content, will remain soft.

If a carbonized part is broken there will generally be found a very slight line of demarkation between the carbonized layer and the interior. It is entirely different, however, if the part has been quenched. The section near the surface has then the characteristic fine grain of a hardened high carbon steel; the core may be fibrous, but it always presents the grain of a low carbon steel. One may readily determine approximately the thickness of the carbonized layer on the fracture. Quenching is therefore necessary for obtaining the surface hardness—at least with all carbon steels and with the majority of alloy steels.

DIFFERENT HARDENING METHODS.

There are four possible methods, which we will discuss in succession, both from the theoretical and practical standpoints. The first method consists in taking the carbonizing boxes from the furnace after the cementation is completed, rapidly opening them, taking hold of the parts and plunging them into the hardening bath. According to the second method, the boxes are taken out of the furnace and allowed to cool down to about 450° or 400° C.; they are then heated to 750° and quenched. By the third method the parts are withdrawn from the boxes at a relatively low temperature, as by the preceding method. They are then raised to a temperature of 900° C., and quenched while cooling at 750°. By the fourth method the parts are withdrawn from the boxes at a relatively low temperature; are then raised to 900° C. and quenched; then reheated to 750° and quenched a second time.

THEORETICAL CONSIDERATIONS.

One might be astonished to find that there are so many different hardening methods, some of them very simple, like the first, for instance, and others relatively complicated, like the last two.

If we keep in mind that the quenching, in order to produce its best effect, must be carried out at a temperature very slightly above the temperature of transformation of the steel, we may conclude that in order to obtain great surface hardness the carbonized parts should be quenched at approximately the temperature of transformation of high carbon steel (containing about 85 per cent. of carbon), since the surface is constituted by steel of this character. This temperature is approximately 700° C. This leads to the first conclusion that, in order to secure a hard surface, it is necessary that the temperature be slightly above 700° C., say 725° to 750°. It is therefore only necessary to take the part out of the carbonizing box, let it cool to 750° C. and quench it. It will then have the surface hardness desired.

We must, however, also consider the effect of the treatment on the core. It will be remembered that the cementation process, in which the whole part has been kept at a high temperature for a considerable time, renders the low carbon steel of the core brittle and the grain coarse, and this up to a certain limit, which is the higher the higher the temperature at which the cementation takes place and the longer this temperature is continued. If the cementation is effected at a low temperature, the core will be more brittle than if it is effected at a high temperature, for the reason that in the former case the process must be continued for a longer time. It would, therefore, be possible to carbonize at 850° C. and quench at 750°, and there need be no fear of excessive brittleness of the core.

If, however, the cementation is effected at a high temperature, 1,000° C., for instance, and the part is quenched at 750°, the core will certainly be brittle. This brittleness can only be prevented by annealing the part. In discussing this subject of annealing we stated that a piece of steel which had been overheated—which is the case with the cemented part—could be restored to its original condition by annealing it at just above the point of transformation, the piece having previously been cooled to well below the point of transformation. Now, the core of the carbonized part is of extra low carbon steel, whose point of transformation is approximately 850° C. The annealing should therefore take place at a temperature slightly above 850° C., say, 875° to 900°. But it is always necessary to quench at 700° C. in order to secure the necessary surface hardness. This leads to the third method, which comprises, after cooling, annealing at 900° C., followed by quenching at 750°.

This method has the same advantages as the preceding one (annealing after slow cooling), but the quenching at 900° C., producing a certain state of the core (martensitic state), always gives the greatest resistance to shock to any very low carbon steel. We might stop at one quenching at 900° C., but this would be too high for the surface layer, which would be very brittle and not very hard. To secure the proper surface hardness, the part must be quenched at 750° C. If the cementation is effected at a relatively low temperature, a single quenching will do, although in that case the core will not have any great resistance to shock. If the cementation is effected at high temperature it is necessary to "regenerate" the core of the part, either by annealing at 900° C., or, what is better, by quenching at 900°. These latter methods are therefore logical.

PRACTICAL CONSIDERATIONS.

The first method, which consists in quenching the parts as they are withdrawn from the carbonizing box, is open to the following serious objections: First, if the quenching is to be accomplished under these conditions the cementation must necessarily be effected at low temperature, else the core would be too brittle. The objection to cementation at low temperature, say 850° C., is that it is very slow. Second, quenching upon removing the parts from the box, although the temperature of the latter is 850° C., and the proper temperature for quenching is 750° C., gives uncertain results. If it is effected close to 850° C. the surface layer will be brittle and not very hard; if it is effected below 700° C. there will be no surface hardness. This first method should, therefore, never be used.

The second method consists in allowing the parts to cool and then raising them to 750° C. and quenching. The same as the preceding method, this one does not "regenerate" the core of the piece, for the reason that the temperature does not reach the point of transformation of extra low carbon steel, of which the core is composed. This portion of the piece must therefore show as little brittleness as possible after cementation, for which reason the cementation is effected at 850° C. In this case the temperature of quenching is very precise. The second method, therefore, requires a slow cementation, but gives a very good surface hardness.

The third method introduces a heating to 900° C., followed by quenching at 750° C. The object of this heating is to "regenerate" the core of the part. This permits of cementing at a high temperature, and consequently shortens the process. The only disadvantage of this method is the following: The method is somewhat difficult to carry out. If a single furnace is used it must be kept at 900° C.; corsequently after the piece has reached this temperature it must be withdrawn from the furnace, allowed to cool to 750° C., and then quenched. But how is the workman to know when the part has reached a temperature of 750° C., especially in the case of small parts? The results obtained by this process are therefore uncertain.

On the other hand, two furnaces may be used, one kept at 900° C. and the other at 750°. The part is then placed in the first until it has reached that temperature, is then withdrawn and placed in the second furnace, and is quenched after it has reached the temperature of this furnace. This method, however, never gives as good results as the fourth method, the core of the parts not having as high a resistance to shock.

The fourth method is that in which two quenchings are employed, the first at 900° C. and the second at 750° C. The object of the first quenching is to "regenerate" the core of the piece, and that of the second to give the necessary surface hardness. It is to be noted that this latter quenching, taking place below the point of transformation of the core, cannot affect the latter. This last method gives the best results from every standpoint. But it has the serious disadvantage that it requires two heatings and two quenchings, and consequently increases the chances of spoliation by decarbonizing and oxidation, and it also accentuates the deformations. These difficulties, which are of no great consequence when the part is heated to only 750° C., become very serious when it is heated to 900° C.

We are thus led to the two following conclusions, which, in the writer's opinion, should be a guide to everyone having to do with the cementing and quenching of steel:

1. In the case of parts which are not subjected to shock, and where deformations have to be feared, it is advisable to cement at 850° C., let the part cool; re-heat to 750° C., and quench. This method is applicable to ball races, cams, anti-skid rivet heads, etc.

2. If the parts must not be the least brittle they should be cemented at 1,000° C., and then quenched successively at 900° and 750° C. This process is adapted for shafts, gears, etc.

TEMPERATURE OF HARDENING FURNACES.

The question may be asked whether a hardening furnace should be kept at the temperature of quenching or at a higher temperature. The same argument applies here as in the case of cementation furnaces. If temperature measuring instruments are at hand it is advantageous to maintain the furnace at 50° to 100° above the quenching temperature. In this way the operation is greatly facilitated.

HARDENING BATHS.

For quenching carbonized parts an ordinary water bath at normal temperature is always used. The precautions to be observed as regards renewal of the liquid and its circulation are the same as those pointed out by the writer in his article on hardening. If deformation of the parts is feared the water bath may be covered with a thin layer of oil.

For hardening partially carbonized parts there are two methods available. Either the protector may be removed after cementation and before quenching, or the part may be quenched with the protector still in place. The first method can, of course, only be employed if the parts are not quenched immediately upon being removed from the carbonizing box. It does not involve any difficulties. It is necessary in case the protectors are very voluminous and have an influence on the rate of cooling. The second method is necessary where metal sleeve protectors are used.

CASE HARDENING DEFECTS.

It is necessary to distinguish between defects due to the carbonizing process and defects due to the heat treatment following it. The principal defects due to the carbonizing process are:

1. Insufficient depth of the carbonized layer.
2. Non-uniformity of the carbonized layer.
3. Warping of the part.
4. A bad "skin" of the part.

The principal defects due to the heat treatment are:

1. Want of hardness.
2. Non-uniform hardness.
3. Brittleness of the surface layer.
4. Brittleness of the core.
5. Warping of the part.
6. Formation of a coating of oxide.

We will now consider these various defects and their remedies.

If the carbonized layer is of insufficient depth, this may be the result of (1) too low a carbonizing temperature, (2) insufficient duration of the carbonizing process, (3) a poor or exhausted cement. It is an easy matter to determine which of these three conditions exists, after what has been said above.

Non-uniform depth of the carbonized layer may result from non-uniform thickness of the cement, from contact between parts, or between a part and the walls of the box—that is to say, from want of care in packing the parts in the box, or from non-uniform heating.

Warping or deformation of the parts after cementation (not after the heat treatment) is due either to the weight of the part itself, or to the annealing, which is to say, to the destruction of the internal strains in the metal. This point deserves some consideration. The deformations resulting from the weight of the part itself may be avoided, at least in the majority of cases. To this end the piece should be placed on supports in such a manner that the carbonizing action will not be interfered with. In the case of a crank shaft, for instance, the supports may be placed between the crank arms opposite the crank pins. As regards deformation due to relieving the internal strains, they are still more easily avoided, and the following is the method according to which, in the writer's opinion, every careful cementation operation should be carried out.

The part is first roughed out in machine tools, and is then annealed at 900° C.; it is then machined to within the finishing cut, then cemented, quenched and ground. It is obvious that the annealing at 900° removes the internal stresses, and as the finishing cut in the machine tools is taken after this, there is no danger of serious deformations, the internal strains resulting from the finishing being insignificant.

A "bad" skin is generally characterized by a sort of granular appearance at the surface. It seems to result from too much moisture in the cement, or from an excess of silica in the fire clay forming the protector, or especially from parts which have been oxidized before the cementation, being placed in contact with silicious products. This is a point on which there is no very definite knowledge, but in any case it is to be recommended to keep the parts very clean and to use a well dried cement.

Among the defects due to the heat treatment the most frequent is want of hardness. This may be due either to defective cementation (the surface layer must have a carbon content of .85 per cent.) or to improper hardening. The latter in turn may be due to too low a quenching temperature, too high a temperature of the quenching bath, or too small volume of the latter, improper handling of the part at the moment of quenching, etc. Finally, the part may have become decarbonized during the heating previous to quenching, if the quenching has not been effected upon withdrawal from the carbonizing box. This decarbonization takes place if the part is heated in an oxidizing atmosphere, which is quite frequently the case.

Non-uniformity of the hardness may result from the same causes, viz., non-uniform cementation, improper quenching (especially improper handling of the part during the quenching process, as for instance, ball bearing cups inserted into the bath flat and inverted, instead of being inserted in a vertical plane), partial decarbonization or non-uniform heating previous to quenching.

Brittleness of the surface layer may be due to one of the following three causes:

1. Too deep decarbonization (presence of cementite, too great a carbon content), which is caused either by unduly prolonging the period of cementation, by a too high temperature, or by a too violent cement (the pure cyanides, for instance).

2. A steel containing too large a proportion of manganese.

3. A single or a second quenching (in the case of double quenching) at too high a temperature.

Brittleness of the core results either from original poor quality of the steel (especially too high manganese content) or from improper treatment; or, rather, to be more exact, from a heat treatment which does not correspond to the cementation utilized. For instance, the core of a part which is carbonized at 1,000° C., and quenched at 750° C., will certainly be brittle.

Warping or deformation of the part is due to the causes already pointed out in connection with hardening, and the writer only returns to the subject here to lay special stress upon the importance of uniform heating.

If there is a coating of oxide, this is due to carrying out the hardening process in an oxidizing atmosphere. This trouble may be avoided by using muffle furnaces or salt baths.

TESTS IN CASE HARDENING.

There are three sorts of tests to be made in connection with the case hardening process, viz.:

1. Tests of the materials used.
2. Tests in connection with the operations.
3. Tests of the finished product.

The materials used consist of the steel and the cement. Tests need only be made of the steel, as the cement should always be made on the spot, and in any case it is an easy matter to determine its composition by the method indicated by the writer for determining the correction to be made after use. As concerns the steel, there are two points of the greatest importance, viz., the carbon content and the manganese content. One may first make a tensile test, and this may be followed by a chemical analysis to determine the manganese content. But what is really wanted is a method of making a rapid test of the parts as they arrive in the case hardening shop, just before they are placed in the carbonizing boxes. Such a test must be rapid and inexpensive and must not spoil the parts tested. The Brinell ball test meets these requirements very well.

The tests in connection with the operations consist chiefly in measurements of the temperature and of time. Nothing further need be said regarding temperature measurements, which the writer has already discussed in these columns. As to the times, they may be fixed from the tables already given. It is a good plan to have near each furnace a slate, on which the data of each operation may be noted down—that is to say, the time the boxes were placed in the furnace, the time of removal and the temperature.

Finally, the tests of the finished product consist in a determination of the hardness and the brittleness. The hardness is generally determined by means of a file. This is evidently a very crude test, but it is rapid, and in the majority of cases sufficient. All that is required is that the file must not bite. New files which have not yet been used, and of a very hard quality of chrome steel, should be used for the test.

The determination of the brittleness is a very delicate matter. The only really scientific method consists in taking several parts from a lot, removing the carbonized layer by means of a grinder and cutting a number of test bars from the core, which are tested by means of the so-called notched bar method. With a good steel and proper treatment this test will show at least 15 kilogrammeters (maximum about 36 kgm.); with an average quality steel and an ordinary treatment, between 10 and 15 kgm., and if the steel or the treatment has been bad one cannot count on more than 8 kgm. The lower admissible limit seems to be 4 kgm.

This method is expensive, and for this reason it is often replaced by the following test, which is much less precise and which has only a relative value: Into the cementation box is placed a test bar of 15 to 20 mm. diameter and 150 to 200 mm. length. This bar, of course, is made of the same steel as the parts to be case hardened, and is subjected to the same chemical and physical treatments. These test bars are then broken in a press, and note is taken whether they break abruptly or with a certain angle. The results thus obtained are affected by a great number of factors, such as depth of carbonized layer, diameter of the test bar, method of applying the breaking strain, etc. At any rate, the grain of the core may give some clue to its condition; if it is coarse, the core must be brittle.

CASE HARDENING MEDIUM CARBON STEEL.

We said above that case hardening steel is a very low carbon steel, and gave the reasons why this steel should be chosen. However, under certain special conditions, ordinary medium carbon steels may be used, which have a tensile strength of 55 to 65 kg. p. sq. mm. Such parts should never be used for machinery, but may be valuable for tools. Thus, certain dies are made from this material. If they were made from extra low carbon steel they would too readily become deformed. A harder sub-stratum is required, and the medium carbon steel gives this. On the other hand, the part is always more brittle than if made of very low carbon steel.

For tools in general it is better to use very low carbon steel. Thus, milling cutters of very low carbon steel, carefully case hardened, give excellent results, and are very much better than if made of medium carbon steel, case hardened.

It remains for us to discuss the important progress which has been accomplished by the adoption of nickel steel. The substitution of nickel steels for ordinary steels in the very delicate operation of case hardening is certainly due to the automobile industry. The following shows the importance of this substitution: It is known that the ordinary case hardening steel contains .12 to .15 per cent. of carbon, and that in order to avoid any brittleness in the steel it is necessary to quench it twice in succession after cementation, first at about 875° C. and then at about 750°. In a preceding article the writer discussed at length the complete theory of this treatment, and also showed the serious drawbacks of this method, especially from the standpoint of deformation.

If now we consider a nickel steel containing .12 to .15 per cent. of carbon, the same as the ordinary case hardening steel, and 2 per cent. of nickel, the steel will show an absolute lack of brittleness after only a single quenching. Such a steel may be carbonized by the same means and in the same manner as ordinary carbon steel. It is to be noted, however, that the rate of penetration is slightly lower than for ordinary steel. After carbonization the steel is allowed to cool (to 300° C. is sufficient); it is then reheated to 700° and quenched. In this manner a very hard surface layer is obtained (if the carbonizing has been well done) and the utmost resistance to shock.

The advantages thus offered by nickel steel become at once apparent, but there is still another advantage in its use. Ordinary case hardening carbon steel has a tensile strength of about 38 kg. p. sq. mm.; the 2 per cent. nickel steel for case hardening has a tensile strength of about 42 kg. p. sq. mm. The core of a part made from this alloy steel therefore has greater strength.

If the nickel content is increased while the carbon content is maintained constant at about .15 per cent., similar results are obtained, as long as the nickel content does not exceed 7 per cent. There is, however, an advantage in using a greater percentage of nickel than 2 per cent.—at least in certain cases. As the nickel content increases the mechanical properties improve. While the ordinary case hardening steel has a tensile strength of 38 kg. p. sq. mm., an elastic limit of 24 kg. p. sq. mm. and an elongation of 30 per cent., the 2 per cent. nickel steel has a tensile strength of 42 kg. p. sq. mm., an elastic limit of 28 kg. p. sq. mm. and an elongation of 32 per cent., and a 6 per cent. nickel steel has a tensile strength of 50 kg. p. sq. mm., an elastic limit of 40 kg. p. sq. mm. and an elongation of 30 per cent. These mechanical properties may be counted upon for the core of the part.

The use of these nickel steels for case hardening cannot be too strongly recommended. The 2 per cent. nickel steel should be used for all common automobile parts, such as shafts, gears, ball races, etc., and the 6 per cent. nickel steel for parts which are subjected to fatigue inducing loads, as, for instance, steering knuckles.

There remains to be discussed a somewhat special case, of a steel which by a simple carbonizing operation, not followed by any quenching, acquires the same properties as other steels by carbonizing and quenching. This steel contains 7 per cent. of nickel and about .15 per cent. of carbon. In order to make use of this steel it is sufficient to carbonize it like ordinary steel, taking account, however, of the fact that the rate of penetration is considerably less than for carbon steel. After the carbonization is completed the steel is allowed to cool, and may then be used without quenching. The surface hardness of this steel is slightly less than that of steels which are carbonized and quenched, but sufficient for a great number of purposes, especially for frictional parts, such as shafts, etc.

The great advantage of this steel is due to the fact that all the trouble due to warping or deformation usually caused by the quenching is thus avoided. If the necessary precautions are taken it is not even necessary to refinish the part. To this end one must proceed as follows: The steel as obtained from the steel mill is annealed at 800° C. and slowly cooled; it is then machined to the proper form, taking care not to bring any great pressures to bear which might cause internal strain. The part is then carbonized, care being taken to properly brace and support it, so it will not sag out of shape during the prolonged heating, and it is then allowed to cool either in the air or in the carbonizing box. This case hardening steel, which requires no quenching, is thoroughly adapted for delicate parts, such as gauges. The results obtained with this 7 per cent. nickel steel are the outcome of theoretical investigations by the writer, detailed in the Bulletin of the Society of Civil Engineers.

It might be added that sometimes nickel chrome steel is used containing .5 per cent. of the latter element. With this alloy steel a greater surface hardness is obtained than with nickel steel.

(Concluded.)

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Changes in Our Foreign Automobile Commerce.

When the financial depression first set in, a little over a year ago, it was accompanied by a slump in the imports of automobiles, and also of diamonds, and the effect of the panic on the demand for these luxuries was a subject of comment in the public press at the time. During the previous fiscal year the imports of automobiles had for the first time exceeded the exports. But the old rule of an excess of exports became soon re-established, for during the first year of the depression the exports increased materially. This was considered to be due to the fact that a number of American makers, who had up to then been unable to meet the home demand for their cars, were now, upon the slackening of the home demand consequent upon the depression, seeking markets abroad.

During the last four or five months there has been a remarkable change in the aspect of the import situation. The first thing noticed was that the average values of the imported cars had dropped materially. In fact they fell from an average of $3,500 in 1905 and 1906 to about $1,800, or practically one-half the former figure. When this change was first observed it was assumed, and no doubt correctly, that it was due to the fact that a large proportion of the imported cars were taxicabs. Of late, however, not so many taxicabs have been brought in, and the continued large number of cars imported and low average value can be explained only on the ground of price reductions by the foreign makers and a change in the type of cars imported from high powered touring cars to more moderately powered town cars. That there has been a decline in the exports of American automobiles recently is readily explained by the fact that the foreign makers have recently taken up the same type of vehicle which has always made up the bulk of American exports, viz., the low priced service car, and are, therefore, now proving more serious competitors in our export markets.

The Tariff Hearing.

The matter of this recent unfavorable turn in our foreign automobile commerce will undoubtedly be referred to at the tariff hearing which is to take place next Saturday. One of the trump arguments of the manufacturers' committee fighting the proposed reduction in the tariff appears to be that only 10 per cent. of the firms manufacturing cars are making money. No doubt this contention is true, but whether the Ways and Means Committee can be convinced of it is another question. The automobile columns of the newspapers have certainly given no hint of this lack of financial success among automobile manufacturers; in fact they have always given the impression that prosperity reigned supreme in the automobile world, and the expensive showrooms maintained on the chief thoroughfares of all the big cities have tended to confirm this view. However, figures count, and the mortality statistics of the automobile industry compiled by the manufacturers' committee are certainly impressive and ought to eradicate any preconceived notion on the part of members of the Ways and Means Committee that the automobile industry is one of large profits to the manufacturers.

The manufacturers' committee is endeavoring to have automobiles classed separately in the new tariff schedule, and not as manufactures of metal, presumably because of the supposed danger of a reduction in the duty on this latter class of imports. There are obviously good reasons why automobiles should be classed separately. The automobile industry is an industry by itself, entirely independent of the general hardware and machine tool industry, and undoubtedly of sufficient importance to merit an investigation of its special requirements.

In conclusion it might be pointed out that, so far as we know, the manufacturers through their tariff committee have never urged an increase in the present duty, as was claimed in various newspaper reports. Such an increase may have been advocated by individual makers, but the Ways and Means Committee, we think, is not likely to consider any demands except those placed before it directly by the accredited delegates of the industry.

The Drunken Driver.

Considerable public concern has been evinced recently over the danger to road traffic from intoxicated drivers of automobiles. "Joy riding," which is generally a combination of "scorching" and "boozing," seems to be still on the increase, to judge from the number of accidents reported, generally happening at night, with cars taken from garages without the knowledge or consent of the owners. Instances have occurred lately of persons being run over and killed by cars driven at high speed by drunken drivers.

A recent case in Hartford, Conn., where a young man was sentenced to not less than three years in State's prison, on being convicted of a charge of manslaughter, to which he pleaded guilty, with an appeal for clemency on the ground that he had been intoxicated at the time, has been widely commented on in the press, the general conclusion being that there is no room on the public highway for the drunken chauffeur, and that intoxication, instead of being a mitigating circumstance, is rather an aggravating one. The matter has also been taken up by the granges, and, as a result, is bound to receive widespread attention.

The serious risks involved in cars being in charge of intoxicated drivers are generally recognized, and it would not be surprising if the present agitation should result in the incorporation into many of the new State automobile laws that will be passed the coming winter of clauses making it a criminal offense to drive an automobile on the public highway while under the influence of liquor. There is really no parallel to the perils to road travelers resulting from this cause. The drunken horse driver is a nuisance, and also to a certain extent a danger, but the fact remains that he usually drives a sober horse, an intelligent animal, and no harm is likely to be done, unless he persists in driving fast or in cutting capers. The drunken soldier armed with a rifle has been instanced as another parallel to the drunken chauffeur, but both the comparisons are fallacious, because the drunken horse driver and the drunken soldier only become a menace if drink induces in them a mania for certain acts, which is only rarely the case; whereas, with an automobile a disaster is certain if only the driver is sufficiently intoxicated. For this reason special legislation to guard against this menace to all road traffic would be entirely justified. The automobile industry would certainly not suffer if some of the superfluous drunkenness, graft and immorality now connected with the use of the machine were stamped out.

Reduction of Valve Noises.

Refinements in engine construction are once again directing public attention toward the noise made by valve operating mechanisms. As a general thing it may be said that an engine with valves in the head will be more noisy than one with valves on the side, both on account of the greater weight and size of the moving parts, and because of the location of the striking points on top, where the sound is more readily heard. Nevertheless some engines with valves in the head are among the quietest running, owing, no doubt, to careful workmanship and refinements in cam design.

Noises in valve mechanisms may be due to a number of causes, as follows: Too much clearance between the valve stem and its push rod or operating lever; to steep an incline to the cam, so that the push rod is started so suddenly that it is thrown clear of the cam, strikes the valve stem, and rebounds against the cam; too steep a decline to the cam, so that the push rod does not follow it in closing, but is left suspended in the air for an instant, and then falls, striking the cam a blow. Any or all of these causes are sometimes found in a single engine.

Where engines are manufactured—not "made"—and their cams are interchangeable, being machined to standard profiles, the valve clearances come very near to what they should be without adjustment. If in addition adjusting means are provided which may be accurately set, and then securely locked, the result will be a very quiet valve action, provided that the cam design is right.

In the case of engines made in this manner—and a number are now so made—it would be advisable to instruct owners to keep this valve clearance at about 1-100 inch throughout the life of the car. The valves of a well designed modern engine seldom require grinding, the wear on cams and rollers is slight, and the difference in the timing caused by individual cylinders making the clearances all alike without reference to their timing would not be sufficient to cause any noticeable difference in the running of the motor. If the clearance is kept down to this amount the valve action will be much more quiet than it is now on many cars in their second season of operation.

Fibre plugs in push rod ends, pockets containing oil, and similar devices for reducing the noise of contact have been tried with considerable success. The more obvious expedient of putting a casing around the valve stems has also been in use to a certain extent for several years past. One of the 1909 cars is being equipped with a telescopic form of individual valve spring cover, which appears to be very effective.

Since public attention is being directed toward valve noise rather by its absence on some engines than by its presence on others, it will apparently be necessary for engineers to study the subject carefully to avoid unfavorable comparisons.

Ignition Tendencies.

There are evidences this season of an increasing tendency to adopt the magneto as a source of ignition current. On a great many of the small four cylinder cars, selling at a low price, some sort of magneto will be offered as a standard equipment. Most of the larger cars fit a magneto as a matter of course, though many of them will have some other system either partly or wholly independent of the mechanical generator. For single cylinder and opposed engines, however, the vibrator coil is still the favorite.

It would seem that the general consensus of opinion among designers is that where the ignition work is intermittent, as on a single cylinder or opposed motor, the current cost is not great enough to render a magneto economical; but that where four or six cylinders are employed the magneto gives enough less trouble to warrant its extra cost. This excess cost is much less than formerly, for not only is the price of magnetos generally lower, but some of the more recent types greatly simplify the wiring and so reduce the cost of assembling the car.

The coil and battery are, however, by no means "dead," even for multi-cylinder work. While the vibrator coil is used in many instances for a secondary equipment, the tendency may be said to be rather away from the vibrator and toward the single spark system. Quite a number of manufacturers of ignition equipment are known to be experimenting with the single spark system, and it is very possible that they may evolve something which will prove a strong competitor of the magneto on both cheap and high priced four and six cylinder cars.

The initial cost and difficulty of attaching have so far prevented the general adoption of single spark generators, though their marked economy in current consumption has gained for them considerable recognition.

Getting Down to Business.

The French manufacturers are evidently sobering up and renouncing their former policy of dash and dazzle. The Paris Show this year is a far less brilliant and expensive affair than it formerly was, and for next year a number of prominent firms have decided not to exhibit at all. Now comes the rather startling announcement that the very leaders of the industry have bound themselves by a heavy bond to hold aloof from the Grand Prix next year. It is evidently being realized that these demonstrations no longer have the effect on business which they were once credited with. At any rate, the "gilded youth" class of purchasers who could be impressed by racing successes and be induced to pay the expense no longer suffices to absorb the output of the makers, and the field offered by the large middle class must now be cultivated. In the future the battle for supremacy will be fought out more along the line of most value for the money, instead of most speed in the Grand Prix or most artistic effect at the Salon.

While these changes are going on in France we have just begun to introduce annual Grand Prize races here, and if the statements of the press agents are to be believed at least one of the two New York shows this winter will be characterized by more expenditure for decorations than have ever been made before. Somehow the French manage to always keep ahead of us by several years.

Turbines as Automobile Motors.

By P. Maissonneuve.

In a previous issue of this paper (November 7, 1900) the writer stated that, as far as water injection in explosion motors is concerned, the best results are obtained from an engine of the turbine type. Since that time a great deal of interest in the subject seems to have arisen in the French engineering world. There is no doubt that if low powered types of gasoline, or even steam, turbines could be designed and built, such engines would rapidly replace the reciprocating engines in automobile construction, the same as high powered steam turbines are replacing reciprocating engines on warships and liners.

The turbine itself is almost the same, whether it is actuated by steam or by burnt gases. In both cases its motion is produced by the impact on its blades of a rapid flow of expanding fluid, whose weight and temperature are, of course, different in the two cases.

The use of steam turbines for road traction is not new. About two years ago an American firm brought out a truck provided with a steam turbine and electric transmission. The dynamo was geared through spur pinions, and generated an eighty volt current that was led to the electric motors direct geared to the driving wheels. The writer does not know what were the results obtained from the above system, but it does not seem to have been very satisfactory, else it would have been referred to again in the technical press.

Fig. 1 shows diagrammatically the arrangement of the power plant; A is the 14 horse power de Laval steam turbine, turning at the rate of 30,000 revolutions per minute, the motion being transmitted to the dynamo C through a 1 to 10 reducing gear B; another reducing gear D operates the air fan E and feed pump F.

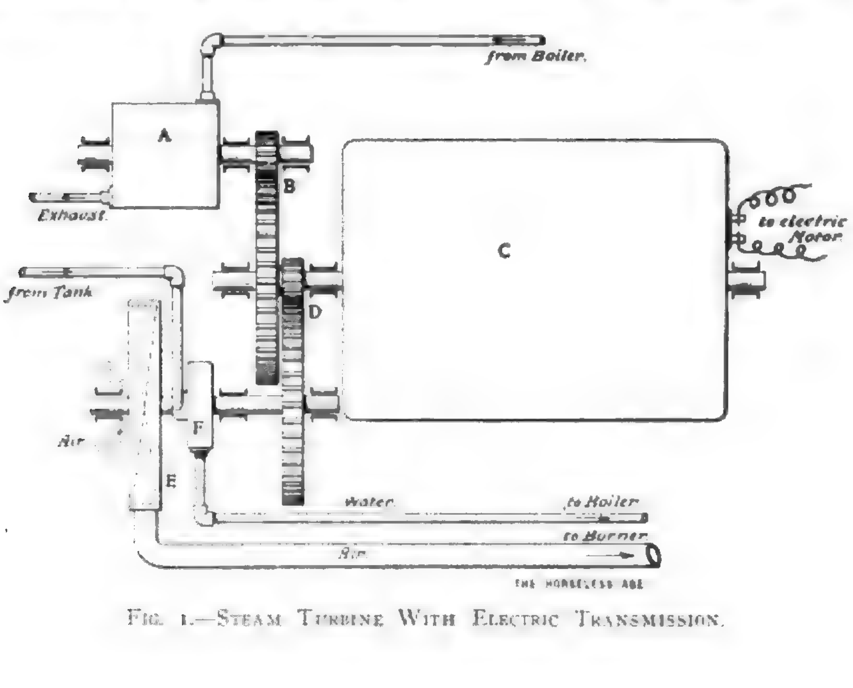


Fig. 1.—Steam Turbine With Electric Transmission.

The thermal efficiency of steam engines cannot bear comparison with that of internal combustion motors; whatever losses there may be in the latter the efficiency still remains higher, though it does not exceed 30 per cent. in stationary Diesel motors, and 20 per cent. in automobile engines. In the writer's opinion the failure in the above case cannot be ascribed to the fact that the engine belongs to the turbine type, but must be due to the use of both steam and electric transmission.

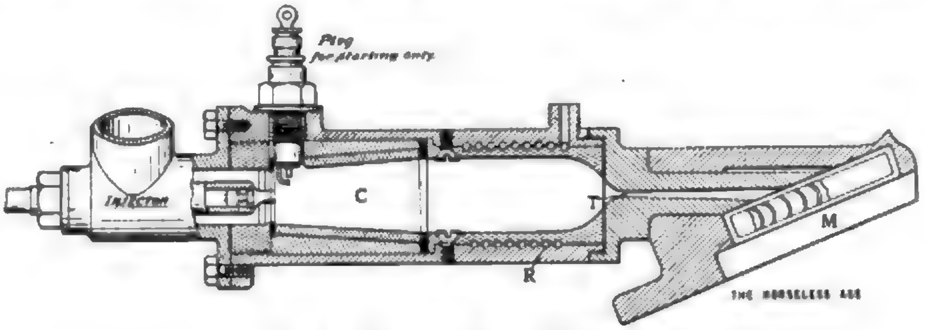


Fig. 2.—Diagram of Gas Turbine.

A glance at the power plant of the above vehicle shows the remarkably small space taken up by the turbine. As an example of the small size of turbines in general, it may be stated that the diameter of a 10 horse power Laval steam turbine is only 4¾ inches, but the number of revolutions per minute is necessarily very high, the 10 horse power turbine rotating at the rate of 24,000 r. p. m.

It might be feared that at such enormous speeds the bearings would either seize or be rapidly worn out. Actual practice, however, shows that, provided the lubrication of the journals is good, high speed can be maintained without trouble. The shaft of the De Laval steam turbines is a flexible one, so that the rotation always occurs around the centre of gyration, even if the latter does not coincide with the axis of the shaft.

The reader may ask what is the advantage of the turbine over the reciprocating motor. I think that when the practical gasoline or kerosene turbine is found it will be as far superior to the best present reciprocating motors as these are ahead of the first Daimler engine. Going further into the matter, it will be found that high speed rotary motors will do away with the necessit, for change speed gears, for in practice the fluid will act continuously, and deliver almost the same power at all speeds of the turbine (above a certain minimum speed, of course).

A motor car propelled by an engine of this kind would be of ideal simplicity, the constituent parts being the frame with its ordinary steering and driving wheels, the latter being fixed to a solid or to a live axle, according to the type of transmission (cardan or chains). The reverse could be obtained by providing the turbine with blades and nozzles arranged so as to drive the turbine in the opposite direction. These blades could be disposed concentrically to the main ones.

In such cars there would be no change speed gear, as in an ordinary steam car, but the general objections to steam remain, whether the engine is a turbine or a reciprocating one. The thermal efficiency of the steam motors is inferior to that of our present explosion motors; moreover, the maintenance of boilers and burners having proved troublesome and costly, there would be no advantage in using steam turbines instead of reciprocating steam engines.

Though many *explosion* turbines have been invented, none has ever been constructed that proved successful. By *explosion* turbine is meant one in which the charge is compressed, which involves the use of a hermetically closed chamber and lubrication of the frictional parts, and it is quite impossible to keep a compression chamber tight and lubricate its walls at the high temperature and the high speed of rotation characteristic of a turbine.

These difficulties are not encountered in the *combustion* turbine in which the burnt gases act by their speed only, and not by their pressure. Tightness between the turbine and the cover being unnecessary, no lubrication is needed, except for the shaft bearing, which never reaches a high temperature. The temperature of the blades is limited only by the resistance to heat of the metal used.

The combustion turbine consists essentially of the following parts (Fig. 2):

1. A combustion chamber, C, in which the gases are raised to a high pressure.
2. A conical nozzle, T, in which the gases expand and change their potential energy into kinetic energy.
3. A turbine, M, the blades B of which receive the stream of gas and absorb its kinetic energy.

There is, therefore, in this motor a double transformation of energy, viz., first from heat energy into potential energy of the compressed gases, and then into mechanical energy. Contrary to what would be expected, these successive changes do not involve any important loss of energy.

If the above system could be practically realized, the thermal efficiency could be expressed by the drop in the pressure and temperature from the combustion chamber to the nozzle of the tuyere. It will be shown later on that other factors are to be considered which lower the final efficiency of the engine; but as further improvements are confidently expected which will reduce or entirely eliminate the objections referred to, it can be stated that the best results will be obtained with high initial and low final pressure, together with low final temperature. In most cases the final pressure will be above atmospheric, and the temperature will never fall below 400° C. absolute.

Although a high initial pressure is advisable, practice shows that it cannot be obtained without previous compression of the combustible mixture; and right here the first difficulty is encountered, for the compression of air takes a great part of the power delivered and necessitates the use of an auxiliary apparatus, the air compressor. The higher the mixture is compressed the higher the efficiency of the engine; but this previous compression is limited by the low mechanical efficiency of high speed piston compressors, and the difficulty of attaining high pressures by means of the turbo-compressors on the Rateau system, which are probably used to greatest advantage in connection with high speed motors.

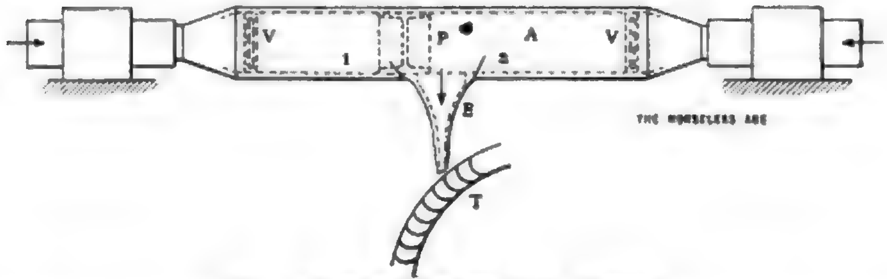


Fig. 4.—Esnault-Pelterie Gas Turbine.

We thus produce burnt gases at a constant pressure, and this fluid expanding while in the nozzles, the thermal energy is changed into kinetic energy, and the drop in temperature may be represented by $T_0 - T_1$. It has already been stated that a great deal of the power delivered by the combustion turbine is used to drive the requisite air and gas compressors. This power is lost as useful motor power. It would consequently be very advantageous to diminish the volume of gas needed to develop a given amount of power; however, the combined volume of air and combustible cannot be very much reduced. If the combustible is a liquid, such as kerosene or gasoline, it can be forced directly into the combustion chamber, and the compressor needs then to compress only the air. But the difference is hardly noticeable, as air forms the major part of the volume of the combustible mixture.

One solution of this difficulty would be to use pure oxygen instead of air. In that case the volume of gas to be compressed would be only one-fourth as large; in other words, the combustion of 1 pound of mixture would develop 3,970 B. T. U. instead of 990 B. T. U., as with air.

The greatest trouble met with in gas turbines is the destruction of the turbine blades by the heat. Even for superheated steam turbines the blades must be made of nickel steel, and then they do not last very long, the extreme heat they are subjected to causing crystallization by the production of "martensite." For this reason, all combustion turbines comprise a cooler. Fig. 2 shows a coiled tube, R, filled with water surrounding the end of the combustion chamber.

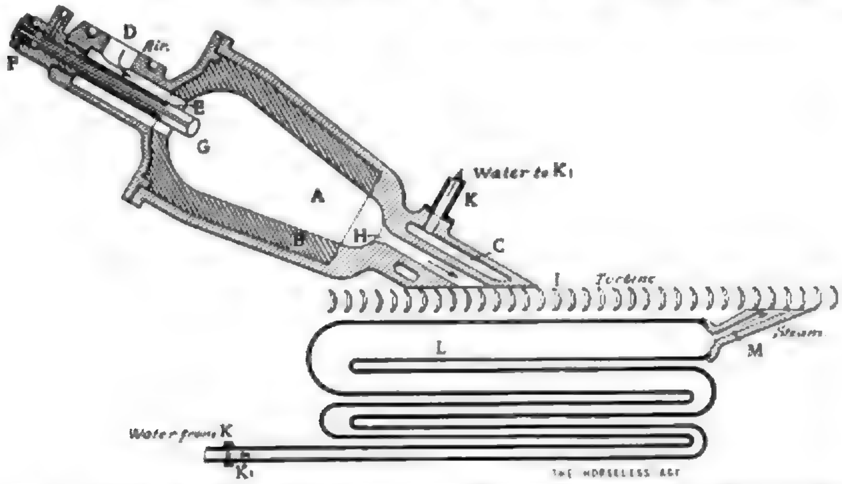


Fig. 3.—Armengaud & Lemale Combustion Turbine With Steam Recuperation.

A, combustion space; B, carborundum wall; F, D, G, E, air and gasoline feeding apparatus; H, gas nozzle; I, turbine; C, water jacket of nozzle; L, boiler receiving hot water from C, and heated by exhaust gases; M, steam nozzle.

As cooling involves a loss of power, some engineers have provided means to recuperate part of the energy thus lost. The best system yet devised is probably that of Messrs. Armengaud & Lemale, illustrated in Fig. 3. The gas nozzle H is water jacketed, and hot water passes from C to a tubular boiler L, heated by the exhaust gases. The steam thus generated acts on turbine I, on the same blades as the burnt gases. Turbines of this type have already been built, and are in operation, but only in stationary plants, owing to the weight of the compressors used.

The latest combustion turbine to be brought out in France is that of M. Esnault-Pelterie, the well known French engineer, who has already designed and built a seven cylinder motor specially for flying machines. The turbine in question, of the De Laval type, is acted on by burnt gases expanding from a combustion chamber, which is identical with an ordinary double cylinder motor (Fig. 4). In cylinder A there is a piston, P, which is free to slide from one end to the other, thus drawing charge into one end of the cylinder and compressing it in the other. The charge is admitted through special valves V V. Each part of the cylinder works on the two stroke principle. Nozzle E is uncovered by piston P, and the exhaust gases act on the turbine blades. The inventor says that as soon as nozzle E is uncovered a slight vacuum is formed in the cylinder, so that a fresh charge is admitted automatically. However, the writer does not believe that the efficiency of the system is very high, for the scavenging is very poor and the friction of the piston causes a loss of power entirely out of proportion to that delivered on the turbine shaft.

The writer's opinion is that the turbines of the future will be combustion turbines based upon some new principle; for instance, compressed air might be used to furnish oxygen, or the turbines might be actuated like steam turbines by the expansion of an unburnt gaseous mixture vaporized in a boiler of the Serpollet type. The combustion turbine will probably be strongly developed in connection with aerial navigation, owing to its lesser vibration as compared with the reciprocating motor.

Limits of Precision in Automobile Design.

By Albert L. Clough.

(Conclusion.)

When bringing out a new model the designer must not only insure that its performance shall equal or somewhat exceed the expected requirements, but he must be able to demonstrate that, in extended practical use his creation shall possess all the endurance which was accorded to it when on paper. This endurance must include a practical freedom from the breakage of parts in legitimate service during a certain more or less indefinite period of service, and must also be such as to insure all parts against the necessity for replacement on account of having worn out during a similar length of time. Just what this period of useful life is no one can state exactly. It is safe to say that it is somewhat less for a low priced car than for a high priced vehicle on the average.

A designer may be expected to strive to make his new car at least as enduring as other cars in its class, and the result of such attempts, coupled with the fact that individual cars are being bought for longer expected terms of service and are not now so soon superseded by more fashionable models has increased the term of usefulness which the designer must try to secure.

The designer's ability to produce parts which will not break during the expected service term depends upon his knowledge of the materials to be employed and his knowledge of the nature and extent of the maximum stresses which each portion of all these parts will be subjected to in service.

DATA ON MATERIALS.

There has been of late an important increase in the body of knowledge possessed by manufacturers as to the qualities of the materials used. Indeed, the automobile industry is probably as well equipped in this regard as any other of the great engineering industries. Mechanical laboratories equipped with static and dynamic testing machines, as well as with facilities for chemical testing, are maintained by the assocations of automobile manufacturers, and very many of the large factories include their own testing plans. In hardly any other mechanical industry has the matter of weight reduction been regarded as so important or pursued so energetically, and this consideration has called for an unusually close knowledge as to the strength of materials, for in industries where the quantity of material permissible is closely restricted its quality must be known with exactitude in order that satisfactory results may be insured.

In nearly all parts of an automobile the important stresses are dynamic rather than static, and the behavior of metals under recurring stresses of extended repetition is of decidedly greater importance than their resistance to the conventional static tests. The automobile industry in its rather recently acquired thirst for information as to the actual resisting powers of materials under variable stresses closely comparable with those met with in its own practice, has considerably stimulated practical work in dynamic testing. Several new alloy steels have been brought into general commercial importance through the demands of the automobile industry, largely by their reputed ability to withstand recurrent stresses, such as automobile parts are subjected to in use. It is safe to say that the automobile designer has at his command at least as full a line of data concerning the qualities of the materials he uses as does the designer of any other class of machinery.

STRESS LIMITS INDEFINITE.

What then in regard to his ability closely to estimate the maximum stresses to which the parts of his construction will be subjected in practice? It is in this regard that the designer is at the greatest disadvantage in closely predicting the endurance of his mechanism. The whole difficulty lies in the fact that the motor car operates under the most widely varying circumstances, and the extreme conditions which it may meet with cannot usually be predicted, or, if they can, their results are not generally capable of exact calculation. The motor car instead of traversing uniformly smooth rails is called upon to operate over a surface of constantly changing quality and contour, ranging in character from a smooth macadam roadway to a pathway offering sufficient resistance to suddenly stall the engine on its lowest gear. It is at the driving wheels that the variable resistances of service directly act, and at which all the stresses incident to road irregularities are first applied. From the drive wheels forward to the engine the effect of these sudden and, in the main, incomputable stresses are progressively ameliorated or somewhat smoothed out, so that the uncertainty in design which they involve is less at the moving parts of the motor than, for instance, at the bevel gears of the drive.

Certain parts of a car, as the frame, axles and springs, perform a supporting or structural function, and are mainly responsible for withstanding the shocks due to road irregularities. Other parts of the mechanism the moving parts in general, are mainly responsible for successfully meeting the stresses due to tractive resistance, although these stresses are often seriously complicated by other stresses imposed upon the transmission parts due to the movement of the vehicle body with relation to the wheel contacts, under the influence of road irregularities. The statement that the basis of the design of all structural parts is, broadly speaking, empirical, will hardly be denied. Wheel and spring making are old arts built up through the centuries upon an experimental basis, and although refined in many ways by their application to automobile manufacture, are still in the same state. It is hardly to be expected that any engineer would seriously undertake to figure what the maximum expected stress would be upon an automobile wheel in legitimate service, even though the maximum speed of the vehicle, its weight distribution and the spring design were given him.

SPRINGS AND AXLES.

It is the same way with springs, and to a large extent with axles. In a new design wheels and springs which have proved satisfactory in practice under conditions as nearly as possible like the new ones are adopted. No one can hope to figure at all exactly the maximum expected vertical transverse stress upon a front axle end, because the effects of road contour and the cushioning action of the spring make the conditions decidedly complicated, and indeed indeterminate. A safe cross section for the axle ends is, however, obtainable from observation of other successful vehicles, and right at this point may be brought out clearly the scope of exact engineering methods in a case of this sort and in many others in connection with automobile design.

Although it is hardly possible closely to evaluate the actual stresses acting it is perfectly practical to determine the relative magnitudes of the stresses acting at all parts of the axle, and thus the designer is enabled to bring out an almost perfectly consistent piece, which will be practically as strong at one section as at another and will contain no excess of material at any one point.

FRAMES.

It is the same with frames. A consideration of the frame side member as a beam loaded and supported in a prescribed manner enables quite a close analysis of the relative stresses at any given section to be made, and, although one is very much in the dark as to the actual stresses which road irregularities at various speeds and spring action impose upon it, a frame design of an excellent degree of internal consistency can be evolved. In the cases of both the frame and the axle a certain section must be proportioned by comparison with a corresponding section of some vehicle which has proved satisfactory in practice, or by comparison with a considerable number of such cars. The special value of many of the extremely able analytical articles upon the design of such parts as universal joints, axles, gear shafts and so on which have appeared in these columns from time to time lies rather in the correct and thorough understanding which they convey as to the manner in which the stresses acting are distributed in the various portions of the parts treated of and the way in which such stresses vary under different conditions, rather than in affording exact information as to the dimensions to be used in any specified case. Following the methods thus set forth results in the production of parts which are consistent.

THE POWER PLANT.

Turning to the design of the various elements of the power producing and transmission system, it is without question practicable to compute the maximum stresses acting in all these parts under ordinary conditions. Given a motor possessing known speed and torque characteristics, a certain transmission arrangement, all details of which are known, and it is possible to determine the stresses in each gear shaft, at the tooth faces of the driving bevels, the torsional and other stresses in the propeller shaft and axle shafts, and the duty of the other parts concerned, for any speed on level roads and for any grade, and for the maximum output of the motor. But these figures are of very little value, as they do not represent the maximum stresses which the parts will have to withstand in practice. Parts do not fail, as a rule, under circumstances such as these, but rather under the exceptional but perfectly legitimate extraordinary conditions with which every car has sooner or later to cope. When a heavily loaded car, with positive traction tires, becomes stalled in a deep mud hole the engine is speeded up to its limit, with the low gear engaged and the clutch, likely enough a "fierce" one is let in, with the possible result that the engine stops with a "chunk" without moving the car. The engine and the flywheel try hard to break something, one may say. There is enough energy stored in the flywheel to lift the whole car many feet off the ground, and this energy is perhaps dissipated in a second of time. What are the stresses acting on parts between the flywheel and the driving wheels? When someone solves the problem of the maximum pressure exerted upon a nail head by the blow of a hammer containing a known amount of energy, they will probably be able to give an answer to the above and not before.

In order to secure satisfactory endurance of all parts under such extraordinary conditions like the above, the maximum stress which the full normal engine power can impose upon each part of the transmission system is multiplied by an appropriate factor of safety and the part is designed to withstand a stress of the computed amount. The factor of safety for each part can be chosen so as to cover possible variations in the quality of its material, as well as the extraordinary stress.

SAFETY FACTORS.

These factors of safety are of course of an entirely empirical origin. Data regarding the cross sections and materials of a certain part, such as the propeller shaft of a large number of successful cars, are obtained and compared with the cross sections which would be required if only the maximum normal outputs of their motors were to be trammitted, and, after all allowances have been made, a factor of safety appropriate to this particular part is approximated. As experience and data accumulate these factors of safety become more and more reliable, but they are bound to be of larger numerical value on the average than the corresponding factors required in most other branches of engineering.

It is decidedly easier to design a car which shall realize the expected degree of endurance as regards freedom from the premature wearing out of parts than it is to insure endurance against the failures of parts.

There is less that is extraordinary about the automobile as regards the friction in its bearing surfaces than in respect to their stresses. Data upon the proportioning of bearing surfaces has accumulated for a long time, and is in a form sufficiently usable so as to be a fairly satisfactory guide to the designer. The manufacturers of ball bearings have specialized upon the proportioning of their bearings to the loads they have to carry, and their researches have proved of immense value to the automobile engineer in enabling him to predict bearing performance with confidence.

It seems fair to sum up the status of automobile engineering in some such manner as this: Owing to the peculiar conditions under which the motor car operates the stresses acting are of a peculiarly complicated nature, and their absolute maximum values are seldom closely known. To make up for this lack of knowledge very large factors of safety derived from practice are required, and the uesfulness of such safety factors depends upon the extent of the practical data from which they are derived.

By the aid of mathematical analysis each part of a car may be consistently designed and excess of weight avoided, but the absolute dimensions of such parts must be obtained from practice rather than from academic considerations of the duties which they have to perform. In the same way the expected performance of cars must be mainly predicted from comparison with the actual performances of similar vehicles in service rather than by direct calculation involving only the physical laws involved.

In conclusion it may be remarked that the two things which the automobile engineer most needs are these: The fullest possible line of data as to the materials and dimensions of all cars constructed, tabulated in some usable form and with conclusions drawn thereupon by some good authority, and furthermore mathematical treatments of the nature and distribution of stresses in all motor car elements such as have been appearing in these columns.

The Riverside, Cal., Hill Climb.

On account of unsettled weather conditions that had necessitated one postponement, and because the drivers for many of the southern California automobile dealers were unfamiliar with the new course, the annual hill climbing contest at Riverside, Cal., did not attract the usual number of entries and of spectators this year. As a rule the contest is held on Thanksgiving Day, but this year a rainstorm interfered, and the hill climb was postponed until Saturday, December 5. Six of the twelve events scheduled for automobiles had to be given up because of lack of entries, and two of the motorcycle events did not materialize from the same cause.

The supervisors of Riverside County, after the 1907 hill climb, had prohibited further contests over the course, and a new course on private roads had been built for this year. The new course is exactly one mile long, and is straight except for one curve. At the start it has a grade of 4 per cent., and the grade gradually becomes steeper until at the finish it rises to 18 per cent. The finish is at the brow of a mesa or table land, allowing the contestants ample time to slow down. The table land rises to another hill, and it is planned next year to extend the course another mile to the top of this second hill.

The feature of this year's contest was the sweeping victory won by a small Stanley, 20 horse power, steam car, which defeated not only the gasoline cars of its own class but won the event for the four fastest cars of the contest. The Stanley established a record of 1m. 12s. flat over the mile course, while the nearest gasoline competitor, a 30 horse power Chalmers-Detroit, negotiated the distance in 1m. 20 1-5s.

The results of the contest were as follows:

First event, for touring cars costing $1,000 to $1,500, carrying four passengers: Stanley steamer first; time, 1m. 24 1-5s.; Tourist, second; time, 1m. 48 3-5s.

Second event, for roadsters costing $1,000 to $2,000, carrying two passengers: Stanley steamer, 1m. 12s.; second, Tourist, 1m. 42 2-5s.; third, Rambler, 1m. 50s.

Third event, for roadsters costing $2,000 to $3,000, carrying three passengers: First, Chalmers-Detroit, 1m. 20 1-5s.; second, Stoddard-Dayton, 1m. 22 3-5s.; third, Rambler, 1m. 38s.

Fourth event, roadsters, free-for-all, carrying two passengers: First, Chalmers-Detroit, 1m. 20 3-5s.; second, Stoddard-Dayton, 1m. 22 2-5s.; third, Rambler (45 horse power), 1m. 33s.; fourth, Rambler (34 horse power), 1m. 46 2-5s.

Fifth event, for touring cars costing $2,500 to $3,000, carrying five passengers: Oldsmobile won in 1m. 25s. On account of the blowing out of a flange at the start the Stanley steamer did not finish.

Sixth event, finals for four fastest cars: Stanley, first, 1m. 18s.; Stoddard-Dayton, second, 1m. 22 2-5s.; Chalmers-Detroit, third, 1m. 24 1-5s.

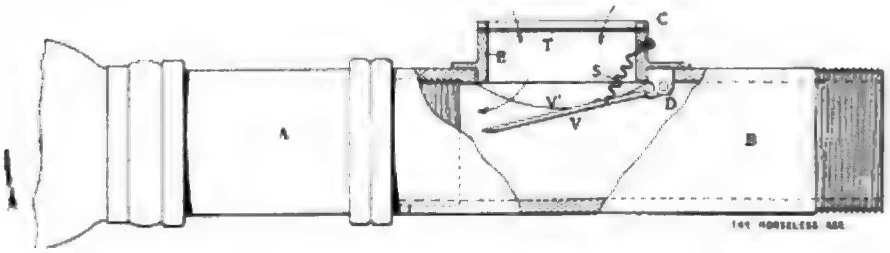
The most important southern California automobile event, the Pasadena-Altadena hill climb, will be held February 22, and from present indications the entries will be more numerous than ever before.

At the meeting of delegates of recognized national clubs at Paris on November 30, Baron Von Zuylen was re-elected president and Counts Sierstorpff and Ferrari di Ventimiglia vice presidents. It was decided to permit the use of demountable rims in next year's races. Upon the motion of the Royal Portuguese A. C. it was decided to appoint a committee to investigate the regulations of international automobile traffic (customs house regulations). It was unanimously decided that the recognized national automobile clubs are competent authorities on all questions relating to aerial navigation.

Maintenance and Repairs

Anti-Clogging Attachment for Horn Reeds.

One of the reasons for automobile bulb horns becoming "dumb" is the clogging of the reed opening by dust and dirt, drawn in through the bell along with the air necessary to fill the bulb after it has been squeezed to sound the horn. All bulb horns draw the air only in this manner, and the reed openings are clogged despite dust screens over the bell or other devices. The writer has used the valve arrangement illustrated on a horn for some time, and although no dust screen is fitted over the bell the horn worked finely even when driven over dusty roads for considerably over 700 miles. The device is given for what it is worth.



Anti-Clogging Attachment for Reed Horns.

The portion A comprising the bulb is usually screwed into a reed holder which is part of the horn tubing proper. A piece of brass tubing B, about 4 inches long, is cut with a male and a female thread at the ends as shown, and an aperture is cut in its circumference for the "valve cage" E. This latter is made of brass tubing and is brazed to the tube B. A small lug D is fitted to E and acts as a hinge rod for the flap valve V. The upper part of E is fitted with a fine mesh screen T, which is held in place by a ring C. The flap valve V is normally kept on its seat by a spring S, but is weak enough to allow it to lift when the bulb expands and draws in air after being squeezed. The end of the valve V is beveled to prevent its being unseated when the bulb is pressed to sound the horn. The dotted lines V_1 show the valve seated, the full lines V showing the position of the valve when the bulb is expanding, the flow of the air being shown by the arrows. The action may be readily understood from the above description. The cost of making and fitting the apparatus was 34 cents, including raw material.

A Robe Guard.

The tendency of the lap robe to get under the driver's feet or otherwise prevent him from operating the pedals quickly and effectively is so well recognized that all instruction books and manuals caution the driver or prospective driver against allowing such a thing to occur, and show the risks attendant on such occurrences. The trade also has recognized this disadvantage in the use of the lap robe and have brought out various modifications, one of which is fitted with a pair of pockets for the feet, whereby the pedals (and also the robe) may be operated, and another is in the form of overalls to be worn by the driver. These, of course, are more expensive than the ordinary lap robe. The accompanying cut shows a guard which can be applied to any car and which keeps the robe clear of the pedals, whether it is fastened to the steering pillar as shown or simply tucked around the driver's body.

Referring to the cut, the robe A_1 A_1 A_1 A is fastened by means of thimbles fitting over turn-buttons D_1 D at the sides and bottom. B is the guard, fastened to the footboard and having its horizontal part sufficiently above the pad of the pedals C_1 C_1 to allow the foot to operate the pedal without striking the guard. The guard is made of 1 inch brass tubing and fastened in the brackets by screwing or soldering. The ends of the tube could be flattened out and screwed to the footboards in place of the brackets if desired. The robe is fastened to the steering pillar in this case by means of a strap, but other methods of fastening could be used equally well. The general arrangement is excellent for winter driving, as it prevents draughts on the feet and legs and keeps the driver and front passenger quite comfortable.

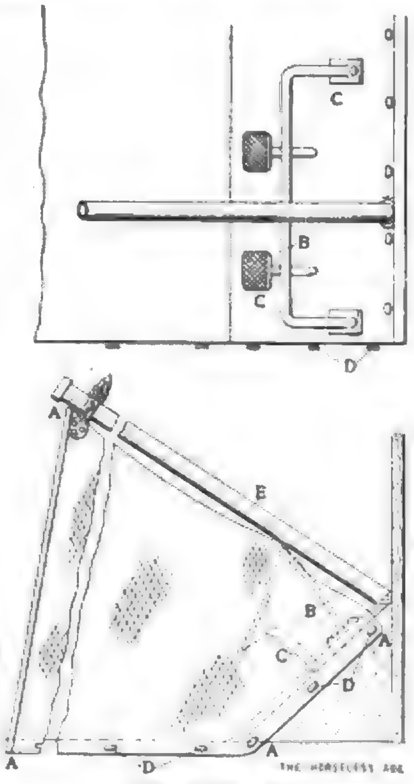
A Temporary Replacement for a Broken Cardan Pin.

The pin coupling the Cardan shaft yoke to the universal joint spider occasionally gets broken by sudden shock or comes away, due to not being properly retained in place by its locknut. In the former case the pin cannot be put into place again, and as a spare pin is not usually carried, recourse must be had to something on or about the car if a blacksmith or repairer is not close at hand. One of the cables operating the hub brakes can be removed and put in in place of the pin, threading the cable in and out of the holes in the yoke and spider, taking care to avoid abrupt bends in the cable in so doing. The cable can then be fastened upon itself by twisting or knotting by means of a pair of pliers. The repair is only temporary, and care must be taken in driving that no great strain breaks or loosens the cable, and also because one of the brakes only is in service, and an application of the brake lever would cause a skid. If the motorist has his hub brakes operated by rods instead of cables one of the rods doubled upon itself and wired in place could be used instead of the cable.

Adjusting Lamp Brackets.

According to some directions given in a French contemporary, the forks of lamp brackets should be placed absolutely perpendicular to the frame of the car, so that the gleam of light will be projected at right angles to the vertical plane. Many owners think that the lamp should be inclined slightly forward, so as to light up the road immediately in front of the car This is a mistaken idea, however, as quite enough light will fall on the road directly in front of the car to show up imperfections in the roadway, water bars, etc., and if the beam of light is thrown directly ahead in a horizontal direction, such road obstructions as unlighted horse vehicles, etc., will be noticed sufficiently early to avoid collision with them. For the proper fitting of lamp brackets the car should be placed on a perfectly horizontal floor and then the brackets should be adjusted until they are absolutely vertical and in line with each other.

In the new Prussian Budget the sum of 2,708,751 marks is provided for acquisitions, installations and trials in connection with military transportation, an increase of 828,000 marks over last year. The sum set out for subsidies to owners of motor trucks has been increased by 200,000 marks, and the direct outlays for motor trucks by 135,000 marks.



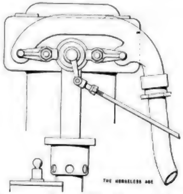
Robe Guard.

NEW VEHICLES AND PARTS

The Renault Voiturette.

The Renault Freres selling branch, Broadway and Fifty-seventh street, New York City, have recently received the first samples of the Renault voiturette, intended for general runabout use. This car is the latest product of the Renault factory at Billancourt, near Paris. The motor is of the two cylinder vertical type, with cylinders cast together. The bore is 75 millimetres (3 inches) and the stroke 120 millimetres (4¾ inches), the rating being 8-10 horse power. All valves are mechanically operated from a single cam shaft located on the left hand side of the motor. The crank shaft is supported in two bearings and is fitted with counterweights and provided with oil channels. The pistons are fitted with four rings, of which three are above the piston pin and one below, the latter being designed to catch the oil and prevent it from being drawn into the cylinder. The half time gears are enclosed in a separate aluminum housing, an extension of the half time shaft driving the laterally placed Bosch high tension magneto, as in regular Renault practice. The inlet pipe is made integral with the top of the carburetor mixing chamber, and is bent over, terminating in a circular chamber which communicates with the inlet ports of both cylinders, in which chamber is fitted the throttle valve. A purging plug is placed in the lower part of this pipe. The throttle valve, as well as the two branched exhaust manifold, is secured to the motor by two bridge and bolt combinations, facilitating removal and replacement. It will be seen from this that the exhaust ports are on the front and rear ends of the casting, respectively, while the inlet ports are situated between them. The cooling water is circulated by the regular Renault thermo-syphon system, and lubrication is by Dubrulle force feed oiler.

The Renault Small Car.



Sketch of Renault Two Cylinder Motor.

The clutch is of the reversed cone type, and is connected to the change gear by means of a short shaft fitted with universal joints. The clutch operating arm acts on the rear end of this shaft instead of directly on the body of the clutch or on a collar. The change speed is of the regular Renault type, running on ball bearings and giving three speeds forward and reverse, with direct drive on the top speed. The shaft of the change gear projects from the case and is fitted with a drum at its rear end, within which works an internal expanding brake operated by a plunger and lever connections from a pedal on the right of the steering post. The final drive is by a universal jointed shaft with live rear axle, all bearings being of the ball type.

The frame is of channel section pressed steel, and is narrowed in front to give a large "angle of lock." The cross members are of channel section, the front ones supporting the false frame which carries the motor and change gear. The front axle is of seamless steel tubing, the steering pivots running on ball bearings, and the drag link being placed in front of the axle. Semi-elliptic springs are fitted all around. The wheels are of the artillery type, 870 millimetres in diameter, and fitted with 90 millimetres tires. Steering is by worm and sector, the steering wheel being small and entirely free from control levers. The external contracting hub brakes are actuated by a "push forward" lever at the right, the gears being operated by another lever working over a sector close to that of the brake lever. Three "press down" pedals are provided on the footboards, the left hand one operating the clutch, the middle one the foot brake and the right hand one the throttle. The wheel base is 77 inches and the tread 49½ inches. Runabout bodies seating two are provided with victoria or Cape top, at the option of the purchaser.

The sketch of the piping herewith shows clearly the gain in simplicity over the usual four cylinder construction.

Speedwell Light Truck.

The Speedwell Light Truck.

The Speedwell Motor Car Company, of Dayton, Ohio, are building a rapid delivery truck, designed for loads up to 3,500 pounds. The running gear and driver's seat are so arranged that any type of body can be fitted. The driver's seat is placed over the engine, but this does not interfere with the accessibility of the latter. A storm hood is provided over the driver's seat. The truck is fitted with very large pneumatic tires, the object being to increase the life of the machinery, by protecting it against excessive jolts and shocks.

Thomas Limousine Body.

The E. R. Thomas Motor Company recently completed for Robert L. Fryer a six cylinder, 70 horse power car, with a full hand hammered aluminum body, made in the new "two piece" construction, which does away with all attached molding, and which is said to be conspicuous for its beautiful lines in the overhang of the upper quarters. This is the latest type of construction in metal bodies.

The doors have a full royal turn-under, and the low base body does away with the awkward appearance which is generally found in large limousine bodies. A wheel house on the side quarters gives ample clearance to the guard and permits the use of skid chains without any possibility of interference. The body is painted a Napier green, black molding, black upper quarters. The hardwood finishings are in walnut. There is a new type of drip used on the roof which prevents the water from dripping over the doors.

The interior is an innovation in the art of coach work. The material is of a golden drab imported broadcloth and the lace is of a French weave, to match. While the body is a full round cornered, the trimming is put on in a panel effect All the fittings are in brass. They include a toilet case with numerous articles, a new style hasty notebook, which permits a sealed letter to be written, and a gentleman's case, containing ash tray, cigar holder, etc., etc. There are also an electric annunciator of the new French type and an electric cigar lighter. The electric dome light with Holophane globe is seen in the roof. A ventilator is put in the front of the body, allowing of circulation of air, and can be regulated according to the weather. Instead of using the old style clouded horn trimmings this car is fitted with a new Maltese pearl.

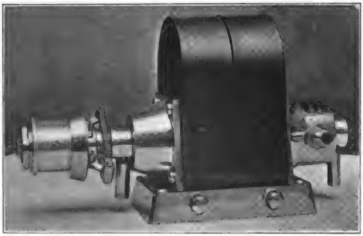
The body has an interior seating capacity of five people. The auxiliary seats are detachable by simply removing the seat from a socket, which is hardly visible when the seats are not in use. While the outside of the window frames is finished in ebony the interior is left in the natural walnut, which harmonizes with the trimmings.

Tonneau Seat and Foot Rest.

Auxiliary Seat.

The Mavity-Sleeper Ignition Dynamo.

The Mavity-Sleeper Company, Fowler, Ind., have placed upon the market a direct current magneto, intended to be used as a substitute for the dry or storage battery in the operation of the regular vibrator coil system of ignition.

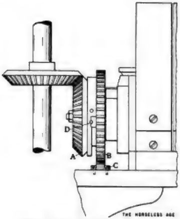


Mavity-Sleeper Magneto.

The bipolar field of this machine is of the conventional U shape, made up of two magnets, 1¾ inches wide, bent out of special tungsten steel, one-half inch thick. Care is taken that the steel is not "drawn" in the forming process, and after forming the scale is carefully removed and the surfaces are thoroughly smoothed.

The soft iron pole pieces are each fastened to each magnet by a large flat head machine screw, after being carefully fitted. They enclose considerably more than one-half of the periphery of the armature. The magnets are mounted upon a brass plate, this base plate being secured to the pole pieces by screws from below. A heavy brass plate is attached to the tops of the pole pieces by screws and acts as part of the armature housing. The base plate of the field is the moving portion of the sliding base which carries the machine. Adjustment of belt tension or of friction wheel pressure is effected by means of four machine bolts, which move the whole machine on the base and securely lock it in position.

The armature core is built up of 148 stampings of silico-vanadium steel. These stampings are perforated with twelve circular peripheral slots, and are insulated from one another and mounted upon the half inch shaft, forming a core 3⅛ inches long and 2⅜ inches in diameter, with fibre end and slot insulation. The winding is of the regular drum type, with two coils per slot, the wire being of good size and insulated with the utmost care, fibre strips being inserted over the winding in each slot, about one-sixty-fourth inch. The clearance between the cores and the pole pieces is very slight. The commutator, consisting of twenty-four bars, is built up with hard drawn segments and mica insulation, in accordance with the practice followed in large generators, and is 1½ inches in diameter and five-eighth inch long. Special insula-



Moon Self Starting Device.

tion is used on the commutator leads, and an oil ring is provided on the shaft.

The armature shaft runs upon two wick lubricated ball bearings in the heavy brass end plates, which are each secured to the pole pieces by four cap screws. These end plates and the upper and lower horizontal brass plates entirely enclose the armature and completely protect it from water or dust.

In the casing of the commutator end two hard rubber bushings are inserted, and the brass tubular brush holders screw into these. These holders carry three-eighth inch round, radial, copper gauze brushes, held in contact by means of spiral springs. Rajah connections are fitted to the outside ends of the brush holders. When the magneto is mounted directly upon the engine base or a grounded portion of the car but one lead is required, the other brush being permanently connected to ground by the substitution of a brass bushing for one of the rubber bushings.

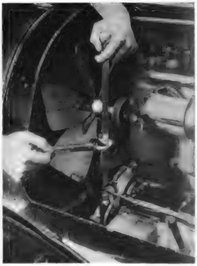
This magneto is fitted with a centrifugal clutch pulley. The clutch is of the regular metal-to-metal cone type, the male member being of cast iron and the female member of bronze. The male member is the driving member and is held from turning on the shaft by means of a key passing therethrough. The keyway in the shaft is elongated, and provision is made for drawing this male member out of contact with the female clutch member by means of a fly ball governor acting through a toggle arrangement. Re-engagement is effected by means of the two spiral steel springs which return the arms of the governor to their normal positions. The female clutch member is integral with the driving pulley, and a ball bearing is provided between it and the armature shaft. Clutch lubrication and the lubrication of this bearing is provided for by a packing of hard grease fed through wicks. Ordinarily, the governor is so adjusted as to maintain a voltage equal to that of six dry cells, irrespective of engine speed. Flanged pulleys of various diameters are furnished to fit any flywheel diameter, and the magneto may be driven either by a flat, waterproof rawhide belt or by means of direct friction on the flywheel, the belt pulley and friction wheel being interchangeable. A speed of about 300 revolutions per minute, at the lowest engine speed, is required, and the diameter of the magneto pulley is chosen to secure this speed.

This generator is 7 inches high and measures about 11¼ inches over all, along the shaft. The base is 5¾x3¾ inches in size. In use its current is wired to one side of the two point switch on the coil box in place of one of the batteries.

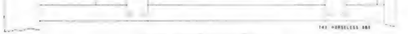
Bay State Socket Wrench.

The Moon Self Starting Device.

As mentioned in our last issue, the Moon Motor Car Company, of St. Louis, Mo., will equip their 1909 models with a Bosch high tension magneto and a mechanism whereby this magneto may be caused to generate a starting spark by pressing on the button on the dash. The two illustrations herewith show the arrangement of this mechanism. The magneto is located at the rear of the engine, crosswise of the frame, and is driven by bevel gears from a vertical shaft, which also drives the overhead cam shaft. Back of the bevel gear A on the magneto shaft is a spur gear B, which meshes with a rack C. The latter, as may be seen by reference to Fig. 2, extends parallel with the engine, and is directly connected to the button on the dash. By pressing on this button the spur gear can be rotated backward through one-third of a revolution, whereby a spring inside the bevel gear A is wound. When the button is released the spring drives the spur gear B and hence the magneto armature upon whose shaft it is secured forward, thus generating an electric impulse and producing a spark in the proper cylinder. The bevel gear A is loose on the shaft, and the two gears have a certain relative motion, but when the spring is unwound they are locked together by a catch or shoulder D, so that the armature is perfectly timed. We understand that this device, on which patents have been applied for, has been tried out in practice and been found entirely successful. It was invented by the engineers of the company.



Bay State Socket Wrench in Use.



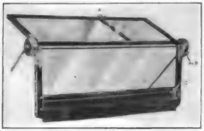
Moon Self Starting Device.

The Bay State Auto Kit.

The Tudor Manufacturing Company, Taunton, Mass., have placed upon the market the ratchet and socket wrench shown in the two photgraphs herewith. The chief feature of this wrench is a reversible ratchet, which can be moved up or down the shank to any desired point so as to enable the user to readily get at any part of the car. The wrench is provided with extension shanks to give 18 inches complete length without any socket attachment. It has a universal drop forge steel handle which folds neatly against the shank, or can be removed if necessary when replacing in the case. This universal handle will obviate the use of the universal joint in most cases, but to make the set as complete as possible the universal joint is also furnished. With the wrench are furnished thirty steel sockets, which are claimed to fit any nut on any car, and also a spark plug steel socket and a substantial square shank screw driver. The sockets are held by a new method by means of spring balls. The case in which the tool is furnished is of a dull black finish outside and mahogany finish inside.

The Rochford "Cleaner" Front.

The new glass front manufactured by the Rochford Manufacturing Company, of Chicago, embodies a number of novel features. The company makes both folding and one part fronts. The former can be folded by the driver without leaving the seat, and are made in two styles. In one style the folding is accomplished by means of a small worm and gear which are operated by turning a little crank at the driver's side of the front. The other type has the upper portion of the front balanced by spiral springs, contained in cases at the ends of the hinge, the front being clamped in the desired position by turning a knob.



Rochford Folding Glass Front.

A, cleaner; B, raising and lowering handle; C, ventilator.

The "cleaner" attachment is fitted to both these styles, and to the fronts which do not fold. It is similar to the rubber scrapers used to clean store windows, and extends vertically across the upper section of the glass. All that is necessary to clean the glass is to move the "cleaner" across from one side to the other.

Along the lower edge of these fronts a ventilator is provided. This device takes the form of a narrow swinging shutter, which can be opened to any desired angle by means of a little handle at the right. Its use is said to add to the comfort of driving in hot weather.

The Tourist Oil and Gasoline Kit.

Dover Stamping and Manufacturing Company, of Cambridge, Mass., are marketing the tourist oil and gasoline kit for automobile use. The kit, which is shown herewith, consists of a black enameled steel case resembling a toolbox, which is intended to be strapped to the running board and which contains two enameled cans measuring 9x1¼x9¾ inches, provided with a special pouring spout and filler cap. The cans have a capacity of 1½ gallons each, and are marked "Gasoline" and "Oil," respectively. Suitable handles are provided by which to remove the cans from the case. By the use of this kit the motorist can always have at hand his own brand of lubricating oil, and also a reserve supply of gasoline. The cover of the case is held in place by the same strap that attaches the case to the running board. The kit is guaranteed proof against dust and severe weather conditions.

Tourist Oil and Gasoline Kit.

The O'Connor Tonneau Heater.

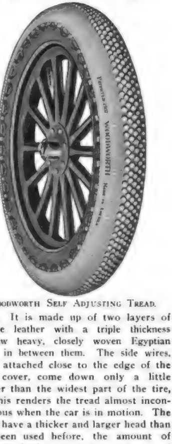
Thomas E. O'Connor, 14 and 16 Town Hall, Saratoga, N. Y., has brought out a tonneau heater for gasoline cars. The device is based on the use of the exhaust gases. These are led through a radiator underneath the floor of the tonneau, which is surrounded by an air jacket communicating with the interior of the tonneau through a grilled plate. The heater is finished in either brass or nickel, and is designed to be set into the floor of the tonneau. The heating effect may be controlled by means of two buttons located at the two ends of the heater respectively. One of these controls the passage of the gas through the radiator, and the other a door regulator on the air jacket. The heat radiator is claimed to be of entirely original design, and to be a fine example of the molder's art. Some of the parts of the heater are made of aluminum.

The Woodworth Self Adjusting Tread.

The Leather Tire Goods Company, of Newton Upper Falls, Mass., have brought out a new type of their Woodworth non-skidding tread, which differs from the former design (which will hereafter be known as the Woodworth adjustable tread) mainly in respect to the means by which it is held to the tire. As may be seen by reference to the cut herewith, in the new form of tread there are a number of waved spring steel wire hoops on each side of the tire. Every alternate curve of the hoops is caught by a strong loop of chrome leather, which is securely riveted to the tread. Owing to the elasticity of the waved spring wire hoops, the tread is held securely in place.

One of the advantages of the new form of construction is that it adds less to the width of the wheel than the old form. There are no buckles or hooks, and the additional width over that of the ordinary smooth tire is only one-quarter of an inch on each side. The new type is especially recommended for motorcycles and chain driven cars; for the latter because the absence of buckles and hooks renders it impossible for the chains to catch, even if they drag against the wheels.

In appearance the new design does not differ materially from the adjustable tread. It is made up of two layers of chrome leather with a triple thickness of new heavy, closely woven Egyptian fabric in between them. The side wires, being attached close to the edge of the main cover, come down only a little further than the widest part of the tire, and this renders the tread almost inconspicuous when the car is in motion. The rivets have a thicker and larger head than has been used before, the amount of metal in the head having been increased about 50 per cent.



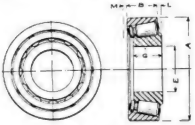
Woodworth Self Adjusting Tread.

New Hoffecker Speedometer Model.

The Hoffecker Company, Motor Mart, Park square, Boston, Mass., are manufacturing a new model of the Hoffecker speedometer, giving a range of speeds from 5 to 60 miles per hour. The present instrument works upon the same principle (centrifugal force) as previous models, the changes being chiefly refinements of construction to lighten the weight of the instrument. A description and illustrations of the Hoffecker mechanism were published in The Horseless Age for July 10, 1907.

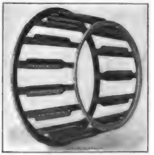
Timken Short Roller Bearings.

These bearings are similar to the regular types, but are made considerably



Timken Short Bearing.

shorter, so that they are handy to use in places where annular ball bearings are commonly employed. A part of the decrease in length is secured by grooving the rollers only at their small ends. While this shortens the bearings, it leaves the two shoulders on the rollers intact, so that they take thrust as well as formerly. The same style of one piece pressed steel cage that was recently adopted for the regular Timken bearings is used for separating the rollers in this new type. The largest of these short bearings given in a recent list has an outside diameter of $4\frac{7}{16}$ inches, and an over all length of $1\frac{1}{16}$ inches.



Timken One Piece Cage.

The St. Louis Show.

The third annual show of the St. Louis Automobile Manufacturers' and Dealers' Association will be held in the New Coliseum Building at Jefferson and Washington avenues, February 15 to 20, inclusive. This building contains 40,000 square feet of floor space, available for show purposes. Lloyd Rickert, secretary of the American Baseball Association, has been appointed manager of the show. The show committee consists of John J. Behen, of the Behen-Faught Motor Car Equipment Company; H. B. Krenning, of the Dorris Motor Car Company; W. C. Anderson, manager of the Ford agency; Samuel Braden, of the Western Automobile Company, and O. L. Halsey, of the Halsey Automobile Company, who is president of the association.

Comment on the Roads Congress by Chairman Page, of the American Commission.

Logan Waller Page, director of the Office of Public Roads of the United States Department of Agriculture, who was named by President Roosevelt as head of the American Commission to the recent International Roads Congress at Paris, has returned to Washington firm in the belief that in some of the more scientific branches of highway construction the United States has nothing to learn from the older nations, though he was willing to concede that those countries surpass this to an amazing degree in the percentage of improved road mileage and in the jealous care with which their splendid highways are maintained.

Among the many things which especially impressed Mr. Page during this European trip were the methods for regulating automobile traffic in France and England; the belief of a majority of the delegates to the Roads Congress that the automobile running at average speed is not detrimental to highways; the discovery that many miles of very satisfactory highways in England have been constructed by mixing limestone and granite after the methods set forth in publications issued through the United States Office of Public Roads, and the discussion now being carried on by English automobilists against horse traffic in city streets and upon suburban highways.

It is his belief that the congress will have at least one important result. On a suggestion by Mr. Page, it was determined to create an International Bureau of Roads, similar in some respects to the International Bureau of Navigation. This body will consist of two or more delegates from each of the twenty-nine governments represented at the congress. Its purpose will be the collecting of all possible information on road work, the passing on it by a committee of experts and its distribution throughout the world.

The congress decided to erect a memorial to M. Tresauget, the great French highway engineer who was the originator of the modern French system of road maintenance. The resolution to that effect was introduced by Mr. Page and unanimously adopted, the secretary general being empowered to receive contributions with which to carry out its provisions.

Mr. Page was told that on the magnificent road leading from Paris to Versailles 5,000 automobiles pass either way on each fine day; but he noted that it was in such perfect condition that it was practically as dustless as the carefully swept asphalt street of a large city. No better macadam roads are built in France than can be and are built in this country; but the maintaining of these roads is attended to with the utmost care, and for that reason the highways are invariably in such splendid condition that they excite the envy of American visitors.

Prior to his arrival at Paris Mr. Page spent some days in England in the company of highway engineers, examining roads throughout England. It is his belief that England has arrived as near to the solution of dustless roads—the present day problem of all highway engineers—as any nation. Her engineers have given the use of bituminous materials for spraying macadam roads the utmost thought and care. Spraying highways with such materials has a tendency to preserve the solidity of the roads and prevent the formation of dust, and England has made such progress in this branch of road study that many miles of suburban roads are as free from the disease breeding dust nuisance as the best kept streets of the principal cities of the world. So firm are the highway scientists in the demand that these conditions not merely maintain but improve that the first fight against the horse has been taken up by the automobilists.

A powerful association of motorists in London advances the claim that the polluting of all public thoroughfares is not done by automobilists but by horses; that if no horses were allowed to drop organic matter on public thoroughfares the dust nuisance would soon be naught but an unpleasant memory. They advance the logical statement that the nuisance created by hundreds of thousands of horses is detrimental to public health and a menace to the pavements, and they charge that the continual cleansing of the streets because of this traffic imposes a vast tax upon the citizens.

Various experiments conducted by the Office of Public Roads have developed the fact that it is possible in road building to obtain a better bonded surface by mixing rocks, such as limestone, with silicious rocks, such as granite or sandstone. That discovery—embodied in publications sent out through the United States Department of Agriculture—has been adopted by some of the British highway engineers, and while in England Mr. Page was driven over a number of stretches of splendid highway built by the blending of such material. In conjunction with that phase of highway construction Mr. Page was asked if it would be possible for his office to receive about 300 samples of the characteristic road building rocks of Great Britain and make laboratory tests of them.

It was specifically stated in the official invitation sent from France many months ago that the congress at Paris was called for the purpose of discussing the effect of automobile traffic upon public highways and if deemed detrimental to devise means of overcoming the effect. Asked what conclusion was reached by the congress, Mr. Page said that automobile traffic and its effect were very thoroughly discussed and that many brilliant papers were presented, every phase of the question being treated. As it was impossible to arrive at a unanimous conclusion, the question of damage done was left for a later determination. It was the consensus of opinion, however, that automobiles driven at ordinary rates of speed are not especially harmful to good highways.

Effects of the New Forms of Traffic on Roads.

(Paper presented to the First International Good Roads Congress, Paris, by M. Ch. Walckenaer, chief engineer of the Department of Mines and professor at the Paris School of Roads and Bridges.)

Automobile traffic is becoming of constantly increasing importance among the causes of road wear. Of course, it constitutes only one of the factors which cause the disintegration of our roads. Many of the latter suffer much more from heavy trucks loaded with sugar beets or ores, and from the tramping of herds of sheep, than from the passage of automobiles. But the development of automobile traffic is so rapid that no definite limits can be assigned to its results in the future.

The effect of the passage of automobiles on the roads depends both upon their weight and upon their speed, but it is necessary to distinguish at the beginning between high speed vehicles with pneumatic tires and commercial vehicles of the heavier type.

PNEUMATIC TIRED VEHICLES.

In the case of pneumatic tired vehicles only dynamic actions are to be considered. When the vehicle is at rest, or when it is being driven slowly, the tire simply rests upon the ground on a flattened surface, the area of which depends upon the pressure of inflation and upon the load on the wheels. The static pressure on the road is always very moderate.

However, at high speed a dynamic phenomenon takes place, which is one of the most serious causes of road destruction; this is the dispersion of the fine materials. The binding material disappears more or less rapidly, being carried away in the form of dust, and only falling to the ground again definitely outside of the track followed by the automobiles. It has been claimed that pneumatic tires create a suction like a cupping glass. The comparison may not be a fitting one. It is certain that the phenomenon, whose effect considerably increases with the speed of automobiles, depends both upon the action of the tires on the ground, by friction or otherwise, and upon the powerful suction produced by the moving screen constituted by the vehicle.

The effect on macadamized roads is that the stones are laid bare. The binding material being carried away at the rate at which it is replenished by the wear of the stones, the latter are deprived of the covering which tends to shield and consolidate them. They are dislodged by all kinds of traffic, and are then crushed when the vehicles are stopped. The stone foundation is disarranged instead of being worn regularly.

In order that the macadam road may best withstand this sort of deteriorating influences, the important condition is not that it be made of very hard stones, but that the road materials are perfectly bound together, and that their consolidation be assured as much as possible independently of the surfacing material. Crushed stones of angular form, used together with a small proportion of filling material and strongly rolled down, are better than round stones or pebbles, especially if the latter are not well compressed (rolled). On the other hand, the stone foundation is less rapidly laid bare if the filling material is compact and not readily changed into dust, adhering to the stones. This applies equally to the original surfacing material and to that which is continually being formed by the wear of the stones. Consequently, there is less deterioration where the road is built of feldspath, whose detritus by kaolinization furnishes a certain proportion of sticky clay, than with the materials whose wear produces a dusty sand. Roads built of granite, gneiss, ophite or compact limestone suffer less than those of silicious pebbles, or, in a general way, of materials which are hard but difficult to bind together.

It is, moreover, evident that for a given road material the action is the more intense the more favorable the atmospheric conditions to the formation of dust and the dryer the ground. Roads on a fresh subsoil will stand up better than those built on a gritty, permeable subsoil. It is these same considerations which explain the effect of sprinkling and tarring. These processes are simply a means of imparting to the surface layer the necessary compactness to prevent the carrying off of the finer materials in the form of dust. The efficiency of these methods is indisputable; unfortunately it is limited as to time. There is no need of argument on this point with respect to sprinkling; its effects in times of good weather are of such short duration that it is impossible to use this method except on a small scale and in entirely special cases. The effects of tarring are much more enduring. However, its success and lasting qualities depend chiefly on the manner of carrying out the process. If the tar is spread absolutely uniformly, and if the proper amount is used and thoroughly incorporated in the surface material of the road, it does away with dust completely, and for a long time protects the road surface against the form of deterioration which we are here discussing. If, on the other hand, the tar is applied non-uniformly; if some points of the road are omitted, or if an excessive amount of tar is used and poorly mixed with the surfacing material, it will soon begin to "plaster" off or become exhausted. Disaggregation of the stone bottom is particularly to be feared when, instead of offering a continuous and even surface, the road contains weak spots or defects in respect of homogeneity. The wear of roads on which there is much automobile traffic is, in consequence, greatly influenced by the maintenance methods. The best conditions are realized by applying a generous layer of crushed stone and heavily rolling it, and by resurfacing the road at such intervals that it will never become very bad. On the other hand, patchwork repairs will not provide the desired homogeneity. From the moment that the stones of the road begin to be attacked the deteriorating effects increase rapidly, unless the surface is remade. Holes will form in the pavement. The wheels of the vehicles, following each other on the road, will strike the ground at the passage of each hole; then they rebound and impart a new shock to the road at a point a little further on. This results in the formation of a series of holes at equal distances, which become deeper and deeper. On certain highways on which there is a great deal of automobile traffic a most curious succession of bumps may thus be observed.

A particularly destructive effect is produced at turns. The centrifugal force causes more or less energetic skidding, which entails transverse friction between the tire and the road. This friction is the more intense because of the fact that the centrifugal force brings the greater proportion of the weight to bear on the outer wheels. Moreover, the driver, who underclutches just before reaching the turn, lets in the clutch again when he is still in the turn, with the result that to the transverse friction is added a tangential friction. Finally, on canted roads (as most roads are) drivers habitually "hug" the corners, so as to take advantage of the arching. The result is that practically all of the vehicles traveling in both directions follow the same track. In consequence a rut is formed at the turns corresponding to the path of the outside driving wheel, which will be at about 6 feet from the inner edge of the road. The finer materials which are dislodged and thrown into the air by the skidding are scattered over the entire outer half of the road at the curve.

In order to prevent this destructive effect at turns it is advisable to slightly raise the outer edge of the road at these points, so the whole width of the road slopes slightly toward the inside. The drivers of automobiles would then no longer have any inducement to all follow the same track. Those proceeding in such a direction that they must turn to the left could easily continue to keep the right side of the road, which is also of advantage from the standpoint of safety, and at the same time the wear of the road would be reduced and distributed more evenly.

The operation of the brakes, especially if it results in locking of the driving wheels, is also a very active cause of attack on the road surfacing. In general, it is entirely to the driver's advantage to stop gradually and to apply the brakes sparingly. It cannot be impressed upon them too strongly that it is as much to the advantage of the automobile as to that of the road to always follow this practice. There are, however, certain special points of roadways, as, for instance, very steep declines, where it is necessary to apply the brakes, and where, in fact, the latter often lock the wheels. In that case ruts are produced, which develop very rapidly, especially if the narrowness of the roadway or the existence of a curve induces all automobiles to follow practically the same track.

At all points of the road, such as curves, steep descents, etc., where there is much sliding of the wheels on the road, it is advantageous to so construct and maintain the road that it will be sufficiently hard and not very slippery, as much from the standpoint of reducing wear as in the interests of the safety and convenience of traffic.

It is evident that the nature of the tire or tread has a certain influence upon the effects which have been described. Some distinctions must be drawn in this respect between a smooth rubber tire and a non-skid cover.

Let us first consider the simple rolling motions of a free wheel on a smooth road without tendency to skidding. Under these conditions the action of the steel studded tire differs from that of the smooth tire in that the static pressure in increased, owing to the fact that the bearing surface, being confined to the rivet heads, is decreased. This localization of the pressure is more or less complete according to the suppleness of the tread, the form and arrangement of the rivets and the condition of the road surface. It may in itself lead to fatigue of the road surface, if the impression made by the rivets is very deep. It must be remarked, however, that this impression on a uniform road is not accompanied by any vertical shock. The rivets of a steel studded tire have been compared to so many hammers strking the road. This statement neglects the fact that a hammer is carried on a long lever arm, while the motion of a rivet in a tire tread is at every instant in a circle toward a tangent which is approached until the rivet coincides with it. If only the vertical component of the motion is considered this component becomes nil at the moment the rivet comes in contact with the ground.

This observation, of course, only applies to motion on a uniform surface. If, in consequence of inequalities in the surface and the play of the springs, the wheel applies a succession of vertical shocks to the road, it is obvious that the rivets take part in these, but their mass being small and they being supported yieldingly in a vertical direction, it is obvious that no effect of this kind need be feared.

On the other hand, the rivets increase the destructive effects in proportion to the depth of their impression on the road, whenever the wheel exerts an energetic frictional effort. Let us consider the tangential effort of a driving wheel. The effect of the rivets is to increase the coefficient of adherence, and, one might say, to cause the wheel to gear or mesh with the road. The substitution of a gear for a smooth frictional contact is not necessarily conducive to wear or deterioration. On the contrary, by preventing slipping one prevents the loss of the power which ordinarily results in the wear of the frictional surfaces.

But the system formed by the steel studded tire and the macadam road does not act like a perfect gear. On the one hand, the prevention of slipping, to the extent to which it is accomplished, is only realized at the expense of increased horizontal efforts on the materials of the road, which efforts tend to dislodge them. On the other hand, slipping still continues; it is perhaps not as frequent and not of as great amplitude, other things being equal, than if the tire were smooth, but if it were of the same amplitude it would tear up the road surface to a greater depth, since the rivet heads sink into it more deeply. This cause of road destruction is particularly effective when the vehicle is started abruptly, or at the bottom of steep grades, the more so because the increased adherence due to the steel studs permits of starting very suddenly and of ascending steep hills more rapidly.

Similar observations apply to transverse efforts, that is to say, to skidding efforts, whether driving or steering wheels are considered. Steel studded treads evidently diminish skidding in a transverse direction, and this is the very object of their use. But this result is secured by means of efforts which tend to dislodge the stones from their places, and the skidding which actually takes place produces a dislocation of the road material, which is deeper in proportion as its range is smaller.

Finally, when the brakes are thrown into action, it is absolutely necessary that a certain amount of energy be dissipated in friction. This friction may take place either between the brake shoes and the brake drums, the braking wheels continuing to turn, or between the tire and the ground, the wheels being locked. The steel studded tire, increasing the adherence of the wheel to the ground, permits of obtaining an increased braking effect by the first method, but at the cost of a greater tangential reaction on the road. As to the second method of braking (locking of the wheels), it is more powerful with the non-skid tread than with a smooth tire, but, producing a more rapid stop, it acts on the road surface to a greater depth.

On the whole, supposing a tire with small rivets which do not imbed themselves into the road surface to an exaggerated extent, it is questionable whether such a tire is harder on the road than a smooth tire, so far as the even parts of the road are concerned. Both tire and road may be saved to a certain extent by the reduction of slipping. But at all points where there is much slipping of wheels on the ground the non-skidding tire, gripping the road surface better than the smooth tire, has a more destructive effect. The use of non-skidding tires insures to motorists such a degree of safety at such points that it would be impossible to induce them to give it up. It is, therefore, necessary that the roads should be so constructed and maintained that they will not be greatly damaged by these effects. On the other hand, motorists should use only such anti-skid tires as will not cause undue damage to the roads. The rivets should have a flat head, and they should only project a moderate distance above the tire, with respect to their diameter.

What has been said so far applies specially to macadamized roads, the great majority of those traveled by automobiles. On stone pavements automobile traffic has practically no effect. However, if there are joints of considerable width in these pavements, the sand filling may also be drawn out from between them by these tires, after which there is a tendency for the stones to come loose. This trouble may be avoided by giving the pavements a slight sanding, but this increases the dust nuisance to those who use and live adjacent to the roads, the very thing which it is intended to obviate by the use of this pavement. A paved road is a very suitable track for automobile traffic, provided it is of uniform surface and the joints are narow and contain only little sand. This object is accomplished by using small blocks with plane surfaces on a well formed and carefully laid foundation. This offers an interesting solution of the road question, which must, however, not be confounded with the old style of pavement, consisting of large and unequal stones, and which at some points where there is very much automobile traffic permits of combining sufficiently smooth riding qualities—much better than those of macadam pavement in poor condition—with great wearing qualities.

Tracks of flagstones, judicially arranged in such a manner that no ruts can be formed, would offer the same advantages.

As to city street pavements, of wood blocks or asphalt, pneumatic tired automobile traffic does not produce any appreciable wear. As concerns wood block pavement, which is of particular interest by reason of its adherence and easy traction qualities, the Avenue of the Champs Elysées in Paris offers a very instructive example of the comparative effects of automobiles and horse vehicles. The central portion of this avenue has been reserved to the first form of traffic and the outer portions to the latter. It must be taken into account in this comparison, however, that the central portion of the avenue is used not only by pleasure vehicles with pneumatic tires, but also by the heavily loaded motor buses with their solid rubber tires, and rear wheels with block tires. Nevertheless, it can be stated that that portion of the avenue reserved to mechanical traction, which is clearly distinguished from the track of the horse vehicle by its darker color, retains a much more uniform surface and does not show any tendency to irregular wear of the elements of the pavement, as do the outer portions of the avenue, which are hammered by horses' hoofs.

(To be continued.)

The French De Dion firm has brought out a small hand drawn fire truck, provided with a pump driven by a single cylinder, six horse power motor. The outfit is specially intended for factories and large public institutions.

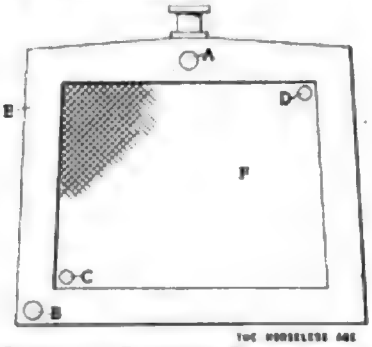
COMMUNICATIONS

A Proposed Change in the Cooling System.

Editor HORSELESS AGE:

The tank and radiator shown are fitted to a foreign car, and it is desired to change the connections so that the cooling would be more efficient.

The water enters the tank from the top of the engine at A, flows from the bottom of the tank at B to the pump, from the pump to the radiator at C, and rising through the radiator returns to the engine from D. The tank E surrounds the radiator F.



SKETCH OF RADIATOR CONNECTIONS.

It is proposed to change the connections so that water will enter at A, flow to the bottom of the tank by gravity to B, rise from B to D, thence through radiator by gravity to C, thence through pump to engine.

The pump is now called upon to raise the water through the whole of the radiator, while in the proposed plan the rise would be through a short length of tubing from B to D and from the pump to the cylinders.

The advantage derived from the present system is that the tank continually supplies its whole contents, whether full or nearly empty, to the pump, while in the proposed plan the water in the tank, unless it completely filled the tank, would not flow to the pump until the pump had taken the water in the radiator and forced it through the cylinders to the tank until it was nearly full.

Would the fact that the pump would have to raise the water a considerably smaller distance overbalance the sole advantage the system now possesses—of having a storage place for water in the tank from which th ewater flows by gravity? READER.

[This would depend entirely on conditions which you do not mention. If the pump is a positive one, of the sliding vane type, for instance, the change would not affect the rate of water circulation. On the other hand, if a centrifugal pump is fitted the proposed alteration of the connections would likely considerably increase the rate of circulation, and consequently the cooling effect. You do not say whether the motor now tends to overheat or not. If it does not, an increase in the cooling effect would be detrimental to the fuel efficiency. The pump might not require quite as much power to drive it with the proposed arrangement of piping, but the power consumed by the pump is a small item in any case, and very little could be saved in this way. However, if you require more energetic cooling and your pump is of the centrifugal type, the proposed change would probably serve your purpose.—ED.]

Freezing Temperatures of Alcohol Solutions.

Editor HORSELESS AGE:

Knowing that you pride yourself on the accuracy of all statements which appear in your magazine, I beg to call your attention to the data given on page 669 in your issue of November 18, on "Non-Freezing Solutions." The curve which appears therein on percentages of different solutions of denatured alcohol and water is, in my opinion, inaccurate. To substantiate this I am enclosing herewith a copy of a curve, plotted from the data given by Dr. Wilhelm Vaubel, one of the foremost German chemists, in his book called "Lehrbuch der Theoretischen Chemie."

If you can see your way clear to do so I would ask that you publish the enclosed curve in your coming issue, as the former curve gives consumers of denatured alcohol a wrong impression as to the amount of alcohol required for various solutions as a non-freezing agent in automobiles.

IRWIN BUCK.

[Our curve was drawn from the figures given in the table below, which were taken from "Physikalisch-Chemische Tabellen" by Landolt und Bönstein, page 163, edition of 1905. This is an up to date work which is recognized by engineers and chemists. Wherever the figures of the authors agree with those of other previous writers the one who first obtained the figures is cited in the table. We believe that Dr. Vaubel's work, from which you took your data, was published in 1897.—ED.]

ETHYL ALCOHOL SOLUTIONS.

Percentage of Alcohol in Water.	Freezing Temperature, Degrees C.	Authority and Date.
.001851	— .000670	H. Hausrath, 1902.
.02299	— .00832	H. Hausrath, 1902.
.04604	— .0181	E. H. Loomis, 1900.
.1332	— .04936	H. Hausrath, 1902.
.3247	— .1307	W. Nernst and R. Abegg, 1894.
.595	— .2367	F. M. Raoult, 1898.
.9319	— .3707	E. H. Loomis, 1900.
2.418	— .9645	F. M. Raoult, 1898.
5.014	— 1.9900	F. M. Raoult, 1898.
8.105	— 3.215	R. Abegg, 1894.
17.96	— 7.49	R. Abegg, 1894.
36.43	— 16.00	Pictet and Altschul, 1895.
51.06	— 23.6	Pictet and Altschul, 1895.
86.22	— 33.9	Pictet and Altschul, 1895.

Queries.

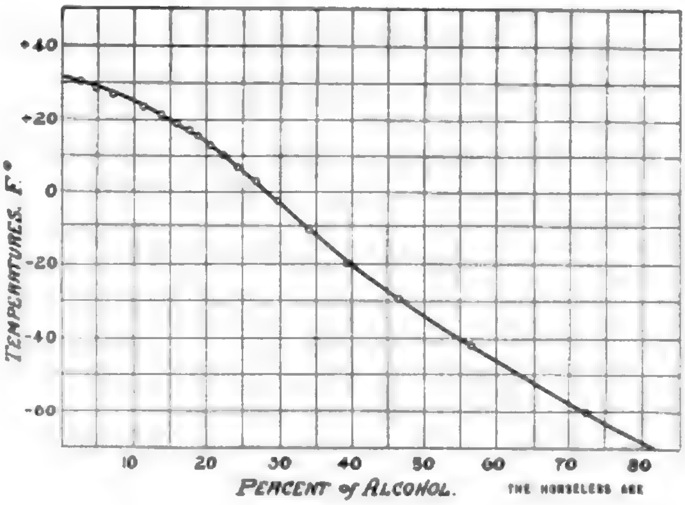
Editor HORSELESS AGE:

1. Will you kindly give a formula in your paper how to calculate the angle of a steering knuckle with respect to the front axle?

2. Which weather conditions require a richer mixture for the gasoline engine, cold or warm, damp or dry?

3. What paper would you recommend for advertising to bring an invention on the market? I have a United States patent allowed for a mixture charging mechanism to start multiple cylinder gasoline engines. There would be an addition to the engine: (1) a hand air pump, (2) the regular cam shaft has an additional keyed cam for each valve and is slidable. The mixture will be very good. J. Z.

[You probably had in mind the angle of the arms of the steering knuckle which are connected by the tie rod. These arms are laid out on the plan view of the chassis, so that when prolonged to the rear they pass through the centre point of the rear axle. If they extend in front of the axle the arms are therefore diverging; if in the rear, converging. The length of the arms is of considerable importance. It cannot be found by any simple formula but must be determined by the cut and try method, the condition being that the axes produced of the two front axle ends must always intersect the axis of the rear axle produced



at the same point. The proper angles and lengths can be obtained from tables published in THE HORSELESS AGE of March 29, 1905.

The proportions of the gaseous mixture, considering only that portion of the gasoline which is vaporized and thoroughly intermingled with the air, should be the same for all sorts of weather conditions. But as, if the air is extremely cold or extremely damp, not all the gasoline fed may be vaporized, it seems reasonable to conclude that under such conditions it is advantageous to feed an excess of gasoline. In fact, it is known that in gas generators and similar devices where the feed of gasoline is controlled by a needle valve, the latter must be opened for starting slightly further in cold than in warm weather.

We cannot recommend any advertising mediums in these columns.—ED.]

How to Treat Tire Rims.

Editor HORSELESS AGE:

After removing the tires from the auto wheels and sandpapering the rust from the rims is it advisable to give the rims a coat of paint? Are the tires liable to stick to the paint, due to heat caused by road friction, particularly in hot weather? Is there any particular kind of paint used for that purpose? F. J. SHARP.

[In painting the rims use air dry enamel, which you can get in any good paint store. The tire will not stick to this.—ED.]

Ignition Query.

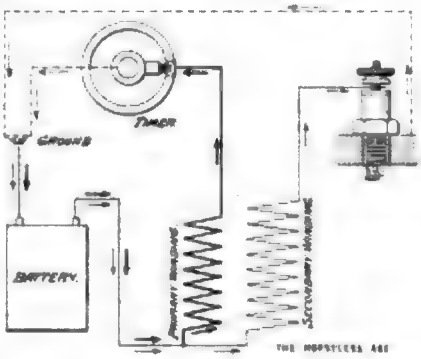
Editor HORSELESS AGE:

Will you kindly state in as plain and non-technical language as possible the solution of the following problem? My car is a four cylinder one, and is equipped with two dry cell batteries, which operate the usual quadruple trembler coil. The wiring, which I did myself, is as follows: The positive wire from one battery goes to the coil, and the other battery is wired the same. The negative wires from both batteries are grounded on the engine. Four wires lead from the coil box to the commutator, and this completes the primary circuit, which is easy to understand. There is a switch on the front of the coil box which enables me to use either one or both of the batteries, as I may choose.

My high tension wiring consists simply of four wires leading from the coil to the plugs. I have had this coil box off the car and sent it away for repairs, and I know that there is no metallic connection whatever between the high tension winding of the coil box and the engine, except through the four wires leading to the plugs.

Now, what I want to know is how and where this high tension current gets back into the coil box after it jumps the gap in the plug, to complete the circuit. I have asked a great many the above question, but they stutter around and it is clear that they do not understand the matter any better than I do. The best electrician in the city here told me it was completed through the commutator wire, but I know better than this myself. I am an old subscriber to your paper and would feel extremely obliged to you if you would make this matter clear to me. INQUIRER.

[One thing that you probably overlooked is that in most coils the primary and secondary windings are connected together, so as to reduce the number of binding posts required on the coil. First, the primary winding is wound on the core of the coil, and when this is all on, the fine wire of which the secondary winding is composed is metallically connected to the end of the primary wire, and is then wound on. Now, when the spark jumps at the gap of the spark plug, presuming that the current arrived through the cable connecting to the spark plug, it passes, of course, into the frame of the engine, or into "ground," as they say technically. The secondary current can readily flow back from ground through the battery to the secondary winding, for the reason that the primary winding is connected to the secondary. The accompanying sketch, in which only one coil and plug are shown, will make this quite clear. The dotted lines indicate the path of the currents through the engine frame or ground. The heavy arrows show the direction of flow of the primary current and the light arrows the direction of flow of the secondary current.—ED.]



Tire Repairs—Chauffeur's Duties.

Editor HORSELESS AGE:

In the last number of THE HORSELESS AGE, page 846, under the heading, "Chauffeurs' Commissions," first column, third paragraph, you mention the chauffeur as attending to all kinds of tire work.

Will you kindly inform me what it is customary to expect these parties to do in the matter of tires? I have never as yet been able to have them do much of this for me, and what they have done has been of a worthless nature, no doubt to demonstrate to me the truth of their statements that this work must be done at a shop to be of any good. Of course, the biggest fool could see the meaning of this, that it was with the object of obtaining a commission; but rather than be left in the lurch, as these parties will manage if they cannot have their way, I have put up with this dodge and allowed my tires to be repaired at a shop, even in the face of assurances by parties who knew that it was an easy matter to have them done at home. However, I would like to know exactly what is expected in tire repair by these parties, as knowing this may exact the service.

I would also like to hear from you the general opinion in regard to filling superficial cracks (that have not attacked the fabric) in shoes with any of the various cements that are on the market claiming to be of use as preservatives for the life of tires.

Here again we are informed by the chauffeur that they are no good, but as neglect means a new tire, with its attendant commission, we take no stock in what they say in this matter.

I would like to hear from you on both these points. PERRY DICKIE.

[If you hire a man who claims to be a mechanic you may expect him to do all the common tire repairs, such as repairing punctures in inner tubes, vulcanizing inner tubes and vulcanizing small cuts in outer covers. We are not prepared to say whether filling superficial cracks in the tread of tires with cement does much good. But we know that vulcanizing the covers with small vulcanizers, which can be used without removing the tire from the wheel, tends to preserve the tire. Such vulcanizers can be operated by anybody. It is well for an owner to have both such a vulcanizer and an inner tube vulcanizer, both of which are comparatively low priced. In the case of big cuts going through to the fabric the tire can generally only be repaired at a tire repair shop.—ED.]

Dependence of Car Speed on Weight and Tire Size.

Editor HORSELESS AGE:

Could you tell me in your next issue what difference this change would make on my car, the working of the engine and the speed of the car? I have a 20 horse power, Model R Stevens touring car, with 30x3½ inch tires. My idea is to change the rims to a quick detachable (Fisk) and have 31x4 inch tires. These rims will add 25 pounds to each wheel. WALTER R. LUSHER.

[The larger size of tire will be an advantage to the engine and the rest of the mechanism in that it will preserve them more from road shocks, if inflated to the proper pressure. In driving on a level road the engine, owing to the increased "gear" of the car and the increased total weight, will run at a lower speed for the same throttle position. Whether the car will run either slower or faster is a matter that can only be settled by actual test. One thing that is certain, however, is that after the proposed change you will not be able to ascend quite so steep a hill on the high gear, and the maximum grade that you will be able to ascend on the low gear will also be cut down slightly. The difference in hill climbing ability will not be great, however. The change in wheel diameter would reduce the hill climbing power by about 3 per cent. and the increase in weight by about 4 per cent., together 7 per cent.; so that if you can ascend, say, a 7 per cent. grade on the high gear now you will be able to ascend a 6½ per cent. grade on it after the proposed change.—Ed.]

Pope Manufacturing Company Formally Reorganized.

The reorganized Pope Manufacturing Company was incorporated under the laws of Connecticut last week, to take over the property of the old Pope Manufacturing Company, with the object of manufacturing Pope-Hartford cars and Columbia bicycles. The incorporators of the new company are Albert L. Pope, Col. George Pope, Charles E. Walker and Wilbur C. Walker. The new company is to issue $2,500,000 preferred stock and $4,000,000 common stock, at $100 per share. A meeting was held in Hartford on Saturday, at which a draft of the proposed bylaws of the company was presented and adopted. The following directors were elected at this meeting: For one year, Harry Bronner, Frederick H. Ecker and August Heckscher; for two years, Lewis N. Freedman, Albert Stickney and A. W. Pope; for three years, Henry V. Poor, A. L. Pope and Milton Ferguson.

A meeting of the directors for the election of officers is to be held in New York this week. It is announced that the fourth and last dividend of 25 per cent. will be paid to all creditors within a few days.

Motor Cycle Federation Meeting.

At the recent annual meeting of the Eastern District of the Federation of American Motor Cyclists, B. A. Swenson, of Providence, R. I., was elected secretary and F. W. Horenburger, of New York, treasurer. E. L. Buffington, of Providence, national vice president, is ex-officio the head of this district. A resolution was adopted at the meeting favoring the restoration and maintenance of the old cycle paths which have been neglected in many parts of the district in recent years. It was also decided to offer a reward of $25 for information leading to the arrest and conviction of any person stealing a machine owned by a member of the district, which includes New York, New Jersey, Pennsylvania, Delaware and the New England States.

Worcester Endurance Run.

Fourteen cars took part in the 200 mile endurance run through the hilly district of central Massachusetts, which was conducted by the Worcester A. C. on Saturday, December 12. The run was rendered more difficult by about 6 inches of snow. The start took place at 6 o'clock a. m., and the majority of the contestants arrived back in Worcester at 6 p. m. Four of the contesting cars met with serious mishaps on the road and had to withdraw. William Bourque, driving a Knox sportabout, was forced to ditch his car by a car ahead of him beginning to skid and block his way. A. E. Dennison and party had a very narrow escape from collision with a train on the Massachusetts Central at Colebrook. The road test was followed by a technical examination on Sunday.

Rival Shows in Buffalo.

There will be two automobile shows in Buffalo this winter, both of which will be held in Convention Hall. The first of these shows will be held under the auspices of the A. C. of Buffalo, beginning February 15; the second under the auspices of the Buffalo Automobile Trade Association, beginning March 1. There has recently been a split between the Automobile Club and the Trade Assoication, who formerly conducted the automobile show together through a joint committee. The cause of the differences is said to be connected with the division of the show profits. Some of the dealers are inclined to the opinion that they have been bearing the bulk of the show expenses, while the club has been reaping the profits, and have been asking for a different division of the profits betwen the association and the club. It is stated that the local dealers are about evenly divided, some supporting the association and some the club.

Craig-Toledo Stockholders Sued.

A suit has been filed by the trustee in bankruptcy of the Craig-Toledo Motor Company, Toledo, Ohio, to recover approximately $30,000 from stockholders of the concern, to pay the debts in full. Trustee Joseph W. Lane alleges that the debts aggregate more than $45,000, and the proceeds from the assets amount to only $16,000. He asks in his petition that the court ascertain the solvent stockholders and the amount still unpaid on each one's holdings. The company was organized with a capitalization of $100,000. Of the total amount of stock, $51,000 worth was issued to John G. Swindeman for the assets of the Maumee Motor Car Works, which Lane alleges were worth no more than $1,500. Part of this stock was transferred to stockholders as a 50 per cent. bonus, and the rest was divided between Swindeman and Wm. K. Terry.

Trade Conditions in the South.

Following is an extract from a report by W. Hildreth, of the Holsman Automobile Company, of Chicago, as a member of the delegation from that city which recently made an extended trip through the Southern States:

"Representing as I did the automobile interests I called on nearly 100 automobile dealers. In every instance I endeavored to learn the conditions of the trade, the number of automobiles in use in proportion to the population, and if this proportion was not satisfactory I endeavored to learn the reason why and to suggest, if possible, some means of increasing the use of automobiles in that locality.

"I found that the most universal obstacle was poor roads. Lack of prosperity was urged in some instances, but two prominent facts seemed to indicate that this was not the real reason. One of these facts was that almost every city visited on our trip had doubled or trebled its population since the last census, showing a greater advancement of the South in the last eight years than in any decade in its history. The other fact was that where roads were good automobiles were quite plentiful, whereas where roads were bad automobiles were very scarce.

"The conclusion that I would offer from these facts is that the only immediate and profitable market for automobiles in the South is in those sections having good roads, and that it is practically useless at present to expend money and energy on the other sections. I do not overlook the fact that the introduction of automobiles encourages good roads, for the automobile is undoubtedly the best good road builder ever invented. I do believe, however, that in the line of automobile sales greater returns can be had by directing the efforts and investment into the localities with good roads, and that the conditions in the South are marked enough to warrant careful investigation in this direction when inaugurating a selling campaign there."

Packard Buys Land in Long Island City.

The Packard Motor Car Company have bought a parcel of land at the corner of Thomson avenue and Van Dam street, Long Island City, where the approach of the Queensboro bridge joins Thomson avenue. It is composed of thirty lots, and has been bought with the view of future developments. The company state that they have no definite plans as yet as to what use the land will be put, but they realize the possibilities that this land will have when the new bridge is thrown open to traffic and the new short route is opened to Jamaica. The purchase price of the land is said to have been $90,000, but the company would not confirm this.

Coming Events.

December 22 to 29—Paris Commercial Vehicle Show.

December 31 to January 7—New York City, Grand Central Palace, Ninth Annual Show American Motor Car Manufacturers' Association.

January 1 and 2—Endurance Run from Philadelphia to Wilkes-Barre and return, Quaker City Motor Club, Philadelphia, Pa.

January 16 to 23—New York City, Madison Square Garden, Ninth Annual Show Association of Licensed Automobile Manufacturers.

January 28 to 30—Philadelphia, Pa., Automobile Trade Association's Annual Show.

February 6 to 13—Chicago, Ill., Coliseum, Annual Show, National Association of Automobile Manufacturers.

February 15—Detroit, Mich., Automobile Show, Casino.

February 15—St. Louis, Mo., Automobile Show.

February 16 to 18—Denver, Colo., Automobile Show, Auditorium.

February 22—Cleveland (Ohio) Automobile Show.

March 6 to 13—Boston Automobile Show, Mechanics' Building.

March 27 to April 3—Pittsburg Automobile Show.

LEGISLATIVE and LEGAL

Missouri Road Building Amendment Carried.

At the November elections in Missouri the voters adopted a constitutional amendment which will revolutionize road building in Missouri. The new amendment provides that counties of the State shall be authorized to levy an annual tax of 25 cents on each $100 in personal and real property for purposes of permanent road building. While the tax appears to be small, figures which have been submitted in one or two of the principal counties of the State show that it will be sufficient to permit substantial progress every year. For instance, in Jackson County, the seat of Kansas City, the annual income for road purposes through the adoption of this amendment will be nearly $500,000. In St. Louis, which is a county of itself, the income will be about $800,000. There are, however, several small counties where the income annually will not be in excess of $25,000. This money will, however, if judiciously used, finally result in the construction of the across-the-State road. Of this about 80 miles have already been built through the individual efforts of the counties, about 45 miles of the road lying eastward from Kansas City and 35 westward out of St. Louis. The one fault with the amendment is that the levying of the tax is not compulsory.

Street Workers Not Required to Look Out for Traffic.

Justice Kerwin, of the Supreme Court of Madison, Wis., in the case of Michael Hiroux vs. John Baum, of Green Bay, decided that a street cleaner is not required to keep on the lookout for automobiles, and that if he is injured by being run over the driver of the automobile is to blame. The accident which led to the suit occurred in Green Bay, Wis., in July, 1907. The complainant, who was working on Main street in that city, was run down and injured by an automobile owned by John Baum, driven by his son Cecil. The plaintiff was knocked down, rendered unconscious and injured on the head and hip. He sued for $1,200 damages. The first question to be decided was whether the son was acting as the agent of his father. This was answered in the affirmative, it being shown that he has his father's consent to the use of the car, and at the time of the accident he was being instructed by the dealer in handling it.

New Maryland Automobile Bill.

A committee appointed by Governor Crothers, of Maryland, last spring, of which State Senator J. Charles Linthicum is chairman, has been at work on a bill to regulate automobile traffic, and to impose a tax on the owners of motor cars, the proceeds from which are to be used for the improvements of roads. The tax will be graduated according to the horse power of the cars, which is to be determined according to a special formula, it being considered unjust to tax the cars according to the manufacturers' rating, owing to the fact that imported cars are generally rated very much more conservatively than those of native manufacture. Another change in the proposed law as compared with the one now in force is that non-resident owners will not be required to take out a license, provided they do not remain in Maryland longer than a certain number of days. The bill will be introduced in the Senate immediately upon the meeting of the next Legislature.

Three Mile Road Bill in Indianapolis.

Representative J. M. Fitch, of Muncie, states that he will introduce a bill in the Indiana Legislature next month for the repeal of the three mile road law, under which road improvements amounting to about $10,000,000 a year have been made. Farmers were satisfied with the law as long as it applied only to the construction of gravel or macadam roads. However, a number of cities and towns have begun the construction of brick pavements under the law, the expense to be divided among the property owners of the whole county. In Centre Township, Delaware County, brick streets to cost $565,000 are now being built or contemplated.

St. Louis Police Board Turn Down Club's Card System.

The A. C. of St. Louis recently worked out a scheme whereby its members were to be saved the trouble of going to the police station in case of arrest for speeding. Each member of the club was to be provided with a card, and upon being arrested was to show the policeman his card and give him his license number and name, and ask at what court he would have to appear the next morning. The policeman was to retain the card and return it to the defendant after the hearing in court. Chief of Police Creecy, following a conference with the Board of Police Commissioners, announced that they would not accept the system, and that speed law offenders would have to go to the police station and remain there until they gave bonds.

Two Years for Manslaughter.

William Goston, a negro, aged twenty-five, was sentenced to two years in the Wisconsin State prison last week for fourth degree manslaughter. He stole a car from his employers, agents in Milwaukee, early in the morning, and went for a fast drive in the gray dawn. He ran down a boy, injuring him fatally.

Legal Notes.

A motor vehicle law has been drafted for the Denver Motor Club by Attorney Frank England. It is modeled after laws in the Eastern States, and will be presented at the next meeting of the State Legislature.

Alderman McGovern, of Omaha, Neb., is preparing an ordinance which prohibits the operation of automobiles and motorcycles by children. It will be brought up for discussion in the city council this week. The Omaha A. C. is in favor of the measure.

The Massachusetts Highway Commission has revoked the license of Hoffman Nickerson, of Pittsfield, following an investigation and hearing regarding an accident on November 13, in which Nickerson was involved, and which resulted in the death of Alexander Pondrier, of Manville, R. I.

Felix Droit, a chauffeur, of 320 West Fifty-second street, New York, was sentenced to thirty days' imprisonment and $250 fine for a third speeding offense last week. According to the testimony of the policeman who made the arrest, Droit sped up Broadway at forty miles an hour at 5 A. M. on August 23 last, and collided with an "L" pillar at Fifty-first street and Third avenue.

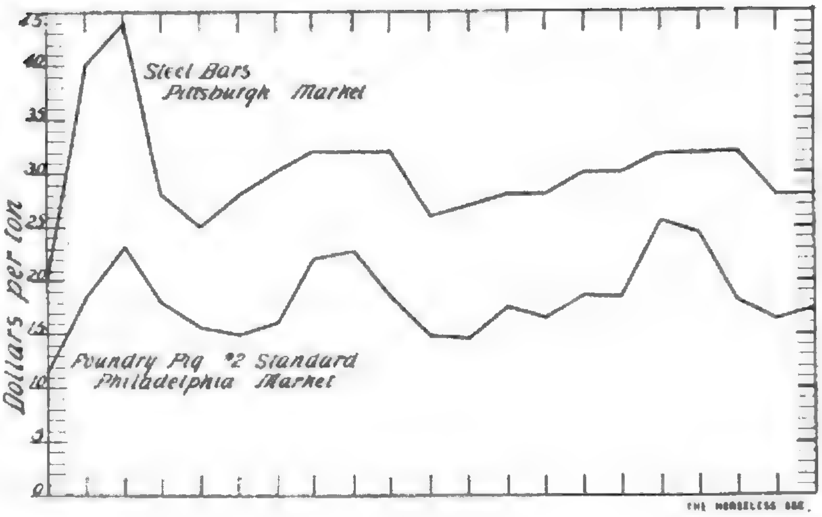
The Associated Automobile Clubs of New Jersey plan to introduce at the next session of the Legislature an amendment to the Frelinghuysen automobile law, granting exemption from registration to non-resident motorists touring in New Jersey. It is claimed that New Jersey is being widely boycotted by motorists outside the State, and that the tradesmen of the State suffer greatly in consequence. It is estimated that Newark alone loses annually over $8,000,000 by the boycott.

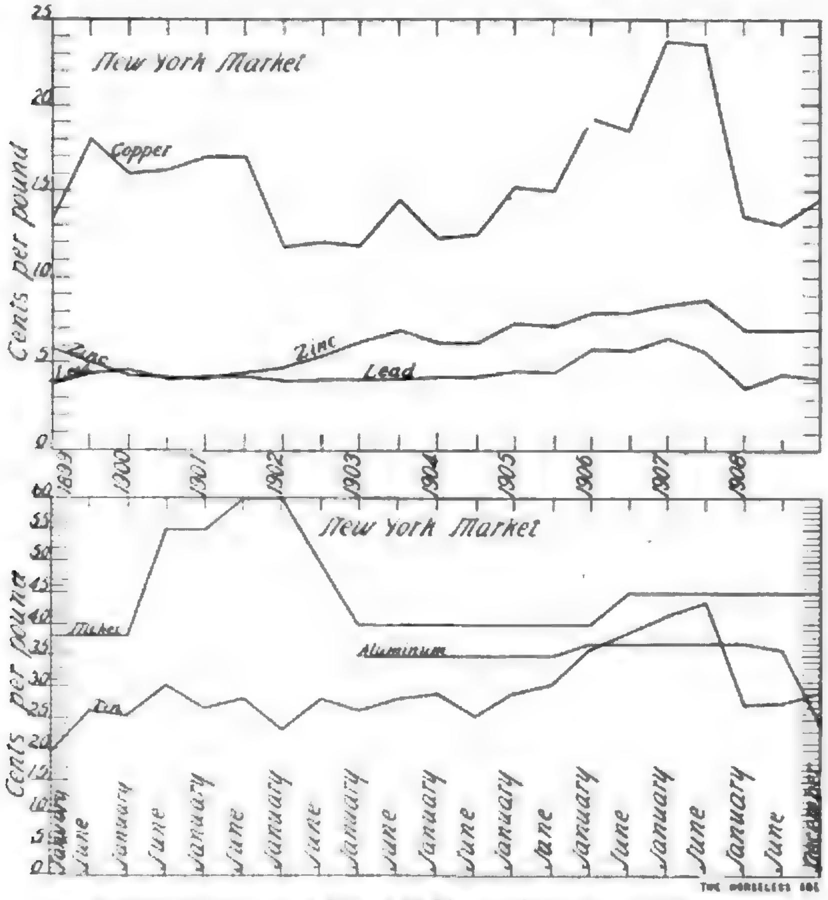
Kansas Motorists Discuss Laws.

At a meeting of the Topeka (Kan.) Motor League held at the Commercial Club in that city on December 8 it was decided that a legislative committee should be named by the president. It was the sense of the meeting that buggies and other vehicles out after dark should carry lights the same as the autos. It was said one of the councilmen would introduce such an ordinance providing the members of the club desire it. The matter went over until the next meeting. There was also some complaint of the condition of the paving where the plumbers have made alleged imperfect repairs. The club offered $10 reward for the arrest and conviction of anyone violating the city ordinance pertaining to the throwing of glass and other substances injurious to auto tires in the street. It will thus be seen that when the legislative committee is appointed it will not lack of subjects to which to devote its attention. The club also decided to adopt the sunflower for its emblem.

Fluctuations in Metal Prices.

The accompanying curves show the price fluctuations in the metal market during the last ten years. Just what effect the automobile has had on the market is difficult to determine, inasmuch as it became popular just as the wave of prosperity started to sweep the country, followed by a big demand for constructional materials of all kinds, with a corresponding increase in prices. The effect of the last depression is very clearly shown, however, prices having fallen quite abruptly. As will be seen, all of the metals whose prices are plotted, with the exception of zinc, were comparatively low in price at the beginning of 1899, but they increased rapidly that year, one of them more than 200 per cent. Steel bars show the most abrupt rise in the latter part of 1899, when the highest price for the decade, viz., $44 per ton, was reached. The price soon dropped, however, to within $5 of the former level, and since 1901 it has not fluctuated more than $10 per ton, the present price of $28 per ton being $2 less than the average price of $30 per ton for the last ten years. Pig iron has also gone through some decided fluctuations, the highest price, viz., $25.75, having been reached in 1907. The present price of $17.25 per ton is also lower than the average price of $18.24 per ton for the last ten years. The most expensive metal listed is nickel, which reached its highest price in 1901, after which it quickly declined. The present price of 45 cents per pound is slightly greater than the average price of 44.95 cents per pound for the last ten years. Owing to the patent control of aluminum, the price of this metal was maintained until this year. As the patents will soon expire, the bottom has almost dropped out of the market, the price having dropped abruptly from 36 cents per pound to 24 cents per pound, the average price for the last decade having been 35 cents per pound. This price is somewhat higher than the European price of the metal, and considerable quantities have been imported for speculation, although it is doubtful if the speculators will profit much by this move. Until 1905 tin did not fluctuate greatly, but later it rose rapidly until the high price of 43.75 cents per pound was reached. Within six months the price fell again abruptly, however, to almost its former level. Of late it has picked up somewhat, the price at present being 29.1 cents per pound, only slightly less than the average price for the decade, viz., 29.6 cents per pound. Owing to stock market manipulation, the price of copper has fluctuated greatly. The lowest price of 11.75 cents per pound was reached in 1902. From that time it rose steadily to the high mark of 23.75 cents per pound in 1907. A sudden decline took place soon after, which brought the price down to 13 cents per pound. It has recovered somewhat in the last six months, the present price being 14.5 cents, as against the average price of 15.5 cents per pound for the last ten years. Lead and zinc show the least fluctuations of any of the metals. The present price of lead is 4.27 cents per pound, as against an average price of 4.59 cents per pound for the last ten years. Zinc is at present listed at 7 cents per pound, while the average price for the last ten years was 6.6 cents per pound.





Fluctuations in the Prices of Metals Used in Automobile Construction During the Past Decade.

New Anti-Skidding Tire.

William A. F. McCallum, of Germantown, Pa., has recently been granted a patent on an anti-skidding tire which comprises sectional hinged or linked devices interposed between the pneumatic portion and the tread portion. This device, while of metal, is flexible or yielding, and is provided with points or prongs imbedded in the material of the tire shoe and projecting to the exterior tread surface of the shoe to present such a biting or frictional engaging surface in contact with the ground as to offer the required resistance on slippery and damp ground and on asphalt pavement, so as to effectually prevent skidding. The metal devices consist of substantially trough shaped sections linked together and placed diagonally across the tread. A patent on this construction was issued on December 8.

OUR FOREIGN EXCHANGES

English Daimler Company's Report Shows Loss.

The directors of the Daimler Motor Company (1904), Ltd., of Coventry, England, in their report for the year 1908 just issued, regret that the year's trading has been of an unsatisfactory nature, involving a loss. This loss is partially due to a decreased turnover, consequent upon the indifferent state of the market, and partially to the change in factory equipment, due to the adoption of the Knight motor. The amount brought forward from last year was £49,395, less directors' additional remuneration of £3,105 and interim dividend paid on preference shares, £2,089, making together £5,194, leaving a balance of £44,200. Deducting the final dividend on preference shares, £2,174, there remains £42,026. From the net loss for the year, viz., £49,286, is to be deducted the above amount, £42,026, leaving a balance of £7,260. Deducting this from the general reserve account of £180,000, leaves the general reserve account at £172,739.

It will be remembered that two years ago the Daimler Motor Company made a profit of approximately $1,000,000. A comparison with the above figures furnishes eloquent testimony to the changes in the big car market conditions in Europe.

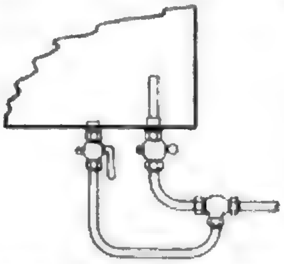
It may be of interest in this connection to refer briefly to the enormous fluctuations of Daimler stock quotations consequent upon the acquisition of the Knight motor patent. When it was first announced that the Daimler Company had decided to fit the Knight motor exclusively the shares rose on the Stock Exchange from 26 to 30, then to 40 in a single day, and finally reached the maximum at 57. However, it then seemed to dawn upon investors that the Knight motor might not be such a great advance over the older type after all, and the shares began to decline again. Just previous to the Olympia Show they stood at 40. Retardation in the issuing of the annual report of the Daimler Company caused considerable uneasiness, and the rumor spread that the report would show a loss, whereupon the shares declined still further, and at the time the report was issued they had reached their former level of 27-28. The Daimler Motor Company distributed 10 per cent. on its common stock in 1904-5, 22½ per cent. in 1905-6 and the same in 1906-7.

Darracq Company's Annual Report.

The firm of A. Darracq & Co. (1905), Ltd., an English stock company with works at Suresnes, France, has just published its annual report for the business year, which ended September 30. The report shows net earnings of £105,305, which, with the amount carried over from last year, made a total of £192,018 available. After payment of interest on bonds and preferred stock there remained £137,313. Of this amount £50,000 was transferred to the reserve fund, and an additional dividend of 2 shillings per share was paid, making total dividends of 4 shillings, or 20 per cent. for the year. The remainder of £35,438 will be carried over. The report points out that although the total net earnings are smaller than during the last two years, this is not due to any retrogression in the number of sales, but to the fact that during the general depression which reigned during the past business year there was much price cutting.

A Substitute for a Gasoline Gauge.

A writer in the *Autocar* describes the following substitute for a gasoline gauge, which involves only simple pipe fittings and enables the driver to know when the fuel in the tank is getting low. There are two outlets from the tank which merge into a common supply pipe some 10 or 12 inches from the tank, each of these pipes being fitted with a cock quite close to the bottom. The end of the outlet pipe in general use extends 3 inches vertically into the tank, the end of the other being flush with the bottom. The cock on this latter pipe, known as the "emergency pipe," is kept closed, so that the driver will be reminded when all the fuel except the last 3 inches in the tank has been used by reason of the motor stopping. By opening the emergency cock the driver will generally be enabled to reach some place where he may obtain a fresh supply of gasoline.



GASOLINE RESERVE ARRANGEMENT.

London's New Cab Whistle Regulation.

The chief commissioner of police of London, England, has issued a new taxicab regulation which bears testimony to the growing importance and appreciation of the motor cab in the British capital. Heretofore the call regulation for cabs was one whistle for a hansom, two whistles for a four wheeler and three whistles for a taxicab. In some localities the frequent whistling for taxicabs was complained of, and to obviate the annoyance as much as possible one whistle is now used for the taxicab, the hansom and four wheeler taking second and third place.

The General Automobile Taximeter Company has recently been incorporated in Brussels, Belgium, with a capital stock of 50,000 francs, which may be increased to 1,000,000 francs. The company is being organized with the assistance of the Metallurgique Automobile Works, whose cabs will be placed on the streets by the new company.

The Protos Automobile Works in Berlin-Reinickendorf, which became known in this country through the participation of one of their cars in the New York-Paris race, have been taken over by the large Siemens-Schuckert electrical firm.

During the period from July 1 to September 30, 1908, there were registered with the London County Council 1,806 motor cars, 53 motor trucks and omnibuses, and 373 motorcycles. There were 1,452 transferences of cars to new owners, and 6,480 drivers' licenses were issued.

The formation of an automobile volunteer corps is being considered in Roumania. The subject was broached by the Crown Prince at a recent banquet of the Roumanian A. C., who expressed the opinion that many members of the club would take pride in placing themselves at the disposition of the army authorities.

The annual report of the Dunlop Rubber Company, Ltd., of England, for the business year which ended on August 31, 1908, shows total net earnings for the year of £302,918. The directors decided to declare a dividend of 100 per cent. (£220,000); assign £90,000 to the reserve fund, and carry the rest, £27,415, forward.

The Grand Prix Race of the A. C. of France will next year be held on the Anjou Circuit on July 1, the race for voiturettes or light cars being fixed for the previous day, June 30. It is rumored that six of the big firms, who were the leaders in the recent movement against the annual show in Paris, have decided not to take part in the Grand Prix next year, and have pledged themselves to withhold from the race by bond of 100,000 francs.

In the report on the Budget read before the French Chamber of Deputies recently, by M. Janet, the advantages of an increased number of automobile services were pointed out, and the suggestion was made that the Government should pay a bonus to even small enterprises of this kind. This would lead to the substitution of motor buses for many horse drawn mail coaches, which would greatly increase the speed and comfort of these services, and at the same time it would help the automobile industry.

Vice Consul John Wardrop, of Sandakan, British North Borneo, reports the formation of a new rubber company in that island. Mr. Wardrop adds that the estate which the company has acquired is the only one in bearing, and that the first tree was publicly tapped by the Governor on July 5, 1905. The tract includes 8,771 acres and 75,000 Para rubber trees, of which 12,500 are over eight years old. The price paid was $160,600.

MINOR MENTION

The general agency for Thomas cars in England has been taken by the firm of Cloud & Co., Ltd., London.

The Sultan Motor Car Company, New York, removed on December 1 to 249 and 251 West Sixty-fourth street.

The St. Joe Motor Car Company, of Elkhart, Ind., proposes to move to Hutchinson, Kan., if satisfactory arrangements can be made.

The Velie automobile, made in Moline, Ill., will be handled in Kansas City at the Deere branch house, where a special salesroom is now being fitted up.

The Auto Cle automobile wrench, formerly manufactured by the Quincy-Manchester-Sargent Company, is now made by the Frank Mossberg Company, Attleboro, Mass.

The Lexington Motor Car Company recently incorporated in Lexington, Ky., is planning to manufacture from stock parts a $2,500 car, for which drawings are now being made.

The Trenton Rubber Manufacturing Company, of Trenton, N. J., manufacturers of tires and Thermoid brake lining, have opened an office and salesroom at 1997 Broadway, New York.

The Ford Motor Company, of Detroit, are reported to be planning to erect 500 workmen's homes on the Medbury tract, on the opposite side of Woodward avenue from the new Ford plant.

The seventh annual automobile show in Buffalo, N. Y., will be held in Convention Hall March 1 to 6, 1909, under the management of the Buffalo Automobile Trade Association, J. A. Cramer president.

Thomas B. Jeffery & Co., Kenosha, Wis., report the following increase in their sales in recent months over the corresponding months of 1907: July, 65 per cent.; August, 175 per cent.; November 520 per cent.

The Owen Thomas Motor Car Company, Janesville, Wis., who are now building two experimental cars, announce that if these prove satisfactory they will manufacture forty cars and erect a factory building next season.

The New Process Rawhide Company, Syracuse, N. Y., has recently begun the construction of an addition to its plant. The addition is to be of two stories and a basement, 60x80 feet. It is of steel and brick construction, with cement floors, and will increase the available floor space by over 13,000 square feet.

Justus Bissing, of Hays, Kan., is organizing a company with $20,000 capital stock to manufacture musical instruments and automobiles (a queer combination) and to do general repair work. Associated with him will be William Lenterbaugh, who was formerly foreman in the Smith Automobile Works, Topeka, Kan.

The Ajax-Grieb Rubber Company, of Trenton, N. J., will bring out a new non-skid tire at the coming shows.

Two nights when the admission will be increased from 50 cents to $1 have been decided upon for the ninth national automobile show in Madison Square Garden.

A rumor has gained circulation in Jackson, Mich., that the Buick Motor Company intends to move part of its factory back there from Flint to manufacture a motor buggy there.

The annual meeting of Maxwell agents, which is always held in connection with the Independent Show, will take place on Tuesday, January 5, at the Hotel Manhattan, New York.

The Marinette Auto Company, of Marinette, Wis., was forced out of business on December 1 by the foreclosure of a chattel mortgage, after creditors had levied upon the stock of the company.

The General Manufacturing Company, of Elkhart, Ind., are bringing out a standard line of automobile parts, starting with cone clutches and selective type transmissions. They will shortly add two sizes of planetary transmissions.

The Knox Automobile Company, of Springfield, Mass., have leased a new three story building at 1458 Michigan avenue, Chicago, for a term of ten years, at a rental of $7,000 a year for the first five years and $7,500 a year for the last five years.

G. M. Nearhood, of Spruce Creek, and G. S. Garth, of Mill Hall, Pa., have completed a saw and spoke mill at Fowler's, Pa., and will engage in the manufacture of automobile spokes. They are said to own 250 acres of hickory in the Allegheny Mountains.

The Pueblo Automobile Goods Company has established an automobile supply store at 214 Fourth street, Pueblo, Col. The company is capitalized at $25,000. W. L. Anderson is president, L. H. Walker vice president, F. H. Bullen treasurer, and Ralph Cruzen secretary and manager.

Following the sale of the Royal Motor Car Company's property to the Royal Tourist Car Company, the capital stock of the latter company has been increased to $900,000. Under the reorganization George J. Dunham, of Boston, is president, and M. S. Calhoun, of Cleveland, vice president and treasurer.

A permit has been granted for alterations in the building at Twelfth and Locust streets, St. Louis, Mo., which has recently been leased by the Buick Motor Company for a term of five years, at an annual rental of $12,500. The Buick Company plans to make St. Louis its headquarters for the entire Southwest.

The R. E. Hardy Company, New York city, have leased a steel and concrete building at Thirty-seventh street and New York Harbor, Brooklyn. In the future their office and factory address will be 201 Thirty-seventh street, Brooklyn, New York city. They will retain their Manhattan office at 25 West Forty-second street.

Automobiles have been excluded from Mound Cemetery, Racine, Wis., owing to the fact, it is stated, that "serious runaways have been narrowly averted when funerals were held."

Harry Dalitz, Cleveland, Ohio, has contrived a novel road map and guide for automobile touring. The map is wound on spools and carried in a brass box secured to the steering wheel, and can be unwound as the car is driven along.

Milwaukee dealers are planning to hold a show during 1909 in the Auditorium Building, a $500,000 structure, within a stone's throw of the local Auto Row, which will be completed April 1. The show may be held in connection with the Milwaukee A. C.'s annual race.

We have received a circular issued by the temporary committee of the Indiana Bureau for Good Roads, to whose organization we referred in recent issues. The object of the bureau is to insure that greater results are obtained from the appropriations for road building purposes made by the State.

The property of the Muncie Auto Parts Company, which went into the hands of a receiver about a year ago, has been taken over by a new company, to be known as the Auto Parts Manufacturing Company, of which John P. Kandel, Francis M. Boyer, Arthur W. Tyler, Jr., A. Boyer and M. Kandel are the directors.

The E. R. Thomas Motor Company, of Buffalo, has decided to locate a factory branch in New York city, in charge of Wm. B. Hurlburt, formerly president of the Garford Motor Car Company of New York. The Thomas cars have so far been sold in this city by the Harry S. Houpt Company. Mr. Houpt recently took the agency for the new Herreshoff car.

According to H. B. Wilson, who has charge of the Packard Motor Car Company's office in Paris, located at 177 Boulevard Pereire, 175 American touring parties in Packard cars visited Europe the past season. Mr. Wilson has made arrangements with the American Garage, 54 Avenue Montaigne, regarding repairs to Packard cars that may be required by tourists.

The Cole Carriage Company, of Indianapolis, which has heretofore manufactured horse drawn vehicles exclusively, announces that it will build automobiles equipped with solid tires, beginning next year. Three models, runabout, runabout with rumble seat and a car with a detachable tonneau, will be built, one type of chassis being used. The engine will have two cylinders, opposed, of the four cycle type.

Consequent upon the disappearance of J. V. Lindsley, of Dowagiac, Mich., to which we referred in our last issue, the shop of the Lindsley Motor Car Company was closed down by the young man's father and the twenty-six employees were paid off in full, it is reported. The company is said to be heavily involved, and an investigation of its assets and liabilities is now being made by the elder Lindsley. The Dowagiac Motor Car Company, recentl, incorporated, is said to have taken steps to take over the plant and contracts of the Lindsley Company.

The amount of the dues to be paid by the State associations to the American Automobile Association has recently been increased from 25 cents to 50 cents per member. Individual members will pay $3 per year hereafter.

The Packard Motor Car Company, Detroit, inform us that they are now employing 3,250 people. On December 4 the company had shipped 904 of their 1909 models, and it is interesting to compare this with the number of cars shipped on the same date the previous year, viz., 588.

It is reported that George La Fond, a chauffeur who has been operating cars for owners of Marinette, Wis., for three years, is in the hospital suffering from a peculiar form of hip disease, which the physicians claim to be due to the constant jarring of the machine and the use of the right foot on the pedal. La Fond has lost the use of his right leg, and his condition is critical.

Jesse Frohlich, managing director of the Times Square Automobile Company, New York, has secured the American agency for the Benz car, made in Mannheim, Germany, in the following sizes: 18-22 horse power, 28-35 horse power, 40-50 horse power and 60-65 horse power. Mr. Frohlich has organized the Benz Auto Import Company of America at 1599-1601 Broadway, New York.

At the meeting of the Iowa implement dealers which was held in Des Moines a fortnight ago quote a number of automobile manufacturers were represented, showing types of cars suitable for farmers' use. It is estimated that of the 3,300 cars sold in Iowa this year at least one-half were sold to farmers. It is thought that within a few years practically every important implement house in the State will handle automobiles as a side line.

The Mason Motor Car Company, of Des Moines, Ia., has been reorganized as the Mason Automobile Company, and the capital stock has been increased from $50,000 to $250,000. A. B. Shiriver, a banker of Winterset, Ia., has become president of the company. E. R. Mason will be sales manager and F. S. Dusenberg remains superintendent of the plant at East Fifth and Vine streets. It is said to be the intention to increase the capacity of the plant.

A United States consul writes that in the Department du Nord of France there is a good field for automobiles. Several American cars are to be seen there, and he thinks that a good, strong and fairly cheap machine, if placed on the market, would undoubtedly have a large sale there; but he fears that the chances of the American car will be spoiled by representatives not keeping repair parts in stock, which was the cause that led to American bicycle manufacturers losing that market.

Club Notes.

The Buffalo Automobile Trade Association held its annual election of officers at the Iroquois Hotel on December 11.

A chauffeur's registration bureau has been established at the Denver Motor Club. Chauffeurs seeking positions are registered free of charge.

The Philadelphia A. C. has obtained permission from the Chester City Council to erect large signs there, to enable motorists to find their way to the streets.

The hill climb of the Denver Motor Club, which was scheduled to take place December 12 up the Chimney Gulch road to the top of Lookout Mountain, has been postponed indefinitely.

The New Haven (Conn.) A. C. is making a special effort to increase its membership so as to be able to make a strong campaign for the retention of the present Connecticut State law next winter.

The Milbank (S. D.) A. C. was organized early this month, and the following officers have been elected: Dr. J. W. Ross, president; G. L. Wood, vice-president; Field Thornders, secretary, and George C. Middlebrook, treasurer.

The A. C. A. Board of Governors is said to be considering the preparation of a bill providing special penalties for drivers of automobiles who escape after having injured persons on the road. The matter has been referred to the law committee of the club.

The Buffalo A. C. will hold its annual meeting on December 31, and will vote on the following slate of candidates for next year: John M. Satterfield, president; Laurens Enos, vice president; Harry Thorpe Vars, treasurer, and Dai H. Lewis, secretary.

A meeting of the Automobile Manufacturers' Committee was held at the Automobile Club of America on December 9, to discuss next year's race for the Briarcliff Trophy. The race will probably be held in June, and it is said that already twelve entries have been promised.

The Findlay (Ohio) A. C. was formed at a meeting in the Phœnix Inn, Findlay, on December 4. Robert Kirk was elected temporary president and F. M. Barnhart temporary secretary. A committee was appointed to draw up a constitution and bylaws. The club starts with thirty-three members.

The following ticket will be voted upon at the annual election of the Denver M. C., December 21: President, Ralph W. Smith; vice-president, William D. Nash; secretary, Frank England; treasurer, C. P. Allen; board of governors, S. D. Hopkins, George Tritch, J. Nicoll Vroom, E. F Dean, Ralph L. Taylor, W. H. Sharpley.

The old Louisiana Motor League, of New Orleans, is to be revived, a meeting for that purpose having been held at the Grunewald Hotel last week. It is reported that the fifty charter members of the recently organized New Orleans A. A., which is affiliated with the A. A. A., will join the revived Motor League in a body, abandoning the N. O. A. A. Homer George, who was recently elected a director of the A. A. A., has been appointed secretary of the new Motor League.

Indianapolis chauffeurs and automobile repair men held a meeting at 232 North Illinois street on December 8, and formed a temporary organization, with S. A. Kepler as chairman, Ray W. Lewis as secretary-treasurer, and Fred Wiltshire as assistant secretary-treasurer.

The Chicago M. C. held its annual election on December 8. There were two tickets in the field, and the so-called members' ticket was elected. The officers for the ensuing year will be F. C. Donald, president; Charles P. Root, first vice-president; David Beecroft, second vice-president, and Frank H. Trego, secretary-treasurer.

The Grand Prize gold cup of the A. C. A. was presented to the American representative of the Fiat Automobile Company at the Automobile Club's headquarters on Tuesday, December 15. The cup was handed over by Judge E. H. Geary, president of the club. Mayor George W. Tiedemann, of Savannah, and F. E. Battey, president of the Savannah A. C., attended the ceremony.

The annual meeting of the Grand Rapids, Mich., A. C., was held on December 4 at the office of Dr. D. Emmet Welsh, the retiring president. The following new officers were elected: J. R. Jackson, president; Louis C. Parmenter, first vice-president; George J. Henzleman, second vice-president; Dr. F. C. Warnshuis, secretary, and Dr. Willard Burleson, treasurer. During the last two years, while Dr. Welsh was president, the membership of the club increased from 25 to 200.

Commercial Notes.

The Taunton, Mass., fire department has recently come into possession of a 40 horse power combination hose and ladder truck.

A company of local business men in Wheeling, W. Va., will start a taxicab service in that city, and expect to have one cab on the streets before the first of the year.

A taxicab operating company is about to be organized in Cleveland, Ohio. It is expected to have ten cabs in service in the centre of the city by the middle of January and fifty cabs next spring.

The Johnson Service Company, of Milwaukee, have had an injunction issued restraining the city from letting the contract for an automobile intended for the police department to a company said to be favored by the police chief and the board. The injunction was issued on the ground that the Board of Public Works did not advertise for bids, as required.

A special inquiry has been made at the office of an American consular officer in eastern Europe for the names of manufacturers of 50 to 60 horse power road tractors. These road tractors must be of a special type for use in a country where good roads are the exception. In writing the party making the inquiry full particulars should be given. The address can be obtained from the Bureau of Manufactures, Washington, D. C., by referring to No. 2875.

The Marott Department Store Company, of Indianapolis, has placed a one cylinder gasoline delivery wagon in service, and later expects to purchase several more, if the one bought proves successful. All department stores in Indianapolis now have one or more motor delivery wagons.

The Board of Public Safety, Indianapolis, finally decided to purchase the truck submitted by the Coppock Motor Car Company, of Decatur, for use in the fire alarm and telegraph system in Indianapolis. It will be placed in commission December 28, replacing a horse drawn wagon that has been used for some years.

The Auto Transit Company has been organized at Towanda, Pa., with F. B. Homet president, W. S. Lafferty vice president, V. D. Keeler treasurer, and W. H. Lee manager, to establish an automobile service between Wyalusing, Camptown and other neighboring villages. A twenty passenger car has been ordered from a Buffalo agency.

According to a United States consular report, Hermann Fricke, of Magdeburg, Germany, has built a sand strewing wagon for rapidly spreading a thin, even layer of sand on asphalt pavements when wet or frozen. The apparatus can be adjusted by the driver to strew a layer of sand from 20 to 50 feet wide. The machine has been taken over by the city.

An automobile bus service was started on December 7 between Sterling and Rittman, Wayne County, Ohio, and Wadsworth and Seville, Medina County. The distance between Wadsworth and Seville is 14 miles. A sixteen passenger car is used, making four trips a day. The service is mainly dependent upon workmen living in one of the towns and employed in another.

Dr. Eugene Buehler, secretary of the Indianapolis Board of Health, is receiving bids for a motor ambulance for the city dispensary. No time has been set for closing bids, as the board expects to make a thorough investigation before selecting a car. The board has adopted no specifications for the car, except that it is not to cost to exceed $2,500. Four bids have been received and others are expected.

The first alcohol motor cab has made its appearance in New York. It is a Franklin 18 horse power cab, identical with the regular cab of the company, except for the fuel system. At first experiments were made with a regular gasoline engine, but after a study of its action an engine was built specially designed for alcohol, and it is with this that the new cab is propelled. Both the compression and the carburetion are modified. The alcohol is said to produce no bad effect upon the motor. The experiment will be watched with interest.

New Incorporations.

Star Auto Co., Wichita, Kan.—Capital, $16,000.

Brintnell Motor Car Co., Ltd., Toronto, Canada.—Capital, $60,000.

Public Motor Co., Billings, Mont.—Capital, $50,000. Incorporators, J. C. West and others.

Pierson Garage Co., Janesville, Wis.—Capital, $10,000. Incorporators, Roy Pierson, N. L. Carle and L. A. Avery.

Morgan Motor Car Co., Wilmington, Del.—Capital, $500,000. To manufacture and sell automobiles and supplies.

Star Garage Co., Londonville, N. Y.—Capital, $25,000. Directors, G. A. Hubbard, John P. Randerson and Gaylord Logan.

F. S. Hoaglin Auto Co., Oshkosh, Wis.—Capital, $10,000. Incorporators, F. S. Hoaglin, A. E. Badger and L. O. Chase.

Fritz Brothers Auto Company, Oklahoma City, Okla.—Capital, $40,000. Directors, C. D. Fritz, E. J. Fritz and R. W. Yantis.

Atlantic Motor Co., Greensboro, N. C.—Capital, $25,000. Incorporators, H. L. and L. B. Hopkins and Thomas S. Beall.

Monarch Motor Car Co., Milwaukee, Wis.—Capital, $20,000. Incorporators, John Godfrey, William W. Welch and Inez N. Welch.

Morgan Motor Car Co., Wilmington, Del.—Capital, $500,000. Incorporators, Ernest L. Squire, K. M. Byrne and J. A. Byrne.

Sharp-Arrow Automobile Co., Trenton, N. J.—Capital, $125,000. Incorporators, William H. Sharp, Job R. Farlee and Fred W. Bennett.

Schwaebe-Atkinson Motor Co., Los Angeles, Cal.—Capital, $75,000. Incorporators, L. H. Schwaebe, Robert Atkinson and L. A. Lothian.

Standard Auto Co., Rockford, Ill.—Capital, $10,000. Incorporators, S. O. Widell, John Wester and S. Loan. To manufacture and sell automobiles.

Randolph Motor Car Co., Chicago, Ill.—Capital, $300,000. Incorporators, E. C. Gage, E. W. Burgstresser and S. Hytowitz. To deal in automobiles.

Auto Parts Manufacturing Co., Muncie, Ind.—Capital, $15,000. Directors, Francis M. Boyer, John P. Kandel, A. Boyer, Arthur W. Tyler, Jr., and M. Kandel.

Maxwell-Briscoe Motor Vehicle Co., St. Louis, Mo.—Capital, $15,000. Incorporators, Valentine Heinrich, L. L. Milks, J. J. Hanley, J. D. Maxwell and J. W. Wellington. To carry on a public garage business.

Mecklenburg Auto Repair Co., Charlotte, N. C.—Capital, $5,000. Incorporators, L. E. Davis, G. W. Wells and E. T. James. To manufacture and repair automobiles.

Lexington Motor Car Co., Lexington, Ky.—Capital, $50,000. Incorporators, B. Stone, John Osborne, J. P. Jackson, L. H. McGraw, V. A. Bradley, Charles O'Neill, Victor Dodge, J. C. Moore, D. D. Wilson and F. O. Young.

Read Garage and Machine Co., Belfast, Me.—Capital, $10,000. The officers are: President, Clarence E. Read; treasurer, Horace Chenery; clerk, Ralph I. Morse. To manufacture, buy, sell, repair, let and operate automobiles and machinery of all kinds.

New Agencies.

Phelps, N. Y.—C. A. Lane, Moline.
Tama, Ia.—Alfred F. Meves, Moline.
Marongo, Ia.—J. A. Wicke, Moline.
Anthon, Ia.—H. A. Wetmore, Moline.
Vinton, Ia.—Vinton Auto Co., Moline.
Savannah, Ga.—W. M. Kidwell, Jewel.
Kalona, Ia.—Louck & Boehme, Moline.
Van Horne, Ia.—J. A. Wicke, Moline.
Muscatine, Ia.—H. H. Hawker, Moline.
Cherokee, Ia.—Lamont Brothers, Moline.
Fairfield, Ia.—Campbell & Earl, Moline.
Ashton, Ill.—William Killmer, Kissel car.
Freeport, Ill.—William Ott, Great Western.
Bloomington, Ill.—Jacob Razor, Kissel car.
Waterloo, Ia.—A. Burhyte, Great Western.
New Haven, Conn.—Holcomb Co., Franklin.
Lawrence, Mass.—Knuepfer & Dimmock, Buick.
Marysville, Mo.—Barmann & Walfeit, Jackson.
Flandreau, S. Dak.—Sommons & Francis, Moline.
Wahpeton, N. Dak.—W. S. Babcock, Moline.
Goltry, Okla.—J. H. Santee, Great Western.
Bloomsburg, Pa.—C. W. Funston, Franklin.
San Francisco, Cal.—Dan E. Whitman, Regal.
Newfane, N. Y.—W. H. Collins, Great Western.
West Liberty, Ia.—E. D. Smith & Son, Moline.
Kansas City, Mo.—Rhodes Implement Co., Jewel.
Kansas City, Mo.—B. L. Colaw, Great Western.
Rochester, N. Y.—Mary E. Carlton, Great Western.
Cleveland, Ohio.—J. C. Hipp, Harrison road, Moline.
Calgary, Alberta, Can.—T. H. Graswick, Great Western.
Marshalltown, Ia.—Johnston Automobile Co., Kissel car.
Lancaster, Pa.—Lancaster Automobile Co., Franklin.
Allentown, Pa.—Lawfer Automobile Co., Chalmers-Detroit.
Jamestown, N. Dak.—Lenz Land and Loan Co., Franklin.
Alden, N. Y.—Bennett Manufacturing Co., Great Western.
Waterloo, Ia.—Cornbelt Automobile Co., Mitchell and Olds.
Milwaukee, Wis.—N. E. Wait, 271 Oregon street, Moline.
Geneva, N. Y.—Geneva Automobile Co., 145 Castle street, Franklin.
Waterloo, Ia.—Moore Automobile Co., 612-616 Jefferson street, Franklin.
Bridgeport, Conn.—Blue Ribbon Garage, 283 Fairfield avenue, Franklin.
Canton, Ohio.—Diabold Motor Car Co., Fifth and McKinley avenues, Franklin.
Rockford, Ill.—Standard Auto Co., Charles and Sixth streets, Kiblinger and Moline.
Washington, D. C.—Cook & Stoddard Co., Twenty-second and P streets, Franklin.
Belleville, Ill.—Belleville Implement and Motor Co., West Main and Mascoutah avenues, Ford.
Salt Lake City, Utah.—Consolidated Wagon & Machine Co., 138-150 South State street, Franklin.

Trade Personals.

Monte Cross, manager of the Kansas City Baseball Club, has connected himself with the Winton branch in Philadelphia.

H. Nelson Dunbar has resigned as manager of the Buffalo branch of the Buick Motor Company. He has well formulated plans for the future.

L. L. Dunlap, of Pontiac, Mich., has taken the factory management of the Oakland Motor Car Co. He entered upon his new duties on December 1.

Harry J. Clinton, formerly connected with the Association of Licensed Automobile Manufacturers, has associated himself with the Fiat agency in Philadelphia.

E. C. Rowe and J. M. Smith, of the Winton Motor Carriage Co., are making a round trip in a Winton 1909 Six, visiting the various agencies of the company on their way.

C. L. Whiting, of Rochester, N. Y., has been appointed district manager for the Buick Motor Co. at Buffalo. Mr. Whiting formerly represented the same company in Rochester.

C. A. Newman, formerly connected with the Atwood Automobile Company, of Toledo, and later with the Sid Black Automobile Co. of Cincinnati, has made arrangements to become manager for Guy E. Blackweider, Franklin dealer at Oklahoma City, Okla.

George Ostendorf, formerly connected with the H. H. Franklin Manufacturing Company, of Syracuse, N. Y., has assumed the position of secretary and general manager of the Brunn Automobile Co., Buffalo, N. Y., who are handling the Franklin line in that city.

Theodore B. Roach, for several years assistant manager of the Milwaukee branch of Thomas B. Jeffery & Co., of Kenosha, Wis., has opened a branch agency for the Rambler at Watertown, Wis., in central southern Wisconsin. He will have charge of a large territory.

GARAGE ITEMS

Novel Garage Features.

The new building of the Thomas Motor Car Company, under construction at No. 846 South Olive street, Los Angeles, Cal., will embody several original features, both in its sales and its garage departments. The garage proper, a room 68x80 feet, besides having electric lamps placed in reflectors, will receive additional light from below through large panes of translucent glass placed in the floor. Both day and night light is to be thrown through these panes, so that the machines may be examined from below without having to be lighted by extension lamps. An electrically operated turntable is being provided of sufficient size to accommodate the largest car.

The entrance to the new building will have a width of 20 feet, or sufficient room to allow three cars to pass each other abreast. The salesroom, with its tiled floor, will be of sufficient size for four machines, with plenty of space between them. Two waiting rooms, both enclosed in plate glass, will be provided, one for ladies and one for men. The machine and repair shop, supplied with machinery to build a machine from the ground up, is located back of the garage, and all the different departments are separated from each other by fireproof walls. The building, which, with land and equipment, is to cost $100,000, will be ready for occupancy in February.

Garage Notes.

Eben Brown, Athens, Pa., is building a new fireproof garage.

E. L. Palmer and D. B. Caughren will open a garage in Spokane, Wash.

Schwender Brothers, Mankato, Minn., are planning to remodel their garage.

John McDonald and his son Frank have opened a garage in Taylorville, Ill.

P. H. Cauley, Graceville, Minn., is erecting a garage. He has the agency for the Cadillac car.

The L. & H. Electrical and Machine Co., 319 South Eighth street, St. Joseph, Mo., will handle automobiles next year.

Harshberger & Jantze, who have been in the automobile business in Aurora, Neb., will open a garage in Seward, Neb.

A. P. Yale, Milwaukee, Wis., is building a large private garage at his home, 855 Shepard avenue. It will be the second all concrete garage in Milwaukee.

D. F. Poyer, of Menominee, Mich., is building a large brick garage and repair depot, to cost $15,000, on Main street, Menominee. He will occupy it about December 20.

Frank B. Wood, Elgin, Ill., has sold his interest in the local garage to E. A. Kelley and J. W. Ross. They took possession of the garage last week, and will move it to 116 Brook street, where it will be known as the Official Garage.

The Zell Motor Car Co., Baltimore, Md., are having plans prepared for a garage on the south side of Mt. Royal avenue, between St. Paul and Charles streets. The building will be three stories high, have a frontage of 50 feet, and a depth of 100 feet. It will be of fireproof construction throughout, and will cost about $50,000. The front will be of pressed brick ornamented with cut stone or terra cotta trimmings, and there will be large plate glass show windows on the first floor.

The D. Priebe Carriage Co., St. Joseph, Mo., will handle automobiles next season.

S. F. Myers, Hiawatha, Kan., is opening a garage, and will handle the Ford and Rambler.

The St. Joseph Auto and Supply Co., St. Joseph, Mo., have just completed a new garage, the finest in the city.

H. J. Nichols, Waverly, Ia., will erect a cement garage 22x85 feet, and will handle the Rambler. H. A. Brunes will have charge of the repair shop.

Charles Wentz, of Dayton, Ohio, has formed the Wentz-Miller Automobile Co., who will operate a garage in Hanna alley, between Fourth and Fifth streets.

Edwin J. Dayton has leased the Burdick garage, Kalamazoo, Mich., and will handle the Oldsmobile line. The garage is located in Water street, opposite the Arcade.

The Olympic Motor Car Co., Seattle, Wash., W. D. Wallace, manager, will erect a two story and basement brick and concrete garage, 60x128 feet, on Broadway just north of Pike street.

R. V. Ankeny, Seattle, Wash., is breaking ground for a garage on East Pike street, just above Broadway, which will be leased to the Brigham & Fenn Motor Car Co., Cadillac agents.

H. M. Covey, Portland, Ore., recently moved into his new garage in the Wemme Building at Seventh and Couch streets, of which he occupies two floors, 100x100 feet. Mr. Covey handles the Cadillac and Pierce lines.

The Beloit Automobile Garage Co. has been organized at Beloit, Kan., and will locate in the Cochran Building on West Main street. The company expects to do a livery business besides the regular garage business.

The Hearsey-Willis Co., of Indianapolis, has decided to close out its carriage department and to confine itself in future to handling automobiles and bicycles. The company's storerooms are at present being overhauled.

John Kopmeier, Jr., and his brother, Waldemar S. Kopmeier, of Milwaukee, have secured the local agencies for the "American" gasoline and the "Detroit" electric cars, and plan to erect a large garage on the east side of Milwaukee.

F. A. Wing, Seattle, Wash., has accepted plans for a one story and basement brick and concrete garage at the northeast corner of Tenth avenue and East Pike street, in which the agencies for the Pierce Arrow and Woods Electric will be housed.

Harry F. Postal and Floyd Dougherty have formed a partnership to conduct an automobile agency in Detroit. They plan to erect a garage at the corner of Woodward avenue and Brady street, and will handle the White steamer, and probably also Reo and Oakland cars.

The garage of E. M. Childs, 68 South Ohio avenue, Columbus, Ohio, was set on fire on December 3 by the owner cleaning an automobile with gasoline by the light of a torch. The automobile was completely destroyed, and about $50 damage was done to the garage.

A new rock faced concrete garage, 36x80, is to be constructed on Broadway, Albert Lea, Minn., immediately south of the Times Enterprise Building. A company is being organized among local men, who are endeavoring to obtain the agencies for several lines of low priced cars, including the Ford and Cadillac.

Plymouth Commercial Motor Company Fails.

A petition in bankruptcy was brought against the Commercial Motor Company, of Plymouth, Ohio, by the J. D. Fate Company last week. The Fate Company is a creditor for $5,500. It was claimed that the company was unable to meet its obligations and the appointment of a receiver was asked for. Judge Mansfield appointed A. M. Trago, the Plymouth banker, receiver, and he gave bond in the sum of $10,000.

MOTOR VEHICLE PATENTS

Patents Issued December 8, 1908.

905,832. Vehicle Wheel.—Joshua B. Barnes Fort Wayne, Ind. Filed February 5, 1908.

905,866. Wheel for Vehicles.—Thomas J. Furphy, Jr., Philadelphia, Pa. Filed September 23, 1907.

905,870. Exhaust Device for Compression Engines.—Emil F. Hafelfinger, Weehawken, N. J. Filed August 29, 1906.

905,877. Tire Surface or Covering.—Peter C. Hewitt, New York, N. Y. Filed August 26, 1905.

905,884. Vehicle Wheel.—William Q. Kennedy New York, N. Y. Filed June 14, 1907.

905,911. Internal Combustion Engine.—Harry M. Neer, Columbus, Ohio. Filed February 15 1908.

905,918. Front Wheel Drive for Traction Engines.—John A. Peters, Plum Coulee, Manitoba, Canada. Filed October 21, 1907.

905,980. Friction Drive for Motor Vehicles.—Vincent Bendix, Chicago, Ill. Filed August 7, 1906.

905,981. Vehicle Spring.—Wesley W. Blair, Newtonville, Mass. Filed November 18, 1907.

905,994. Friction Coupling.—Paul Daimler, Untertürkheim, near Stuttgart, Germany. Filed May 11, 1908.

906,016. Differential Clutch Mechanism for Automobiles.—Frederick W. Hedgeland, Chicago Ill. Filed May 18, 1907.

906,017. Differential Clutch Mechanism for Automobiles.—Frederick W. Hedgeland, Canton, Ohio. Filed April 13, 1908.

906,022. Fuel Pump for Reversible Internal Combustion Engines.—Knut J. E. Hesselman Stockholm, Sweden. Filed May 18, 1908.

906,026. Distributing Arm for High Tension Magnetos.—Theodore Hubert, New York, N. Y. Filed October 17, 1907.

906,039. Automatic Double Air Inlet for Carburetors.—Julien Le Plain, Andoversford, England. Filed March 24, 1908.

906,054. Anti-skidding Tread for Motor Vehicle Wheels.—William A. F. McCallum, Germantown, Pa. Filed July 13, 1907.

906,078. Starting Device for Automobile Engines.—Samuel E. Spencer, Springville, N. Y. Filed March 1, 1907.

906,118. Power Transmission Mechanism.—William R. Donaldson and George W. Marble, Chicago, Ill. Filed September 24, 1906.

906,136. Engine.—Roscoe C. Hoffman, Argos Ind. Filed May 6, 1907.

906,158. Valve for Pneumatic Tires.—Harry K. Raymond, Akron, Ohio. Filed March 1, 1906.

906,159. Valve for Pneumatic Tires.—Harry K. Raymond, Akron, Ohio. Filed March 1, 1906.

906,167. Vehicle Wheel Rim.—Edwin C. Shaw Akron, Ohio. Filed February 20, 1907.

906,241. Shock Absorber for Vehicles.—Edmond E. Lantz, Paris, France. Filed October 11 1907.

906,281. Vehicle.—William G. Polsgrove, Roswell, N. Mex. Filed January 23, 1908.

906,290. Spark Adjusting Starting Means for Automobiles.—Andrew L. Riker, Short Hills N. J. Filed November 4, 1902.

906,304. Guard for Tires.—Charles R. Saunders and Anton B. Breitweg, Cleveland, Ohio Filed February 21, 1907.

906,332. Automobile Horn.—Ira E. Stump, Cleveland, Ohio. Filed June 17, 1907.

906,417. Motor Cycle Frame.—Azy H. Harman, Philadelphia, Pa. Filed February 1, 1908.

906,437. Tire Protector.—Harry M. Leese, Washington, D. C. Filed February 20, 1908.

906,481. Running Gear for Automobiles.—Martin L. Williams, South Bend, Ind. Filed December 26, 1905.

906,487. Pneumatic Tire for Wheels.—Charles S. Challiner and Joseph A. Challiner, Manchester, England. Filed April 2, 1907.

The Horseless Age

First Automobile Journal in the English Language

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Testing and Correcting Alcohol Cooling Solutions.

By Albert L. Clough.

While definite instructions have been given in these columns as to the proportions of alcohol and water required to be used in making up a safe anti-freeze solution, a few instructions as to the method of maintaining the quality of these solutions may not come amiss.

Alcohol boils at about 140° Fahr. and water at 212° Fahr., and, as the average temperature of the circulating water in a modern automobile is somewhere from 160° Fahr. to 180° Fahr., the alcohol is being distilled off from the cooling solution most of the time when the car is in use, while there is practically no loss of water, under ordinary conditions, except as it is carried off mechanically with the alcohol.

The actual proportion of alcohol in the cooling solution is constantly diminishing, if the car is used for any but the very shortest runs, and quite frequent tests are essential to determine whether the proportion has fallen near the danger mark. For these tests an alcoholometer is almost a necessity. The alcoholometer is simply a hydrometer, in principle exactly like a gasoline tester, but calibrated in a special manner. These instruments are obtainable from wholesale druggists or from the manufacturers of chemical glassware, and cost from 40 cents each upward. As these instruments have quite a long scale, in order to afford graduations of ample width, they are usually 16 or 18 inches in length and must be used in a high vessel of small cross section. A "plain cylinder," 18 inches in height and a few inches in diameter, is suitable for this purpose, and lists at about 65 or 75 cents.

These alcoholometers are usually graduated so as to read directly in percentage of alcohol in the solution in which they are immersed. The stem of such an instrument is usually graduated from 0 to 100, and, when the instrument is placed in pure water at the standard temperature stated upon the stem, it sinks only to zero, there being, of course, a zero per cent. of alcohol present. If the instrument could be floated in absolute grain alcohol, it would sink nearly to the top of its stem to the point marked 100, there being 100 per cent. of alcohol present. The intermediate points to which it sinks give the percentages of alcohol present in the mixtures used. This form of scale is the Gay Lussac, and the Tralles scale is the same. Some instruments are graduated in accordance with the "proof" scale, but this is usually combined with the Tralles scale so that it need not be considered. It may be remarked, however, that full proof alcohol contains practically 50 per cent. of absolute alcohol, so that if a cooling solution tests full proof or 100 per cent. proof it is safe to use in any climate. One which tests 50 per cent. proof contains about 25 per cent. of alcohol, and so on. In the lower portion of the scale of the ordinary commercial alcoholometer the graduations are much closer together than in the upper range, and this is unfortunate, as the motorist uses the lower portion of the scale below 50 per cent. and never the upper portion about 50 per cent. However, an extreme degree of precision is not required in this matter and the motorist who makes his solution somewhat richer in alcohol than the climatic conditions require will provide against any danger arising from inaccurate readings.

Alcoholometers are primarily made for use in testing mixtures of pure grain alcohol and water, but their indications are sensibly correct when used in the ordinary automobile mixtures of denatured alcohol and water. The wood alcohol and petroleum products used in denaturing are in such relatively small proportions and their specific gravities are so nearly that of grain alcohol that their presence does not materially affect the readings.

TEMPERATURE CORRECTIONS.

The temperature of the sample affects the reading. The sample may be cooled or warmed to about the temperature at which the alcoholometer is stated to be correct. Most of the better grade of instruments have a thermometer mounted in the glass containing tube, but in the cheaper instruments an ordinary thermometer may be used. An instrument which is fitted with its own thermometer is generally accompanied by a table of corrections for temperatures above or below the point at which it is correct, and by following this it is no longer necessary to bring the sample tested to any special temperature, but the temperature is read on the thermometer and the reading is corrected by a very simple arithmetical calculation.

Suppose the cooling system of a machine is filled with a solution of 40 per cent. alcohol, as determined by the addition of about 2⅔ quarts of denatured alcohol to 1 gallon of water, and the percentage checks up properly when the alcoholometer is applied to it. After a certain period of use of the car it becomes advisable to ascertain whether sufficient alcohol has distilled off dangerously to raise the freezing point. The actual danger point depends so much on local climatic conditions and the season of the year that it cannot be broadly stated, but it may be assumed that the solution is not to be allowed to fall below a 25 per cent. content of alcohol.

The circulating water, if the car has stood for some time in a garage, and the motor has not been run in the meantime, will be at somewhere near the temperature at which the alcoholometer is correct, and the glass cylinder which accompanies the instrument should be filled with cooling solution from the radiator pet cock or other convenient outlet. If no thermometer is combined with the insrtument one should be placed in the glass vessel and, if no correction table is furnished, the solution should be brought to about the right temperature, if required, by setting the glass cylinder in a pail of warm or cold water and stirring its contents with the thermometer until the required result is obtained. If a correction table is provided this will not be necessary, and if there is a combined thermometer and a correction table the reading of the thermometer and the use of the table will make a correct reading easy.

USE OF ALCOHOLOMETER.

The alcoholometer should be placed in the sample and the stem figure to which the instrument sinks when freely floated should be noted. If the sample is at the temperature for which the instrument is adjusted this figure is the percentage of alcohol in the solution, and if the temperature of the sample is not that required by the instrument the correct reading is readily obtained by the correction table, the thermometer and the stem reading giving the necessary data. In fact, unless very close results are desired the temperature of the sample may vary several degrees from that marked upon the stem of the instrument without seriously vitiating the results.

It is assumed that the test of the percentage of the solution is made with the radiator entirely full, as this is the condition in which well kept machines are usually found. In cooling solutions containing the following percentages of alcohol the following amounts of alcohol (expressed in pints for convenience) are present in each gallon:

Per Cent.	Pints of Alcohol Per Gallon.	
20	1.6 or slightly over	1½
25	2.0	—
30	2.4 or very nearly	2⅜
35	2.8 or slightly over	2¾
40	3.2 or very nearly	3¼
45	3.6 or slightly over	3½
50	4.0	—

Suppose that in a machine which was

originally supplied with a 40 per cent. solution, the cooling system of which contains 5 gallons of solution, the percentage has fallen, as indicated by the alcoholometer, to 25 per cent.

By reference to the above table it is seen that each gallon of the solution originally contained 3.2 pints of alcohol, while it now contains but 2.0 pints per gallon. The loss is thus 3.2 — 2.0 = 1.2 pints of alcohol per gallon, and a loss of 5 × 1.2 = 6 pints from the whole solution.

As six pints of solution must be withdrawn from the system to permit of the introduction of six pints of alcohol, there is a loss in alcohol of 25 per cent. of six pints of solution, or 1.5 pints. Seven and a half pints of alcohol are thus to be added, after drawing off the same amount, as a fair approximation to correctness. That the result is quite close may be seen from the following calculation: After drawing off the necesary amount of solution to give room for the alcohol to be added, there remain just about 4 gallons of solution, containing 2 pints of alcohol each, or a total of 8 pints, and with the addition of 7½ pints of alcohol the amount becomes 15½ pints, which gives just about a 39 per cent. solution. An absolutely correct result can, of course, be attained by more figuring, but it is really not worth while.

The final test of the correctness of the result should be by means of the alcoholometer, applied to a sample of the corrected solution. This sample should not be taken until the solution has been thoroughly mixed by cranking the engine over a number of times at short intervals. If the sample does not test quite as high as it should a little more alcohol may be added.

Duty on Reimported Car.

The customs authorities of the port of New York decided on December 17 that Peter F. Collier, of New York city, must pay duty on the full value of an automobile which he had taken abroad for touring purposes last summer. The chauffeur, who made the customs declaration, stated that $600 had been spent for repairs abroad, made necessary by a collision with a stone wall while Mr. Collier was on a trip to Andrew Carnegie's castle in Scotland. After filing a protest Mr. Collier wrote to President Roosevelt that American tourists were being discriminated against. The Treasury Department rule is that where more than 10 per cent. of the cost of the car is spent in repairs abroad full duty must be paid on the car when brought to this country. The statement was reported to the collector, who decided that the duty must be paid, as the repairs had exceeded 10 per cent. of the appraised value of the car, which was $5,000. Mr. Collier, however, said that he had paid $14,000 originally for the car—$5,000 in cash and another automobile in trade for the balance. The President has turned Mr. Collier's letter over to Secretary Cortelyou and his protest will be considered.

Clutches.

By J. S. V. Bickford.

I believe that quite a few designers in the past overlooked the fact that the clutch has a double function to perform. It has to act as a clutch pure and simple, to start the car from rest, and, secondly, it has to act as a change speed device, and these two functions, though allied, are different.

For starting from rest there is only one thing to consider, or at most there are only two. When the clutch is withdrawn, the male portion must stop moving in a reasonably short space of time, and after the gears are engaged and the clutch is "let in," the drive must be taken up as smoothly as possible. The ideal clutch is the one which will start the car from rest on any speed on which it will drive. That is to say, on the level it will start the car on top speed without jerk or jar, and if the maximum hill which the car will climb on second speed is, say, 5 per cent., then the car must be capable of starting from rest on a hill of 5 per cent. on second speed. Further, with the ideal clutch, if the car is stopped when descending a hill in the ahead direction, and the reverse is engaged, and the car then allowed to run down the hill by gravity, the pedal of the ideal clutch may be instantly released, when there will be neither jar nor shock, but the car will steadily come to rest, and then gradually gather way backward up the hill. This is the ideal clutch, and some people will doubtless be inclined to say that it is ideal, indeed, and to doubt the possibility of producing such a clutch. It is, however, by no means impossible. I have myself built a clutch which will do all this, with the one exception that I have never tried suddenly releasing the clutch with the gear in reverse. I have, however, stopped the car on the top speed gear, jammed in my side brake, and unwittingly taken my foot off the clutch pedal to leave the car. There was not the slightest shock, the engine began to slow down, and I had ample time to take out the clutch again before it was anywhere near stopping.

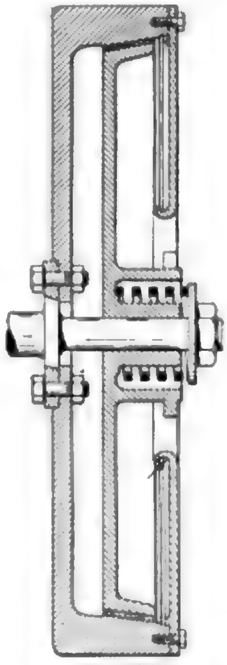

THE HORSELESS AGE

Fig. 1.

This clutch was a leather faced clutch running in oil. The dimensions were as follows: Angle of cone, 15 degrees; largest diameter, about 16½ inches; smallest diameter, about 15 inches; 3 inch face of female cone (the above dimensions are all of the female); face of male cone, 2 inches, covered with ordinary store leather. A plate was secured to the face of the flywheel with a hole in it to retain oil, and oil was introduced, ordinary gas engine oil being used. The first thing noticed was that the male clutch would not stop when withdrawn, and holding a broom handle against its face would not stop it. On letting out some of the oil, however, this was overcome, and the male cone stopped easily. With this clutch all the above points were secured. In a word this clutch was absolutely ideal in its action as a starting mechanism, and I have stopped my car with it descending a hill of 12½ per cent., engaged the reverse, allowed the car to attain 10 miles per hour by gravity, and then quite gently stopped it by the clutch alone, and ran it backward up the hill. This is about as severe a test as can be had for a clutch.

An illustration of a section of the clutch is given in Fig. 1. It will be pertinent to ask here why this clutch was not adhered to. The reason was that it was far too heavy, and was consequently the worst change speed mechanism it has been my ill fortune to handle.

We will now consider this function of the clutch. Suppose that the car is running on top (or fourth) speed up a hill and it is necessary to change to the third speed. For the sake of clearness we will assume that the car has no direct drive, the power being transmitted across the gear box from primary to secondary shafts at all speeds. I call the shaft in the gear box coupled to the clutch and engine the primary, and that coupled through the Cardan shaft to the back axle the secondary, because it gets its motion from the first, and is, therefore, in a measure, second to it. Further, consider the two gears making up the third speed. The one on the primary shaft we will call the P gear, the other on the secondary we call the S gear. Now the fourth gear being engaged, it follows that the peripheral velocity of the P gear of the third speed is less than the peripheral velocity of the corresponding S gear, because if the car speed remain unchanged the engine speed will be higher in third speed than in fourth.

From this it also follows that if we wish to effect a silent and smooth change of gear from fourth to third the primary shaft must be increased in speed after the fourth gear is disengaged and before the third gear is engaged, because a silent change is only effected when the peripheral velocities of the engaging gears are the same, and since the P gear is running more slowly than the S gear it must be speeded up before the gears are engaged. It is, however, never possible to get these speeds exactly the same, and an approximation is all that is possible. When the gears are in mesh their peripheral velocities are obviously identical. The difference has to be made good by the friction of gear against gear on engaging. Now, if we assume, for the sake of argument, that the P wheel is going 1 foot a second too slow, the friction of gear against gear on engaging the second gear will have to accelerate the primary gear by 1 foot per second before the gears can engage. But to the primary shaft is rigidly attached (as far as rotation is concerned) the male portion of the clutch, so that this has also to be accelerated. It will then be obvious that the heavier the clutch the more work has the friction of gear teeth to do in correcting any discrepancy in velocity at changing. In this fact lies the secret of some of the designs which make for easy changing. The lighter the clutch is the easier it is to change speed. So much is this true that in some of the cars fitted with plate clutches it is nearly impossible to make a noise. It is even possible to engage the reverse by accident when traveling 20 miles per hour ahead, and that without a sound. (Of course this is not an advantage; I simply cite it to show that such clutches lend themselves to easy changing, for in running into reverse when the car is going ahead the friction of gear teeth has to do the maximum amount of work, for it has to entirely destroy the velocity ahead and change it into velocity astern.)

Another point should be noted. The momentum is the thing that counts, and this depends not only on weight but on velocity. Speaking from memory, it depends on the square of the velocity. Now suppose, as will be nearly the case, that the weight in a leather faced clutch rim varies as the diameter, the lineal velocity will vary also as the diameter, so that if we double the diameter of the clutch we double the weight of its rim and double the velocity, and the momentum which was originally, let us say, mv^2, now becomes $2m(2v)^2$, or $8mv^2$, so that the momentum varies as the cube of the velocity. In actual fact this is not even enough, for we have not taken into account the weight of the arms, so that the increase in momentum will vary somewhere between the third and fourth powers of the diameter of the clutch. It is now obvious why a small clutch is of such enormous advantage in changing speed. Probably Herr Mybach was the first to realize these facts, and this led him to design the 1904 Mercedes clutch, which consisted of a barrel only, about 4 inches in diameter, driven by a spiral spring coiled round it. This was probably the lightest and smallest clutch ever designed, and as a change speed mechanism was the best I have ever seen or heard of, but it left something, in fact a good deal, to be desired as a starting mechanism.

Now, while we are on change speed gears, there is another factor which makes for easy changing, and that is the actual size of the gears themselves. Suppose we have a clutch which at 1,000 revolutions stores up 10,000 foot pounds of energy, and this has to be altered to 9,000 foot pounds by gear friction. It is obvious that it will be much easier to do this on the teeth of a gear 12 inches in diameter than on those of 3 inches in diameter. It follows, therefore, that for easy changing of gears the gear wheels on the primary shaft should be as large as possible. In the case of a car with direct drive small gears can be used on the secondary shaft, and the consequent increase of secondary shaft velocity may be again reduced with the constant mesh gears. In actual practice the primary shaft may be either of the shafts in the gear box if the constant mesh gears are in the front nearest the engine), and the lay shaft will be the primary; if the constant mesh gears are at the back of the gear box (nearest the back axle), then the shaft in line with the crank shaft is the "primary" shaft.

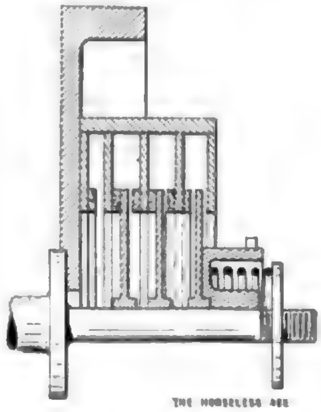


FIG. 2.

Here then we can sum up the conditions which make for a good clutch for both its functions:

(1) The surfaces must be of such a nature as to take up the drive gently, and for this purpose nothing can exceed the sweetness of leather running in oil, which, when properly proportioned, never slips or grips.

(2) The clutch must be as light as possible, but it is far more important that it should be small in diameter, as the momentum will vary only directly as the weight, and may vary by as much as the fourth power of the diameter.

(3) For easy changing the gears on the primary shaft of the gear box should be as large as possible.

It would be interesting to try a combination of the plate clutch with the leather faced clutch running in oil. The spring of the clutch described above was "weighed" by putting a weigh bridge on the platen of a drilling machine, and screwing down the spring between the nose of the drill holder and the weigh bridge platform, and measuring the weight for each inch of compression. The results showed the maximum tension to be about 500 pounds. In use the spring was screwed up to about 300 pounds. Now the angle of the clutch being about one in four, the thrust of the spring is multiplied by four, which brings up the load on the leather to 1,200 pounds. The average diameter was 15¾ inches. The engine was one which developed 25 horse power at 1,000 revolutions per minute. That is to say, at 1,000 revolutions per minute the clutch, which was traveling at a mean velocity of 4,000 feet per minute, would transmit 25 horse power, which means that it transmitted a pull of 200 pounds, which gives a frictional coefficient of .17. This figure was checked by a very crude little experiment I tried, by pulling a piece of leather belting loaded with a weight along a well oiled lathe bed, which showed a coefficient of .20. It should be noted that the load per square inch of the leather was comparatively light (about 12 pounds), and this is essential. Once let the oil get squeezed out of the leather, and it will slip forever. I do not think that it would be expedient to use a load per square inch much in excess of this figure, or at any rate 20 pounds per square inch, which was the maximum obtainable in my arrangement.

Now apply this to a plate clutch. Assume that we used plates of 5 inch outside diameter, and leather rubbing rings attached to the male cone plates of 1 inch in width, as per Fig. 2. The average diameter of the clutch rings would then be 4 inches. Neglecting fractions, at 1,000 revolutions per minute these would travel at 1,000 feet per minute. The maximum pressure allowed is 20 pounds per square inch, according to our assumption, and each ring on one face will have 12 square inches surface, so that the load may be 240 pounds. One-sixth of this, or 40 pounds, will be the tangential pull on the plate. This pull at 1,000 feet per minute means roughly 1⅓ horse power, so that we shall be able to transmit, say, 1¼ horse power per plate face used. I say plate face advisedly, for it is obvious that the middle plates of the series have two faces, each of which will come into action for pulling purposes. This means, for a 25 horse power engine twenty faces or eleven plates.

I can most strongly recommend this design to manufacturers. It has another advantage. The leather pads, being of some width, will allow each plate to have a good bearing on its shaft, which will make for long life. One of the troubles of plate clutches is that they cripple at the inner keys, and this limits the smallness of the diameter. The inner shaft has to be made larger than necessary for transmitting the power, to reduce the thrust on the keyway. The clutch I am sketching would not suffer from this fault, as it might have a half inch bearing on the key and be hardened.

Automobiles in Nevada and Utah.

By F. G. Eastman.

Nowhere in the world is time a more vital consideration in the activities of everyday life than on Nevada's vast stretches of desert and interminable succession of forbidding hills. A mining operator takes his seat in a swift motor car and accepts as a pleasant outing a trip through the wilds when other available modes of travel would impose insurmountable hardships. Thus it is that Nevada buys more automobiles in proportion to its population than any other State in America. The motor is the pathfinder of the Great American Desert. Mining camps that have produced millions in precious metals owe their place on the map to gasoline cars.

Nevada's marvelous development of the past five years is due to the automobile, which blazed the trail through the great central string of mining camps now connected by rail. The auto, by bringing in capital and demonstrating the possibilities of that region, has converted the doubtful railroad project into a reality.

The Engine Is Drowned Out in Spanish Fork Canyon.

Navigating the Water Road Between Springville and Thistle.

H. H. Clark, known to thousands in the mining country as Bullfrog Clark, is the pioneer automobilist of Nevada. Five years ago he set up his first car in Austin, an outpost of civilization at the end of a railroad branch. A novice in the handling of automobiles, he undertook the unprecedented journey across country to Tonopah, involving 110 miles of the most hazardous travel. He negotiated the trip without serious mishap, and the exploit gave him confidence for his subsequent exploits.

Tonopah is the one big camp of the present day that came into prominence before the era of the automobile in the mining business. The car came into prominence along with Goldfield. Soon after the earliest discoveries in the new Eldorado an automobile line was established connecting the new camp with Tonopah. This precipitated the Goldfield boom. Capitalists dashed in and out, and money and men were poured into the great gold camp.

Bullfrog was a drive of 75 miles from Goldfield. In 1905 H. H. Clark made the first trip by automobile to Bullfrog, at a time when no one else in camp could be induced to undertake the journey. The Bullfrog district then consisted of a few tents and some mining claims that might have been termed good prospects. Clark had already put in a telephone line. Upon the completion of his first trip by automobile he 'phoned back to Goldfield that he had made the journey to Bullfrog in four hours and twenty minutes. The next day three cars carrying capitalists came down from Goldfield. These men made Bullfrog, which includes among its successful enterprises Charles M. Schwab's Montgomery Shoshone. Within sixty days of their arrival regular automobile service was established between Goldfield and Bullfrog.

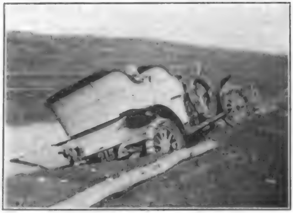
Persons in Nevada who travel by stage when an automobile is available are surprisingly few. Money appears to be little or no object when time can be saved. Here is an illustration. The stage fare from Tonopah to Goldfield was $2.50 and the automobile charge was $6. The stage often made the trip with two or three passengers when the gasoline cars were crowded. Three years ago H. H. Clark paid $650 for the use of an automobile to carry his party from Tonopah to Greenwater and back again. His own machine was out of service, and he had to make the trip without delay. Consequently he hired the automobile for a two days' trip at a figure that would buy a small runabout in the Eastern market.

Dr. L. E. Benson, an associate of Mr. Clark, performed the greatest and most hazardous feat recorded in the annals of automobiling in Nevada. This was in 1904. Starting out from Tonopah he traveled 150 miles southeast into a trackless wilderness of sand and rock. The gear broke on the way out, but a prospector's camp in the neighborhood happened to be equipped with a crude forge. Dr. Benson and his companion repaired the break and continued their journey. At some points they were compelled to hack their way through the tall sagebrush, yet they never faltered until their objective point was reached in the heart of the Troba Range. The return was made in two weeks without any ore specimens worth mentioning, but with a rich fund of experience.

On such a trip as this there are times when a breakdown means death, yet the annals are singularly free from accidents of this character. Nowhere does the automobile get a more severe test than in the wilds of Nevada. One manufacturer (Thomas) makes a special car designed for use in that rough and perilous country. It has the double chain drive, great power and high clearance. The last named feature is made necessary by the deep ruts in the roads.

Experienced automobilists carry extra parts to guard against the most likely contingencies, while most of them are equipped with a good working knowledge of mechanics. Repair shops have sprung up along the automobile routes, and there are numerous places in Nevada where there are many gallons of gasoline and not a drop of water. On many of the long journeys, however, it is necessary to carry sufficient gasoline for the round trip. In such instances it is customary to caché the gasoline at convenient places along the route. On the toll road from Tonopah to Bullfrog there are gasoline stations where the automobilist helps himself, paying at the end of the journey.

Radiating from the central mining camps



Stalled on a Railroad Grade Near Lake.

Another View of the Same Predicament.

of Nevada now connected by rail there are many automobile lines to the rich and promising new camps. When Fairview and Wonder were opened up nine-tenths of the prospectors, operators and miners went in by automobile. When the Rawhide excitement was at its height the cars lined the road from Schurz to the new camp in an almost continuous procession. Manhattan, Reveille, Silver Peak, Schwab, Round Mountain and Seven Troughs owe their development to the automobile, which compresses within two and one-half hours a 50 mile journey that would require a day and a half by team. Mining operators are unanimous in declaring that the development of Nevada is years ahead of what it would have been at this time without the transportation facilities afforded by the automobile.

The gasoline motor of the strong and durable type seems peculiarly adapted to travel through canyons and gorges, over endless hills and across long stretches of barren desert. Where the burro falters and the blooded horse drops from exhaustion the tireless automobile speeds on its way, lending a touch of exhilarating enjoyment and picturesque color in addition to its efficiency as a mode of travel. Up to the present time its use in Nevada has been largely in the line of carrying passengers and personal equipment, but its utilization for carrying ore and supplies is only a question of time and the development of the right type of car.

In Utah the use of the automobile for commercial purposes is now in its infancy. This is not due to lack of enterprise on the part of manufacturer or dealer, but mainly to the condition of the country roads.

At the next session of the Legislature, which convenes January 1, 1909, a bill will be introduced, backed by the administration, providing for a bond issue of $5,000,000, the proceeds to be devoted to improving the roads. A great highway, extending from St. George, in southern Utah, through the heart of the State and Salt Lake City to the Idaho line, is the purpose of the movement. Idaho is expected to continue the work and provide an extension of the road up through the wonderful new district of irrigated farms.

The initiative was taken by the Salt Lake Automobile Club, which numbers among its members many of the most substantial men of the town. The value of the proposed highway from a commercial standpoint is simply beyond comprehension. A State of vast area, whose railroad facilities are extremely limited, is dependent upon its roads for the channels of trade. The beet sugar industry, the dairy and creamery business, ranching and fruit raising are now in a state of retarded development owing to the lack of rapid transportation between the cities and the large stretches of settled territory.

The use of the commercial motor vehicle and the improvement of the roads will go hand in hand. Tests already made have demonstrated the immense possibilities of the automobile in filling the place of branch railroads and electric lines which await a large population.

And in this connection it is well to remember that Utah is now entering an era of remarkable growth. Two railroad stations costing several million dollars each now in course of construction at Salt Lake City, attest the confidence of Gould, Harriman and Clark in the future of the city as a railroad centre. The Harriman interests are investing $7,000,000 in improving the local street railway system.

Moving Boulders Out of a Mountain Road.

Climbing Soldier Summit, So Steep That the Gasoline Would Not Run Into the Carburetor.

APPARENTLY HOPELESSLY MIRED BETWEEN COLTON AND TUCKER.

A METHOD OF LOCOMOTION SOON TO BE SUPERSEDED IN UTAH BY THE COMMERCIAL MOTOR VEHICLE.

Conditions attending the harvesting of sugar beets this season have furnished a powerful argument for improved highways and better transportation facilities. After getting nicely started several factories were compelled to close down as a result of the inability of the farmers to move the beets fast enough to supply the plants. The season is short, and it is of vital importance to the companies to have the beets moved rapidly and without any delay. There are seven beet sugar factories in Utah and Idaho drawing from a large area for their raw material. This industry alone offers a most promising and profitable field for the commercial motor vehicle.

Specialty manufacturing is beginning to take hold in the principal centres of the State, and here again the motor vehicle is the one factor needed to couple up the law of supply and demand. Canning factories and makers of prepared food products are only awaiting better means of transporting raw materials to expand their business, while other manufacturers seek a distributing agency to extend their home market for finished products. Traveling salesmen find the greatest difficulty in visiting the remote districts, and many of them have urged the establishment of automobile routes.

At the present time Utah supplies only about one-half the dairy products consumed within her borders. This is due to the limited communication between farm and creamery. A large company was formed here recently to develop the creamery business of the State, and already one commercial motor vehicle has been purchased for the purpose of transporting the butter fat. The results attained indicate a growing demand for the horseless vehicle in the creamery business. An electric truck with a special body designed to carry milk cans appears to be the most practicable type for this work.

There are numerous mining operators and smelter officials making their headquarters in Salt Lake City, Ogden and Provo who are compelled to make periodical visits to mines, mills and smelters that are not conveniently reached by rail. D. C. Jackling, general manager of the Utah Copper Company, sent to Europe for a $13,000 car to furnish him rapid transit to the company's mill at Garfield and the mines in Bingham canyon. A local syndicate operating in the Oquirrh range near the shores of Utah Lake has a 7 mile haul from Lehi, the nearest point on the Rio Grande Railroad. This company is one of the pioneers in the matter of using electric trucks as ore carriers. There are four trucks in operation between the mine and the railroad, each making three trips a day. The machines are charged at night and an automatic device shuts off the current when the batteries are fully charged.

The development of electric power from mountain streams has resulted in a comprehensive power system extending all over the State. This system furnishes cheap electric power and should prove an important factor in encouraging the use of electric trucks for commercial purposes. Electric machines are preferred in the more elevated districts, as the altitude has an important bearing on the working of a gasoline motor, and the difficulty is accentuated by the impossibility of obtaining gasoline of a uniformly high grade.

Under present road conditions in Utah interurban trips are difficult and a campaign of education is necessary before automobiles come into general use. Washed out roads, uncovered irrigation ditches, sluice boxes that project several inches above the level of the highway are among the more common obstacles. These difficulties, coupled with steep grades, call for great care and ingenuity to be successfully overcome. The accompanying pictures tell a graphic story of some of the difficulties encountered by Keith Clark in an automobile trip from Salt Lake over the Wasatch divide to Price, Utah.

The mere fact that under the most adverse circumstances a start has been made shows conclusively the demand for the motor vehicle and gives an idea of the field to be opened up in the era of good roads about to ensue. The tendency is toward the stronger and better type of cars, as even the most favorable conditions in the mountain country test the power and durability of the automobile. George H. Lloyd, manager of Studebaker Brothers' automobile department in Salt Lake City, is among those who have made a study of the situation, and who predict a widespread use of commercial motor vehicles in Utah within a few short years.

Details of Automobile Engineers' Meetings.

The annual meeting of the Society of Automobile Engineers will be held in New York during the shows, and it has been decided to hold sessions on dates a fortnight apart. On Tuesday, January 5, members will convene at the A. C. A., Fifty-fourth street between Broadway and Eighth avenue, at 10 a. m. During the forenoon tests of the club dynamometer will be made on different cars. The afternoon will be devoted to a technical session, the subjects to be discussed being the "Economics of Weight Reduction," by F. D. Howe; the "Factor of Reliability in Ignition Apparatus," by A. Atwater Kent; "Requirements of Automobile Brake Construction," by Lawrence Whitcomb and Thomas J. Fay. Immediately following the reading and discussion of these papers the meeting will adjourn for the annual dinner given by the society. This will be held at the Automobile Club. After the dinner the meeting will adjourn to Tuesday, January 19, again convening at the Automobile Club at 10 a. m. Following the demonstration of the club dynamometer, the members will adjourn to the Engineering Societies' Building, 29 West Thirty-ninth street, for the afternoon session, the subjects for discussion being "An Improved Type of Compression Coupling," by W. S. Noyes; "Standardizing Automobile Motor Bearings," by S. P. Wetherill, Jr., and "Some Practical Considerations in Autogenous Welding," by Henry Cave. Immediately following this session the annual dinner will be held at the Engineers' Club.

THE HORSELESS AGE

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Violations of Our Copyright.

Many automobile papers take a great deal of their technical matter from the publications of the manufacturers, evidently reasoning that most observations of a technical nature are originally made in the shops or by the testing staff of the makers, and that the factories are therefore the best source of original information. In last week's issue of one of our contemporaries we find an article, "About the Auto's Indispensable Footwear," concerning which the editor has the following to say in a footnote: "From a little book by the C. A. Shaler Company, Waupun, Wis., makers of vulcanizers and tire repair materials in general. The information is so pertinent and so full of sound common sense that the temptation to give it wider circulation is irresistible." After thus commending the matter our contemporary may be interested to learn a few things concerning its previous history. Practically all of this matter appeared originally in a series of articles on tire maintenance and repairs which ran in THE HORSELESS AGE from August 3 to September 7, 1904, and was later reprinted in our book on "Operation, Care and Repair of Automobiles." Whole paragraphs of the matter which appeared originally in THE HORSELESS AGE have thus been copied verbatim. Here and there are slight changes in the wording, and the matter regarding the use of the Shaler vulcanizer is, of course, added.

Another instance where several articles on ignition were "lifted" bodily from our columns, illustrations and all, and incorporated in a book on "The Care of a Gasoline Engine," has recently come to our knowledge. This latter booklet, though it bears the name of a publisher in this city and the price is given in it as 25 cents, is sent out free by a manufacturer who had been induced to buy advertising space in it.

We have never yet refused permission to reprint anything that may have appeared in our columns in catalogues, etc., when such permission was asked and when proper credit was promised, but we would have it understood that no general invitation to "help yourselves to anything" in our columns has ever been issued. The matter appearing in our pages is copyrighted, and a court decision in our favor in an action taken some years ago was to the effect that the copyright is valid, and an injunction was granted at the time.

Refinements in the Design of Water Jackets.

It would seem at first thought that all parts of the combustion space and valve seats being surrounded with water they must operate at temperatures but slightly higher than the average temperature of the whole body of water circulating in the jackets. This assumption only holds true when each portion of the surfaces has continuously passing over it a body of water sufficient to abstract an amount of thermal energy equal to that which enters its wall at the safe temperature at which it is desired to be kept. In other words, in order to keep all surfaces from overheating they should be directly in the line of circulation from the water inlet to the outlet, and water should be circulated faster around those particular parts where the transfer of heat through the walls is greatest, and which therefore are most likely to overheat.

In many otherwise very good engines there are portions of the jacket in which the circulation is very sluggish and of an eddying nature, and in extreme cases certain parts of the jacket space are practically without circulation. The tendency is for the water to pass from inlet to outlet by the path of least resistance, and this may mean that the bulk of the water goes by an approximately straight path, leaving a large portion of the jacket filled with sluggishly moving or eddying liquid. Jackets which enclose more than one cylinder probably exhibit this tendency more markedly than the jackets of single cylinders. Deflector plates are sometimes employed to spread the current of moving water, but their use is not general. If a water jacket could be made of transparent material and the water filled with light floating particles, much information could doubtless be gained as to the rate of flow at various points.

Where an eddy or dead water space exists steam is likely to form when the engine is worked hard, and such part dangerously overheats. Hot spots may often be detected in cylinder jackets by touching them with the hand. Under normal conditions of running no serious trouble may arise, but in cases of faulty cylinder lubrication, slow burning mixture or a retarded spark the influences of local faults in the circulation are liable to make themselves manifest by preignition.

It is usually the surfaces around the exhaust valve which first show signs of overheating. It is, therefore, common practice to locate the water inlet in the near vicinity of the exhaust valve so that the surfaces heated by the exhaust may directly receive the cool incoming flow.

In a recent design by one of the most careful American builders not only does the water enter the jacket of each cylinder pair close to the valves, but a portion of the flow is carried by a special pipe directly to the hottest joint of the exhaust region of each cylinder. The rest of the entering water is allowed to flow through the jacket in the usual manner.

It is believed that there is room for a little more care on the part of the designers in the direction of securing a definite flow of cool water to the points which are most liable to overheating; not only must all surfaces subject to the heat of the explosion be jacketed with water, but they should be surrounded by moving water. There are many good engines which begin to lose power and operate noisily on account of overheating due to local inadequacy of the water supply to certain portions of the jacketed surfaces where "hot spots" develop when unusually hard work is called for.

Light versus Heavy Car Controversy.

Two of our well known manufacturers have recently been drawn into a dispute regarding the desirability of weight in automobiles, one claiming that weight is a detriment and the other that it is an advantage. The question is rather an academic one and is not likely to be settled unless it is given a more definite form. If direct effects alone are considered weight is a detriment, as the power required to propel the car is directly proportional to the weight, consequently the gasoline and oil bills will increase directly with it, while on the other hand it is known that tire expense increases even more rapidly than the weight.

However, it would not do to be guided solely by this consideration, as it would lead us to weightless cars—an absurdity. There is this further point to be considered, that the strength of the parts depends largely upon their weight. The necessary strength depends in turn upon the total weight to be moved—the combined weight of the car and the passengers—so that if we cut down the weight of the car we also reduce the needed strength of parts, but not in proportion, as the weight of the load remains constant.

In so far as weight is really necessary to supply adequate strength it is not a detriment. However, the car of maximum weight is by no means necessarily the strongest, considered as a whole. With a given weight of material the strength depends upon the distribution of the material and upon the quality of the same. It might thus be said that any weight in excess of what is necessary to secure the required strength or factor of safety from the best materials commercially usable, when so distributed as to give the same relative strength at every point, is a detriment. There are still other factors to be considered, however.

One of these is the comfort of passengers. Roomy tonneaus, necessitating long wheel bases, necessarily make for increased weight. The so called double rumble seats are lighter than the regular tonneau, but they do not afford the same riding qualities. A comparison with the Pullman car has sometimes been made to prove the beneficial influence of great weight on comfortable riding qualities, it being well known that the palace car, which has its floor laid out with lead, jolts much less than the ordinary day coach. The comparison is not a fitting one, however, except possibly as applied to closed cars, as the object of the lead in the Pullman car is to lower the centre of gravity, and thus reduce the moments of transverse jolts. No appreciable effect of this nature could be produced by placing additional weight in the mechanism of the ordinary car, with no high superstructure.

Weight can also be saved at the expense of other desirable features, such as durability, noiselessness, etc. In a racing car, for instance, one does not look for great durability, and all frictional parts are cut down to the very minimum, while mufflers are generally dispensed with as unnecessary.

From the above it may be concluded that any reduction in weight that does not affect the strength or safety of the car, its comfort and its durability, is an improvement, while if the reduction is made at the expense of any of these its merits are extremely questionable. The saving to the owners of a certain reduction in weight, through its reduction in the fuel and tire bills, might be expressed directly in dollars and cents, but it would be practically impossible to reduce any accompanying losses, especially those in respect to comfort and safety, to the same basis, to say whether the weight reduction were justifiable.

Some Questions in Brake Design.

Not long ago a case was noted where in a high powered car when stopped suddenly the spokes in the rear wheels were broken near the hubs. From what little was learned of the matter it appears that the car was being driven at a high rate of speed, and the brakes were applied quickly. It seems probable that the brakes were powerful enough to stop the wheel drums so quickly that the spokes were not strong enough to withstand the stresses thus imposed upon them. A moment's consideration will show that at the instant the wheels of a moving car are locked the momentum of the car must be overcome by the stresses set up in the wheel spokes, and that the magnitude of these stresses depends largely upon the friction between the tires and the road. The greater this friction the higher the stresses. In addition to these forces, which are probably always considered in the design of brakes, there is another which is becoming important now that large wheels and heavy tires are common on touring cars. This is the momentum of the wheels and tires, due to their revolution. The amount of energy stored in them is considerable, and the time in which it must be overcome is determined by the suddenness with which the brakes can be locked. Where the brake linkage is powerful enough the stresses from this source may run very high indeed.

There are three general factors in brake design, viz., the area of the contact surfaces between shoe and drum, the materials and condition of those surfaces, and the surface pressure between them per pound of effort applied to the operating lever or pedal. The first factor affects the dispersion of heat, and hence, taken in connection with the second, determines the wearing qualities of the brakes. Satisfactory combinations for ordinary services have been evolved by long experience, and are in use on many well known cars. The third factor is perhaps the one which is giving most trouble at present.

It is common to hear a salesman or even an engineer boast of the quickness with which the brakes of his car can be applied. While quick application is essential, it is quite an important question what foot or hand pressure should be required to lock the brakes. Too easy locking is hard upon the mechanism of the car and wears the tires badly, and with a nervous operator it may also be a positive source of danger to the occupants. On the other hand, if too great operating pressure is required some change in brake adjustment, or in the condition of the friction surfaces, may make the brakes inoperative, which is much worse than the additional strain on the car by too easy locking.

There seems to be two courses open to the brake designer, either of which will give satisfactory results. One consists in using ordinary designs and adjusting the leverages so that a rather large, but not extreme, operating pressure is required to lock the wheels. The other lies in using fully enclosed brakes and keeping the condition of their surfaces always about the same, the leverage being such that it takes nearly the full strength of an average operator to lock the wheels. The latter course seems to be the more scientific, and is giving satisfaction on some well known cars.

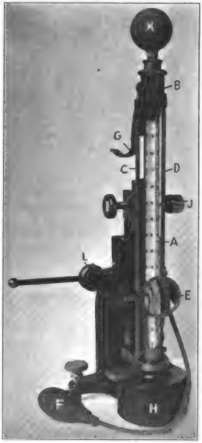
In cold weather when leaving your water cooled car stand outside for any length of time, put a robe over the radiator to keep the heat in

A New Instrument for Testing Hardness in Metal.

The necessity of being able to ascertain the hardness of metals has long been recognized, and several methods have been brought forward which were claimed to solve the problem, but they had certain defects which prevented them from coming into general use. Inasmuch as hardness bears a direct relation to the composition and heat treatment of metals, any tests that will quickly and accurately determine the hardness of the metal will serve to detect changes from any predetermined standard or differences in hardness between different materials, and in this way forestall the use of defective material or the passing of parts improperly treated. The file is still used to a great extent for testing hardness, the metal in question being filed and the hardness gauged by the degree of resistance that the metal presents. It is evident that this method is defective in principle, as it depends upon the sensitiveness and experience of the operator for the accuracy of the results. Until the advent of alloy steels, however, this file test served the purpose in a way, but the new alloy steels have proved it to be extremely deficient. There are two conditions determining the results of a test of alloy steels by the file, viz., hardness and what has been termed resistance to abrasion. The latter characteristic will be taken for hardness in the above test and the metal judged hard enough when in reality it may be considerably softer than a corresponding piece of carbon steel which tests the same.

There has been placed on the market recently an apparatus designed to permit of accurate tests of hardness being rapidly made. This instrument uses a diminutive drop hammer, which is dropped from a fixed height onto the piece of metal under test. The consequent rebound of the hammer from the piece being tested is observed on a scale. The height of the first rebound is taken as a measure of the comparative hardness of the metal tested. The theory of this method will be explained further on. The instrument is called the Scleroscope, the word being derived from the Greek meaning "direct reading of hardness." It consists primarily of a glass tube A, Fig. 1, which is about 10 inches long and is graduated for convenience into 140 equal divisions, this being the scale. The tube is accurately ground to present a true bore for the drop hammer to operate in and is secured in a metal bracket B, at the top of which are located the operating devices. The hammer is of such diameter as to slide in the tube without appreciable friction, and after each drop it is drawn to the top again by the vacuum created by the bulb K, which is pressed and then released suddenly. The hammer is caught at the top of the tube by a spring latch, which slides into a groove formed in the upper part of the hammer. This catch also forms a trip for releasing the hammer and is operated by the trigger G, which is pressed by the fingers

The hammer is about three-quarters of an inch long and about one-quarter of an inch in diameter and weighs only 40 grains, yet it is claimed to be capable of exerting, through its convex point, which has an area of about 1-2500 of a square inch, pressures as high as 500,000 pounds per square inch, these pressures depending upon the metals being tested, the highest pressures being reached with the hardest steels. Inasmuch as the pressures exerted by the hammer are in excess of the elastic limit of the metal and it is not this factor which causes the subsequent rebound, the question naturally asked is, What does cause the rebound? The elastic limit being exceeded, a minute permanent deformation is made in the metal, and the theory advanced for the rebound, which seems most plausible, is that it is caused by "the recuperative power of the molecular structure of the metal under test." If this be the case, the instrument would indicate directly the hardness of metals irrespective of their elasticity. The tube bracket B has a stay rod C on one side which also serves as a guide for the microscope E. This microscope is used to facilitate the reading of the scale. On the other side of the tube is a plumb rod D, which is used to set the tube plumb and thus give a perfectly vertical fall to the hammer. To the rear of the bracket is secured a holder, which adapts the instrument to either the self contained testing stand shown in Fig. 1, a swinging bracket shown in Fig. 2, or to use in the hand. When used on the stand thumbscrew J is used to raise the instrument from or lower it to the material to be tested, I being used to lock it to its standard.



The Scleroscope.

The self contained testing stand adapted for small work consists of a tripod H provided with adjusting screws for leveling it. On this tripod is mounted a hardened steel anvil, to which the piece to be tested is secured. To use the instrument the work to be tested is secured to the anvil if the stand is to be used, or to any suitable support if the swinging bracket is used, and the tube A and its bracket B are lowered onto the metal by thumbscrew J and also by the screw L, Fig. 2, if the stand is used. Fig. 2 illustrates the instrument in use with the swinging bracket, and the piece to be tested in a vice. The trigger G is pressed, which releases the hammer, and the bulb F is pressed at the same time, which opens an atmospheric valve in the head of the instrument, thus preventing the formation of a vacuum behind the hammer and giving the hammer a constant velocity in all cases. The rebound of the hammer is observed on the scale, the height to which it rises on the first rebound being taken for the comparative hardness of the metal.

Although the regular hammer (called universal) is adapted to be used for testing both hard and soft metals, it is more difficult to detect slight variations when testing soft metals with this hammer, consequently a hammer with a blunter point (called "magnifier") is supplied by which readings are more easily made, slight variations more easily detected and closer discriminations made. This hammer must only be used for testing soft metals. With the special charts supplied with the instrument these comparative readings of the magnifier hammer can be reduced to the same scale as that which would be obtained with the universal hammer. The quickness and accuracy with which the readings can be made depend upon the operator, but the manufacturers claim that anyone of ordinary intelligence can quickly obtain accurate results. After the use is once learned an average of five or six drops is all that is necessary to be made on various parts of the piece under test. The average of these readings is obtained and this result taken for the hardness of the metal.

The hammer is made of specially treated steel and its life is several hundred drops, and can be greatly lengthened by drawing it to the top after the first rebound, instead of letting it come to a rest. A standard hammer and block of steel is furnished with which the hammer can be compared, and if found to read too high, as it will when the point becomes blunted after repeated tests, it can be sharpened by rubbing the end on a piece of old emery paper until it has been brought back to the standard. A diamond point is also furnished which has practically an unlimited life, it is claimed.

Although the wide range of use of any instrument of this kind will be at once apparent to those requiring it a few of its applications will be specially noted. Take, for instance, its use in the foundry. From experience the foreman can tell approximately what quality of iron, copper or other metal he will obtain by mixing with it certain ingredients. However, there are times when the run results in a quality of metal much below the desired standard, in spite of the fact that apparently the same conditions existed as on previous runs. By this instrument certain products which have shown good service can be tested and the hardness noted and this taken for a standard. It is obvious that one set of standards adaptable to universal use by all manufacturers would be impossible, owing to the fact that each manufacturer employs his own methods, which in many cases amount to trade secrets. Therefore each user must create standards of his own by experiment. Subsequently each run can be tested before it is poured by running off a sample of metal and testing it for hardness, each run being, of course, composed of the same ingredients and proportions as that of the standard.

If too hard or too soft the proper corrective ingredients can be added to bring it up to the standard.

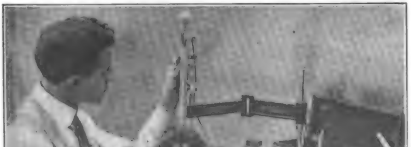
An instrument of this kind is equally applicable in the machine shop and forge room. In the forging department the proper treatment of any piece of material can be ascertained by testing for hardness and comparing the result with the standard. In the machine shop there is often considerable time lost in frequent resharpening of the lathe tools, drills, milling cutters, etc., that are too soft for the work being done, or the speed at which they are being worked is too high. If hardness can be ascertained the proper tool working at the most economical speed can be used, thus eliminating much unnecessary regrinding and consequent loss of time. In case hardening the result sought for is to give to the wearing surfaces of the metal great hardness and at the same time to leave the rest in such a condition as to be able to resist shock. If the piece to be case hardened has such a high initial hardness that the final hardness will be uniform throughout it is obvious that the advantages sought are impossible. The following table compiled by Mr. Shore, inventor of the Scleroscope, will illustrate what is meant by this statement. Four samples of steel were tested, giving the following results:

	Initial Hardness.	Leather Charcoal at About 1,700° Fahr.		
		1½ Hrs.	2½ Hrs.	3½ Hrs.
No. 1	93	90	91	92
No. 2	63	89	93	94
No. 3	22	88	93	93
No. 4	21	83	83	83
Depth of carbonization		.018 in.	.022 in.	.026 in.

It is obvious that sample No. 1 has been hardened uniformly throughout and is worthless for the purpose intended. By testing the initial hardness unsuitable material can be detected and rejected. The following table, the compilation of Mr. Shore, shows the comparative hardness of different metals. The figures are, of course, subject to variations, owing to differences of composition or compression:

	Degree of Hardness.
Lead, cast..............................	2
Babbitt metal, cast.....................	4-9
Brass, soft, cast.......................	7-10
Brass, hard, cast.......................	15-25
Brass, rolled...........................	26
Copper, cast............................	6
Copper, rolled..........................	14-20
Zinc, cast..............................	8
Zinc, rolled............................	20
Nickel, cast............................	27
Silver, pressed.........................	34
Iron, hot rolled........................	18
Iron, cold rolled.......................	25-35
Iron, gray, cast........................	39
Iron, gray, chilled.....................	50-90
Steel, tool, annealed (carbon)...........	30-35
Steel, tool, not annealed (carbon).......	40-50
Steel, tool, hardened (carbon)..........	90-110
Steel, high speed, hardened.............	70-105

The Scleroscope is the invention of A. F. Shore, and is manufactured by the Shore Instrument and Manufacturing Company, 226 West Twenty-fourth street, New York city. It is supplied, packed in a wooden case, with one steel metal holder, one finger ring, one swinging bracket, one plaster mount vessel, two magnifier hammers (for use with soft metals), one brass and one hard steel standard reference bars and fifty blank curve charts.



TESTING HARDNESS OF METAL.

Automobiles in Nova Scotia.

Consul General David F. Wilber, of Halifax, furnishes the following information concerning automobiles in Nova Scotia:

"If manufacturers would follow the same methods in introducing and pushing the sale of their products here as they do in the home market the results would be much greater than they are. This holds good in all lines of trade as well as automobiles. Motor cars have not been in much favor in the past on account of the poor condition of the roads throughout the province, but there has been a decided effort made to overcome this defect. At the last session of the Legislature a bill passed authorizing the establishment of a department of roads, and appropriated for the improvement of roads $175,000, and also $25,000 for small bridges.

"There are 97 automobiles registered at the office of the provincial secretary, divided as to origin as follows: United States, 61; Canada, 32; England, 3; Scotland, 1. According to the population and wealth of Nova Scotia, this is a poor showing, and is largely due to defective methods used in introducing this line of goods. The Canadian makes are built on the same lines as those made in the United States, most of them being manufactured by American firms having factories in Canada. The predominating style is the runabout and the lighter touring cars, from 8 to 30 horse power.

"While improved roads will do much to increase the sale of motor vehicles the last Legislature passed another law which will have a tendency to interfere somewhat with the general use of automobiles in some localities. This law gave to each local government the right to regulate the running of automobiles in their respective jurisdictions. It was claimed while the bill was up for consideration that, owing to the narrow roads so prevalent in Nova Scotia, it was dangerous for farmers with teams to meet automobiles, as the drivers of the latter disregarded the rights of the former, which had resulted in accidents.

"Of the twenty-four municipalities (districts), thirty-four towns and two cities in the province, four municipalities and two towns have regulated the running of automobiles and prohibited them on the following days: Pictou: Sunday, Tuesday Wednesday, Thursday and Saturday. Kings: Thursday, Saturday and Sunday West

Hants: Tuesday, Thursday, Saturday and Sunday. Yarmouth: Saturday. Town of New Glasgow: Sunday, Tuesday, Thursday and Saturday. Town of Pictou: Sunday, Tuesday, Wednesday, Thursday and Saturday.

"Medium and low priced cars are mostly in use, and there is no question but what a larger business could be done here if the market were properly looked after. The Province of Nova Scotia has a population of about 500,000 and the city of Halifax 50,000, the wealth of the people comparing favorably with similar districts in the United States. The condition of the streets in Halifax and other cities and towns is good.

"The duty on automobiles from the United States is 35 per cent. ad valorem; from Great Britain a duty of 22½ per cent. ad valorem is charged. Shipments from the United States should be accompanied by a certified invoice; the forms required by the Canadian customs can be obtained from the nearest British consular officer, or United States customs brokers, as a rule, and any information in connection with same."

Buffalo Show Question Settled.

The Buffalo Automobile Trade Association held its annual meeting and election of officers at the Iroquois Hotel on Friday, December 11. As stated in our last issue, there were two opposing tickets in the field, one representing the faction friendly to the Buffalo A. C. and the other the faction antagonistic to the club. The former faction won in the election, the following officers being chosen for the coming year: President, W. C. Jaynes Automobile Company; vice president, Maxwell-Briscoe Buffalo Company; treasurer, Brunn Carriage Manufacturing Company; secretary, Dai H. Lewis; executive committee, George N. Pierce Company, E. R. Thomas Motor Company and G. H. Poppenberg. Most of the retiring officials of the Trade Association were antagonistic to club influences in trade matters, and the old executive committee of the association had made arrangements for holding a separate show, to open on March 1. The contracts which had been entered into by the old committee in this connection will be cancelled by the new committee, and a meeting to that end will be held in the near future.

Proposed Exemption for Insurance Companies.

So many accidents result from "joy riding" that a proposal has been made to exempt insurance companies from liability on automobile policies when the accidents occur between midnight and 6 a. m. Underwriters have prepared statistics showing that a large percentage of the mishaps occurs after midnight.

A company has recently been started in Glasgow having for its object the safeguarding of the property of foreign patentees selling in the British Isles.

Radial Angular Drilling Apparatus.

Devices for drilling square or angular holes in metal, stone or wood have been a subject of inventor's efforts for years, and although several such devices have been put on the market they have either been objectionably complicated, shortlived or both. There is now being introduced into this country an apparatus which is remarkably simple, and which is claimed to have excellent wearing qualities. It consists of a chuck, Fig. 1, which can be attached to a lathe, milling machine or drill press without any changes thereto. This chuck consists of two parts, *b* and *d*, held together by the ring nut *c*, but free to revolve on each other. By means of the chuck plate *a*, *b* is secured to the driving spindle of the machine. The drill is screwed into the plates *g g'*, which are secured to *b* in such a manner that they are free to move sideways to a certain extent, this kind of a connection being essential, as the drill has two motions, one rotary and the other around its own axis. The guide by which the drill is given its peculiar motion is part of *d*, and is adjustable for the different size drills within its range. The screw bolt *d'* is used for holding *d* and its guide stationary, this feature being essential to the operation. A special clamping device for securing *d* is provided, which facilitates setting. The drill proper is formed with three cutting edges, and the cutting action is more that of a milling cutter than that of a drill. For square holes the drill is of a uniform size throughout its length, the shank having three sides, each side being a segment of a circle struck off from the opposite angle, the radii of the three circles being the same and equal to the length of one side of the guide in which the shank turns. Inasmuch as the guide in *d* is prevented from revolving, the drill shank has a rolling sliding motion in the guide when the drill is turned. Fig. 1 shows the outline of the shank of a drill, and when it is revolved in the guide the cutting head is given a straight line motion corresponding to the sides of the guide. The resulting hole is square, except for the corners where a small fillet is left. For cutting out a perfectly square hole a special holder is used, the shank of which is considerably larger than the cutting head. The outline of the shank is struck off in the same maner as that shown in Fig. 2, except that one of the edges is rounded, the resulting motion of the cutting head taking out the corners also. Fig. 3 shows the outline of this special shank, with the outline of its cutting head and the hole, shown bored in the centre. As the guide and shank are hardened steel and means are afforded for liberal lubrication there is said to be almost no wear. The cutting speed in hard steel is claimed to be only 30 per cent. less than that of an equivalent size round drill, and somewhat greater in wood. A special holder is provided to facilitate grinding and insuring that the three cutting edges are ground properly. Fig. 4 shows an assembly of the chuck, with drill in place in its guide. The last described drill is the one with the larger shank, and the one which is of uniform diameter leaves a fillet.

The Radial Angular Drill Company, 114-118 Liberty street, New York city, are American agents for the device.

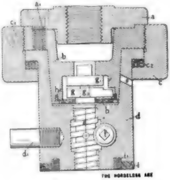


FIG. 1

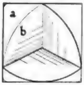


FIG. 2.

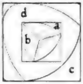


FIG. 3.

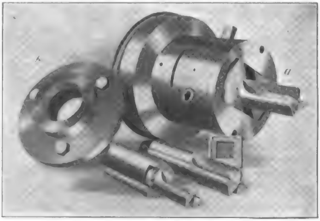


FIG. 4.

Effect of the New Forms of Traffic on Roads.—II

(Paper read before the Paris International Good Roads Congress by M. Ch. Walckenaer, Chief Engineer of the Department of Mines and Professor of the Paris School of Roads and Bridges.)

HEAVY TRAFFIC.

When heavy commercial vehicles are considered the question becomes quite different. We have no longer to do with speeds of the same order; on the other hand, the axles are much more heavily laden and the wheel treads are no longer the same.

Certain vehicles belonging to this class, such as motor omnibuses, or some types of light trucks, have all of their wheels fitted with tires or blocks of rubber, either solid or slightly hollowed out. In that case the necessity of keeping down the compression and the heating of the rubber restricts the specific pressure of the wheels on the ground within narrow limits; and as, on the other hand, the elasticity of the rubber, even when solid, reduces the shocks in a very notable proportion, it is not found that these vehicles, at the moderate speed at which they are habitually operated, do any material injury to the well paved streets of our cities.

However, there is one other little difficulty to be mentioned in connection with this class. Some of these vehicles, as, for instance, the motor omnibuses now in service in Paris, whose rear axle carries a load of 4½ tons, and whose wheels are fitted with non-continuous tires formed by a crown of blocks, owing to the resistance to skidding which they offer, cause a vibration of the surface of the public road. This vibration is especially noticeable when the runway is constituted by some building structure, as is the case in the streets underneath which passes the Metropolitan underground railroad, and when the paving has a hard and non-uniform surface, like the usual stone pavements. The vibration transmitted by the ground causes a vibration of the adjoining buildings, which is particularly noticeable in the upper stories. The same as in the case of the majority of other dynamic effects referred to previously, this trouble increases rapidly with the speed.

For this kind of traffic it is, therefore, of importance, on the one hand, that the streets have a solid foundation and that the surfaces be as continuous and uniform as possible without, however, favoring skidding; and, on the other hand, that the weight of the vehicles be reduced, that their sped be limited, and that the wheels and suspensions be so arranged that the motion is smooth and uniform.

Let us now pass on to heavy vehicles fitted with steel tires. There are no mechanical limits to the loads per axle in vehicles of this type. In consequence, not only may the street pavements be endangered in certain cases if the weight of the vehicle is excessive, but building structures in the streets as well. Let us investigate these two questions in succession, taking up structures first.

This danger is not purely chimerical. There have been placed in service in certain cities, especially in Paris, steam trucks weighing 20 tons with load. Now, the ordinary road bridges are not constructed to carry such heavy loads. In France, on the national roads, all recent metallic works have been constructed in conformity with the ministerial decree of August 29, 1891. Their strength is specified by paragraphs 15 to 19 of that decree. The stress of the metal has been calculated by assuming the loads specified in paragraph 17, and each truss has been tested according to the method described by paragraph 19. The normal load is composed by a series of farmers' carts weighing 6 tons, to each of which are hitched two horses. It is true that the regulations provide for the passage, during the trials, of heavier vehicles, 11 ton carts with five horses hitched thereto, or four wheeled trucks weighing 8 tons per axle and having eight horses hitched thereto; but the extreme loads specified already stress the metal to the extent of 1 km. p. sq. mm. more than the limiting stress specified, and, moreover, the bridges are not made to be tested every day.

Let it be noted that what has been said applies to the structures on the national roads constructed subsequent to the issuing of the decree of 1891. The bridges of the departmental and local roads are not of this same strength. On the other hand, on roads of all the different classes there are old structures and special structures, such as suspension bridges, whose strength is materially smaller and is impossible of a general definition. On the whole, even on leaving out of account especially weak structures and considering only ordinary conditions on the roads, it will be seen that in the construction of heavy commercial motor vehicles a limit must be placed on the weight, if these vehicles are not to damage the bridges.

What precedes takes account only of the static effect of the weight on the structure. When a motor vehicle passes over a metallic bridge, the latter is subjected not only to a static load, but also to various dynamic effects, which are a function of the speed of the vehicle, the distance apart of its axles, the arrangement of the bridge and the nature of its surfacing. Considered from this standpoint, the question is not the same when automobiles are concerned as where horse drawn vehicles are in play, owing to the fact that the resonances do not correspond to periods of the same order. The very few experiments made on this subject have given interesting results; but it would be unwise to generalize or draw conclusions hastily.

Let us now take up the question of the injury to the road. The first requirement is that the pavement must not be shorn by an excess of pressure on the surface. There must, therefore, be a limit fixed to the load per centimetre width of the tire. The steam rollers ordinarily used give pressures varying from 80 to 120 kg. per centimetre of width, and it often happens that they themselves cause a certain crushing of the materials. It is true that the latter have not definitely settled into place; after that the macadam offers more resistance. In any case, the ordinary road pavement is incapable of supporting pressure in excess of 150 kgs. per centimetre width of tire without damage; only in the case of roads specially built with a view to supporting heavy traffic can we go as high as 200 kgs.

As a matter of fact, the pressure on the ground for a given load on the wheel is not simply a function of the width of the tire. It depends also on its curvature, that is to say, on the diameter of the wheel. But in this consideration, which is necessarily of an approximative character, we may leave this element out of account, for the reason that the diameters of wheels used on commercial motor vehicles do not vary greatly. A more important condition is the following: The figures given above were arrived at under the assumption that the load was uniformly distributed over the whole width of the tire. This hypothesis is not absolutely correct, its deviation from the true conditions being the greater the wider the tire, the further the two wheels on the same axle are apart and the more bumpy the road surface. Aside from the proportion to be maintained between the load and the width of the tire, care must therefore be taken to limit the absolute width of the former, so that the useful width of the tire need not be excessive. For wheels with tires of 15 centimetres width (6 inches), a load of 150 kgs. per centimetre corresponds to a total load of 4½ tons per axle.

In the case of stone paved roads, at least if the pavement is not made with small materials and with special precautions to insure an even surface, the non-uniformity of the surface does not admit of the assumption that the wheel bears on more than one paving stone at a time. In that case, therefore, we cannot count on a uniform distribution of the load over the whole width of the tire; consequently, this width no longer enters into the problem, and the absolute value of the load on the wheel is the only factor. This load tends to form a depression in the pavement. The resistance of this sort of pavement to the injurious effects of heavy motor traffic depends, therefore, on the solidity of the foundation on which the pavement is placed.

We referred above to the static action of the wheels on the ground. This, however, is only one side of the question. The speed plays a most important part. The greater the speed the more intense the horizontal reactions of the wheels. On a macadam road they tend to dislodge the stones, on wood block pavement, on which the heavy vehicles travel at speed, it has been observed that the fibres of the wood become turned in a direction opposite to the direction of motion. The shocks, the intensity of which increases so rapidly with the speed, particularly effective by reason of the rigidity of the tires. It has thus been observed that on roads paved with sandstone the rapid passage of heavy cars detached shells parallel to the upper face of the paving stones, which is a good indication of the violence of the horizontal shocks. There is, therefore, need for a speed limit for heavy commercial traffic which is a function of the weight of the vehicle.

In fact various transportation enterprises which placed in service motor trucks of 10 and 15 tons, and even more, were sorely disappointed by the rapidity with which the heavy vehicles wore ruts in the macadamized roads and dislodged and crushed paving stones. They were obliged to bear the very heavy expenses of repairing these roads and to limit themselves to speeds equal to those of a horse walking.

It is at present being recognized that it is most advantageous wherever the nature of the goods to be transported admits of it, to use relatively light trucks, having a maximum load of about 4 tons on the most heavily laden axle. These vehicles of more moderate weight are easier to handle. They may be operated at the speed of a horse trotting, without appreciably increasing the wear of the roads. Now, the speed of operation is a factor determining the usefulness of the car, which compensates for the smallness of the loads carried. Moreover, this speed leads to important commercial advantages. It is one of the qualities which tend to make mechanical transport preferable to ordinary horse trucking. In the contests of gasoline motor trucks held under the auspices of the A. C. of France the average weight of the vehicles laden, which was only 3,300 kg. in 1900, owing to the fact that at that period the art of commercial vehicle construction did not permit of building very large units with this type of motor, increased at first gradually up to a maximum in the neighborhood of 7,000 kg., which was reached in 1905; at that date the heaviest vehicle taking part in the contest weighed 8,800 kg. Then a rapid decrease manifested itself, and in the contest which was held in 1908 the average weight of the vehicles laden was 6,000 kg., the extreme weights being 4,500 and 7,500 kg. The present tendencies of the industry may therefore fortunately be conciliated with the need of preservation of the roads, on the condition that the speeds remain moderate.

In what precedes we supposed that the tires of the wheels, if they were metallic, were exclusively of smooth surface. Rigid tires fitted with strakes subject the road to additional wear, which in some instances has proven absolutely disastrous. This effect has particularly been produced in the case of road trains drawn by a tractor whose driving wheels must impress upon the road a tangential reaction equal to the total driving effort required by all of the vehicles. The use of tires with protruding strakes, which imbed themselves into the road surface, evidently furnishes a means of increasing the adherence and thus increasing greatly this tangential reaction. But undue increase of the latter tends to dislodge the elements of the pavement, and this disintegration once begun leaves the paved surface more vulnerable to the action of ordinary traffic. It might be added that road trains in general have this detrimental effect on roads that if the first vehicle produces a defect of any kind the trailers, following substantially in the same track, accentuate the damage in the form of a deepening rut.

RESUME AND CONCLUSION.

In summarizing it may be said that automobile traffic produces on macadamized roads a dispersion of the fine materials, thus baring the stone foundation and facilitating the deterioration of the road body. These effects are the more pronounced the greater the speed of the automobile, the smaller the binding effects of the materials, the more their solidarity depends upon the filling material, and the more readily the latter is raised in the form of dust. Every defect of homogeneity favors and precipitates deterioration. These observations should influence the choice of materials, the methods of construction and of repair of roads.

At road turns a special cause of wear results from effects of centrifugal force. From this point of view it would be advantageous to raise the outer side of the curve. On the other hand, it is desirable, as much at curves as at other points where the wheels are likely to skid appreciably, that the road should be constituted of hard and non-slippery materials.

Motorists, on their part, with the object of preserving the road, should use no antiskidding tires of the steel studded variety, except those with studs having a flat head of a comparatively low height in proportion to their diameter.

Commercial vehicle traffic, so far as rubber tired vehicles are concerned, running at moderate speed, are generally not injurious to well paved roads. But there is a certain type among this class of vehicles, including certain motor omnibuses, which impress upon the roadway, especially if the latter is supported by a structure or has a stone paving, vibrations which are transmitted to the adjoining buildings. In order to obviate this effect it is necessary to take special care in the construction and maintenance of the public roads, and, on the other hand, to limit the weight of the vehicles, not to unduly increase their speed, and to secure by all suitable means a smooth rolling motion.

As to heavy motor vehicles with rigid tires, it is first of all necessary to limit their weight to figures compatible with the safety of road structures. On the other hand, in view of their operation on macadamized roads, the load per wheel must, as a rule, not exceed 150 kg. per centimetre width of tire. This width must not be excessive, which condition imposes a limit on the total load per axle. The limit of 4½ tons seems to be well chosen from this point of view. The permissible load varies, however, as a function of the speed of the vehicle. The use of relatively light trucks is to be recommended, and this recommendation is in conformity with present tendencies of the industry.

Rigid tires should, moreover, be of the smooth surface type, except in special cases, and for operation on suitably chosen routes.

Bendix May Not Move to Logansport.

A hitch has occurred in the negotiations between the Bendix Automobile Company, of Chicago, and the Business Men's Committee of Logansport, Ind., which were recently reported as having been concluded. The Logansport men who purchased stock in the new Bendix Company did so with the understanding that the entire assets of the old company were to be turned over to the new company and moved to Logansport. The provisions of the contract were that at the time the assets were transferred to the new company the first third of the $50,000 was to be paid in, when the buildings to be erected in Logansport were under roof the second third was to be paid, and when operations actualy commenced the last third. The local stockholders were to retain title to both the site and the buildings until all of their stock was redeemed.

Vincent Bendix, president of the company, was in Logansport on December 10 to close the deal. It was then found that minority stockholders in the old company objected to the transfer of the assets to the new company, and threatened to take out an injunction if the assets of the company were to be moved out of Illinois. These stockholders, it is stated, demanded that the first third of the stock subscribed for be paid on the transfer of the assets, and that this money be used to operate the factory in Chicago. To these terms the Logansport stockholders objected, and it is reported that some of them called at the Logansport Loan and Trust Company and demanded that they be paid back the money on stock subscriptions they had deposited with the Trust Company.

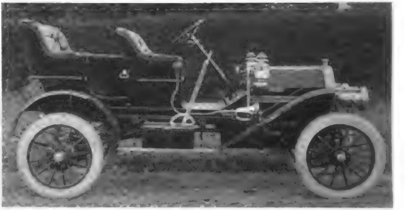
Operation of the New British Patent Act.

Answering an inquiry as to the interpretation placed on the clause "worked to an adequate extent," the United States consul at Glasgow writes that it would appear to be perfectly in order, in the meantime, to manufacture the parts of a machine in the United States and have them assembled in the United Kingdom. The ground on which this view is taken is that each part of the machine, taken separately, is not a patented article, the patent merely applying to the machine as a whole. No test case has yet been taken in the British courts, and it is stated that the above is the generally accepted reading of the law at present.

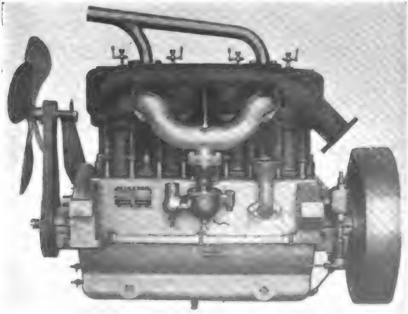
NEW VEHICLES AND PARTS

Jackson 1909 Models.

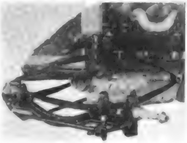
Four distinct types of chassis will be manufactured by the Jackson Automobile Company, of Jackson, Mich., during the coming season. The largest of these cars is their Model E, which is a continuation of this year's model. The unit power plant is retained, but is somewhat modified in detail. The inlet manifold has been changed to the fan type, giving more direct gas passage to the cylinders. The two main supports for the power plant are at the sides of the flywheel, additional flexible supports being provided at the front of the motor and at the rear of the gear case. Lubrication is provided for by circulating oil from a reservoir in the motor base. The overhead cam shaft is retained practically without change. Thermo-siphon circulation is used for the cooling water in this and all other Jackson models. Ignition is by Splitdorf magneto and battery. The clutch is of the disc type, with five 12 inch discs pressed together by spring and toggles. The change gear is a three speed, sliding, selective, with annular ball bearings. The rear axle is fitted with roller bearings and with ball thrusts on both sides of the differential. The bevel driving pinion shaft is mounted on ball bearings. Both internal and external brakes act on double rear wheel drums which are separated by an air cooling space. Steering is by a combination gear which uses both a screw and nut and a rack and pinion mechanism in the reduction. Full elliptic springs are used throughout on all these models. The cylinder dimensions are 4¾x4¾ inches and the motor is rated at 36-40 horse power. The wheel base is 111 inches. The tires are 34x4 inch.



Jackson Model K.



Jackson Model E Motor.



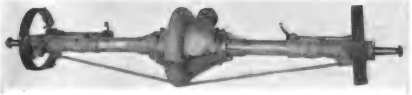
Front Axle of Jackson Model H.

Model H is an entirely new four cylinder touring car. It has a typical four cylinder motor with valves on the side. This motor is 4½ inches "square" and is rated at 30 horse power. The cylinders are cast in pairs and a three bearing crank shaft is used. Clutch, steering gear and magneto are the same as in the larger model. A multiple disc clutch is used and the change speed gear is of the selective sliding type with three forward speeds. It is mounted on annular ball bearing of the separated ball type. The front axle is a weldless drop forging, as in all 1909 Jackson cars. The rear axle is provided with roller bearings at the wheels and with ball bearings at the bevel gear and pinion. Two universal joints are used in the propeller shaft, a separate torsion rod being provided. The wheel base is 110 inches. The wheels are 32 inches in diameter with 4 inch tires.

Model C is continued practically without change. It is a single chain driven car with an opposed motor under the body. This motor has a 5¼ inch bore and a 5 inch stroke, and its valves are located in the head. Ignition is by jump spark with storage battery and dry cells. The change gear is of the planetary type. Thirty-two by 3½ inch tires are used all around. The wheel base has been lengthened to 104 inches.

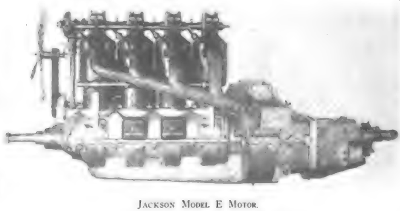
Model K is the smallest car in the line and a new model. It is sold with a runabout or with a four passenger touring body.

The motor is an opposed, set crosswise under the hood. It has a 5 inch stroke, with 4 inch bore, and is rated at 15 to 18 horse power. Lubrication is provided for by a mechanical oiler driven from the cam shaft by bevel gears. The cooling water is circulated by thermo-siphon action. Ignition is by jump spark with two sets of dry cells. The transmission is of the planetary type and is connected to the rear axle by a propeller shaft with two universal joints. A separate torsion member is provided. Roller bearings are used at the outer ends of the axle shafts and ball bearings at the driving gears. The wheel base is 96 inches and the weight 1,650 pounds. The wheels are 30 inch and fitted with 3½ inch tires. Full elliptic springs are fitted all around. A set of expanding brakes act on the rear wheel hubs, and, besides, the reverse gear may also be used for braking. The front



JACKSON REAR AXLE.

axle is an I section forging. The car carries 4 gallons of water and 12 gallons of gasoline.



JACKSON MODEL E MOTOR.

The Cameron 1909 Model.

The Cameron Car Company, Beverly, Mass., in their 1909 models are adhering closely to their characteristic methods of construction. The crank case has been redesigned and is now of macadamite, an aluminum alloy. It is constructed in upper and lower sections, the upper section being bolted to the sub-frame. There is a full division wall between each cylinder pairs and an oil partition between each two cylinders of each pair. All moving parts are accessible when the lower case section is dropped. The cam shaft housings are solid and bored out so as to allow of the shafts being inserted from the ends. Each shaft has three bearings in cast iron bushings which are bored out to the diameter of the cam throw, allowing of the shaft with cams attached being inserted through them. These bushings are held from turning by the stems of their compression grease cups, which pass through the housing and into the bushings themselves. The cams are hardened and pinned on.

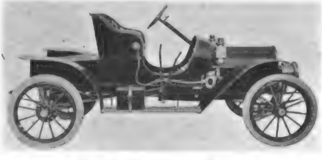
Somewhat longer main bearings are now used, the lengths being as follows: At the flywheel end 3 inches, at the front end 2 inches and at the middle 2 inches. Bushings of Parsons white bronze are employed. Oil pockets are cast in the main bearing brackets.

The cylinder bore has been increased from 3¾ inches to 3⅞ inches and the four cylinder engine is now rated at 24 horse power. The pistons have been considerably lightened, thus securing much quieter running qualities. Two oil baffle rings are turned in each. The pistons are finished to 0.010 inch under side toward the top and 0.005 inch at the bottom. The piston pins which are fast in the piston bosses are secured by a tapered pin threaded at its larger end, passing through the pin and through both sides of the boss. The heads of the two pins are wired together.

The engine gears are enclosed in an aluminum housing, which has cast upon it bosses corresponding with the main and cam shaft bosses of the crank case front, so that, when in place, it is to all intents and purposes integral with the crank case. It is held thereto by two long bolts.

A steel crank shaft gear, of five-eighths of an inch face, with twenty-four eight pitch teeth, meshes with the two forty-eight tooth, cast iron gears which drive the inlet and exhaust cam shafts, respectively. The magneto driving gear is also enclosed in this housing. A bolted aluminum cover closes this case. A high tension magneto and a self contained oiling system are found in the 1909 Cameron. The magneto, a Remy Model L, is bolted to four bosses cast upon the front of the left hand side of the upper crank case section. Very short cable connections, carried in a fibre bushed bracket, are used, and a battery of dry cells is furnished as an auxiliary. The engine is capable of being started on the magneto, however.

On the bottom surface of the lower crank case section is cast a large rectangular oil compartment, closed by an aluminum under cover plate secured by two lock washered thumb screws. In this compartment is located a float, which regulates the admission thereto of oil from a one gallon reservoir, located on the dash, so that a constant level is maintained therein. The gear type oil pump is at the lower end of a separable bronze housing, carrying the bevel driving gear at its upper extremity. This self contained pump fits into a space chambered out for it in the crank case and its gear meshes with a bevel gear on the inlet cam shaft. Oil is drawn by this pump from the crank case compartment and forced through a pipe running lengthwise of the crank case, which has a branch delivery to each of the three main bearings, which are kept thoroughly flooded. The oil escaping from the bearings settles in the bottoms of the crank case sections and returns through two standpipes to the crank case oil compartment. These standpipes maintain a constant correct level in the crank case sections, and the connecting rod tips distribute lubricant to the pistons and other working parts.



CAMERON FOUR CYLINDER ROADSTER.

The Breeze carburetor is retained, but the gasoline needle valve is now adjustable from the seat. Adjustable ball and socket joints are now used in the throttle and spark linkages.

A complete metal dust pan is fitted under the engine, extending to the rear of the clutch and its operating mechanism.

The new clutch is a reversed leather lined cone of 11 inches diameter and 2 inch face, with ten seven-eighths of an inch cork inserts. A 350 pound spring effects engagement, but the clutch push pedal operates very easily, as the release is effected by the action of a cam of easy outline. In this model hub emergency brakes of the metal shoe expanding type, acting on 10x2 inch metal drums, are employed. These

Method of Housing Gears—Cameron.

brakes are set by the forward motion of the reversing lever. A single universal joint of the Kinsler-Bennet pin type is employed. The engine being mounted about 2 inches lower than heretofore, a more nearly straight line drive is secured.

The driven bevel gear of the transmission is broached out and pressed over a four feathered shaft. The hub is also pinned through the shaft and as the flush ends of this pin are surrounded by the cup of the ball bearing it cannot work out. A. L. A. M. standard threads have been adopted throughout.

The differential gear is of the four pinion bevel type, with twenty tooth main gears and ten tooth pinions of five pitch. Cut teeth are now employed. The housing is of malleable iron. The gear ratios are slightly lower than last year and are as follows: On the high, 3.66 to 1; on the intermediate, 5.12 to 1, and on the low, 8.63 to 1.

Annular ball bearings with one-half inch balls are employed at the outer ends of the rear axle. Instead of the manganese bronze I section axle formerly used, a No. 8 gauge Shelby steel tube of 1¾ inches diameter is employed, with the drop forged forks pinned and brazed thereto. The steering arms are inserted in the drop forged knuckles. The front wheels are on annular ball bearings.

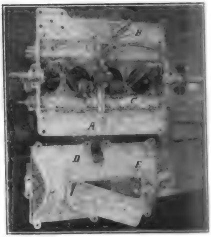
Wheels of 30, 32 or 34 inches diameter are optional, corresponding changes being made in the gearing. A greater rake is given to the steering post, which is fitted with an internal sector and pinion steering device. Shock absorbers of the spiral spring type are regularly fitted between the rear springs and the body; flush mud guards are supplied.

The foregoing description, referring primarily to the four cylinder car, applies equally to the six cylinder, which is rated at 30-36 horse power, and which has a wheel base of 112 inches, 32x3½ inch wheels and a stated weight of 1,650 pounds. Engine construction is essentially the same in both models. The springs are, of course, heavier in the six, consisting of five 1½ inch leaves instead of the same number of 1¼ inch leaves, the full elliptic type being used in the rear and three-quarters elliptics in front.

A feature of the new line is the racing type of runabout, known as the "Featherweight Flyer." This has the regular four cylinder power plant, but the engine is hung very low so as to give a straight line drive. The wheel base is 85 or 94 inches, as specified, and wire wheels of 32 inch diameter are used. A body of very light construction, with two bucket seats and the 15 gallon cylindrical gasoline tank placed to the rear thereof, is used. The steering column is at a very rakish angle and a hooded dash is employed. The weight is 950 pounds.

The Regal for 1909.

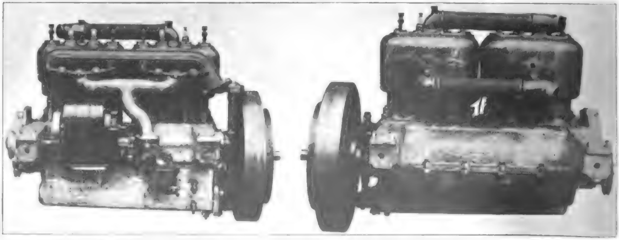
While the 1909 Regals are similar to the 1908 models in type and size they are entirely new cars, there being scarcely a detail which has not been redesigned to reduce weight, increase efficiency and make the parts more accessible.



Cameron Crank Case.

A, Upper crank case half; b, oil pump; C, oil distributing pipe; D, lower crank case section; E, oil compartment with removable cover.

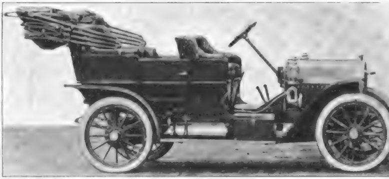
The engine has a 4 inch bore and stroke, and is rated at 30 horse power. The cylinders are cast in pairs with the valves all on the left side. Means for adjusting the valve timing are provided at the upper end of the tappets. Tappets, valves and manifolds are all readily removable. The crank shaft, cam shaft and connecting rods are single piece drop forgings; their bearings are of die cast white brass. Lubrication is provided for by an oil pump at the rear of the base, which forces a stream of oil to the bearings and connecting rods; the overflow from the bearings returns to the pump supply chamber in the base. Cooling water is circulated on the thermo-siphon system using a vertical tube radiator and large connecting pipes. A belt driven fan draws air through the radiator. A Remy high tension magneto is the standard ignition equipment; it is driven by a spiral pinion meshing wth the cam shaft gear. Dry cells are supplied as an emergency source of current.



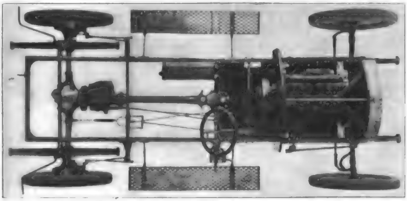
Showing Carburetor and Magneto Regal Motor Showing Water Connections.

The clutch is a leather faced cone. It is provided with small springs under the leather to facilitate easy engagement. A sliding universal joint connects it to the propeller shaft.

The rear axle shafts and bevel gear run on Hyatt roller bearings. The entire top of the bevel gear case is removable for inspection or adjustment. To the flanged front end of this case is bolted the three speed selective sliding gear. Its case is also fitted with a large removable cover. The gears are mounted on ball bearings. At the front end of the tube surrounding the propeller shaft is a machined steel globe which is carried in a babbitted bearing on the frame.


Regal Touring Car.

A tubular front axle is employed. It is dropped outside the spring seats, but the drop is less marked than last season. This permits the use of a low frame while maintaining a good road clearance. The front springs are semi-elliptic with rebound clips. The rear are full elliptics, hinged to the frame. The wheel base is 105 inches and the gauge is 56 inches. The wheels are 32 inch, fitted with 3½ inch tires. The weight with touring body is given as 1,900 pounds, with runabout body as 1,825 pounds. Both contracting and expanding brakes act on the rear wheel drums. The latter set are equalized. Steering is by a worm and sector gear. The control is standard. Besides the five passenger touring and three passenger runabout body shown, there will be a taxicab and a toy tonneau model.


Regal Chassis.

The Wisconsin Two Cycle Motor.

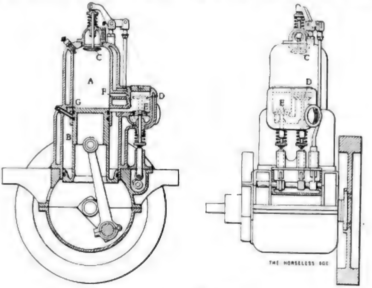
This motor is made by the Wisconsin Machinery and Manufacturing Company, of Milwaukee. It is of the differential piston type. There are three valves to each cylinder, all of them of the common poppet type operated from a cam shaft, as in ordinary four cycle motors. This cam shaft, of course, turns at the same speed as the crank shaft.

The novel feature of the motor is that it does not precompress its charge in the crank case or any other chamber, the charge being drawn directly into the working cylinder as in four cycle motors.

Referring to the drawings of the motor, A is the working cylinder and B is the annular chamber. Suppose the piston to be at the top of its stroke and the charge contained in A to be exploded, driving the piston down. When it gets well toward the bottom of its stroke port F is uncovered and a large part of the burning gas passes out through exhaust valve D, which has been opened in proper time by its cam. Meanwhile the downward movement of the piston has created a vacuum in closed chamber B, and as the piston continues to move down this vacuum increases. When the piston is near the bottom of its stroke it uncovers a series of ports G and the remaining burnt gases rush through these ports to fill the vacuum in B. After this movement is well under way valve C is opened by its cam and mixture is drawn in around C to fill A directly from the carburetor.

When the piston reaches its lower dead centre valve C closes; so as soon as the piston has moved up far enough to close ports G it begins to compress mixture in A. Valve E then opens and remains open for the entire up stroke, so that the burned gases are completely exhausted from chamber B.

In another form of this motor both valves C and D are placed in the head, thus avoiding the loss of the small volume of fresh charge which is trapped in passage F and above valve D in the type shown.



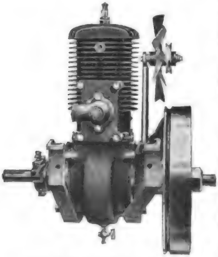
Wisconsin Two Cycle Motor.

Trojan Two Cycle Motors.

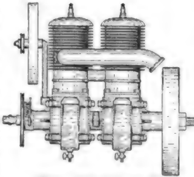
The Trojan Motor Company, of Louisville, Ky., offer for the coming season a line of two cycle automobile motors in one, two, three and four cylinder models, rated at 8, 16, 24 and 32 horse power, respectively. This motor is of the two port type, and the makers advise us that this principle was only adopted after much experiment. Advantages claimed for the two port over the three port engine are increased efficiency, flexibility and ease of starting.

The accompanying illustrations show the air cooled models. We are informed that long continued tests under the most severe conditions have shown the cooling of this engine to be absolutely adequate. It is effected by a ball bearing fan which directs a strong blast of air against the cooling flanges. The incoming charge of cool gas also assists materially in keeping the motor at an even working temperature. The cylinders have deep, thin integral cooling flanges. Cylinder and head are a one piece construction.

The pistons are fitted with two triple rings of the Cartwright type, both above the piston pin. These rings are claimed to have good packing properties and at the same time to create considerably less friction than ordinary snap rings. The piston pins are of liberal size, hardened and ground; they are made hollow and run in phosphor-bronze bushings. The connecting rods are of H section, bronze bushed at the upper ends, while the lower ends are of the full marine type and bushed with babbitt. The rods are cast of manganese bronze of 65,000 pounds per square inch tensile strength. The crank shaft journals are 1⅝ inches in diameter by 4 inches long. The crank pins are of the same diameter with a length of 2⅛ inches. This gives for the main bearing surface of the crank shaft in the four cylinder motor a projected area of 32½ inches, and a total projected area for the four crank wrists of $13\frac{13}{16}$ square inches. The connecting rod is cast with a passage through its centre in order to facilitate lubrication. The crank cases are of an aluminum alloy, and the crank shafts are steel forgings. All crank shaft journals run in babbitt bearings.



Trojan Single Cylinder Motor.



Trojan Two Cylinder Motor.

Oil connections lead to the shaft bearings and to the cylinder. The oil connection to the cylinder enters at a point corresponding to the lowermost travel of the piston pin, which is hollow and through which the oil is conducted to the piston pin bearing and down through a tube cast in the centre of connecting rod to the crank pin bearing. On the inside of the cylinder wall an annular oil groove is turned connecting to the above oil inlet, thus affording lubrication to the piston and cylinder wall.

In respect to flexibility it is claimed that the motor answers promptly to the throttle and spark levers, the working speeds ranging from 200 to 2,500 r. p. m.

Rambler Close Coupled Car.

A new Rambler model just announced by Thomas B. Jeffery & Co. which will be first shown and demonstrated at their New York branch, 38 and 40 West Sixty-second street, during the period of the New York automobile shows, is a 45 horse power car with a four passenger or close coupled body and spare wheel. The color combination is dark Brewster green, black effect, striped in orange, with orange wheels. The upholstery is highly finished smooth leather, which contrasts strongly with the bright orange of the wheels.

The Unisparker.

The Unisparker is a simplified form of the Atwater Kent spark generator. It is designed for use on cars where the arrangement of the cam or magneto shafts makes it inconvenient to install the spark generator, or where it is desired to use an outfit of somewhat lower cost. It consists of two separate units—a contact maker and distributor, adapted to go in place of the ordinary timer on any convenient half-time shaft, and a spark coil, complete with condenser and switch, adapted to go on the dashboard.

Current is derived from six or eight ordinary dry cells, a set of which is claimed to last from 1,500 to 2,000 miles in the average four cylinder car, because only one spark is produced per ignition, and the contact duration is as brief as will permit the coil to "build up" when the engine speed is high.

The mechanism of the contact maker in the Unisparker is the same as in the spark generator, and most of the working parts are identical and interchangeable with those of the latter. The moving parts of the contact maker are the notched shaft A, the steel snapper B, and the contact arm C. Rotation of the shaft draws the snapper to the position shown in Fig. 3. Here it snaps off, and, riding up on the rounded part of the shaft, exerts a wedging action against the steel hook D of the contact arm. This forces the contact spring E against the insulated platinum pointed contact screw F, and closes the circuit. Further movement of B permits D to snap off (see Fig. 2), thus suddenly breaking contact at the platinum points. The duration of contact is the time it takes the snapper B to slide past the hook D. It may be adjusted for a short or long

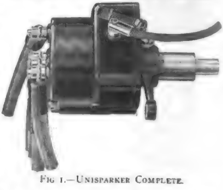
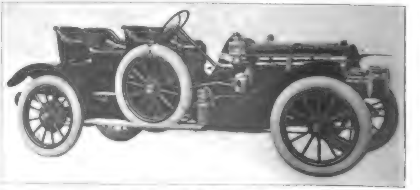


Fig 1.—Unisparker Complete.



Forty-five Horse Power Rambler Close Coupled Car.

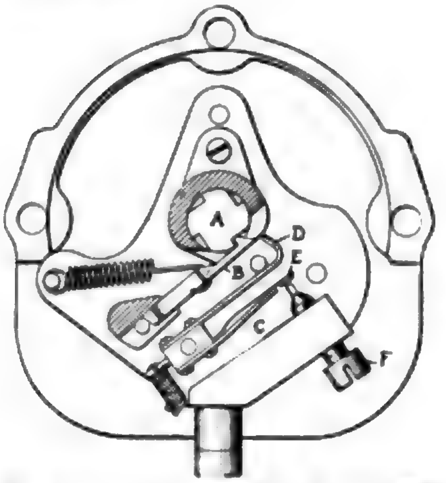


Fig 2.—Plan of Contact Maker, with Snapper B Just Released.

spark by turning the screw F, but it is always brief. The notches in the shaft A are very accurately milled, and are glass-hard, and it is claimed that the synchronism of the sparks is perfect. The Unisparker is furnished to run either right handed (clockwise) or left hand (counter clock-wise).

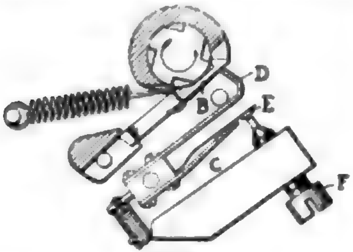


Fig 3.

The distributor casing is of hard rubber, and is held by three screws. Four posts in the casing (or as many as there are cylinders) connect to the spark plug cables. A central post receives the high tension current from the coil and carries it to the distributor blade. This blade is carried by a hard rubber block, removably mounted on the contact maker shaft.

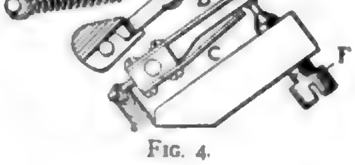


Fig. 4.

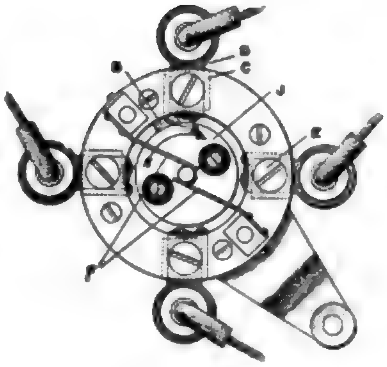
The coil box, of unusual size, is mounted on the dashboard. The condenser is enclosed with the coil, and the switch is mounted on the box. On closing the switch, snapping the lever to the left against a special contact permits the engine to be started on the spark when there is fresh gas in the cylinders.

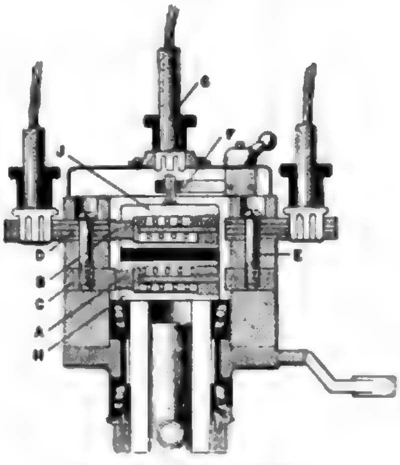
The positive and negative wires from the battery are connected to binding posts under the coil box. Two primary wires run from the coil to the contact maker. One secondary cable connects the coil and the distributor, and four cables run from the distributor to the spark plugs. The body of the contact maker is rotated by a lever in the ordinary manner for spark advance and retard.

The Battery Saving Timer.

The Autocoil Company, of Jersey City, N. J., have placed upon the market a timer with two sets of contact segments and contact brushes, forming practically a double timer on a single shaft and in a single housing. The object is not, however—as might possibly be concluded from a comparison with the practice of duplicating other ignition parts—to make use of the one in case the other should fail in service, but, rather, to use one for all ordinary motor speeds and the other for high speeds, and thus to obviate waste of current at low speeds. It is well known that in order that the coil vibrator may operate properly at the highest speed of the motor the timer segments must be made to subtend a considerable arc, the usual arc in a four cylinder timer being 45 degrees. This is a much larger arc of contact than is required for normal speed. Suppose, for instance, that it suffices for a speed of 2,100 r. p. m., then the length of contact at 700 r. p. m., which would probably correspond nearly to the average speed of the motor, would be three times as long as necessary, and there would be a corresponding waste of current.

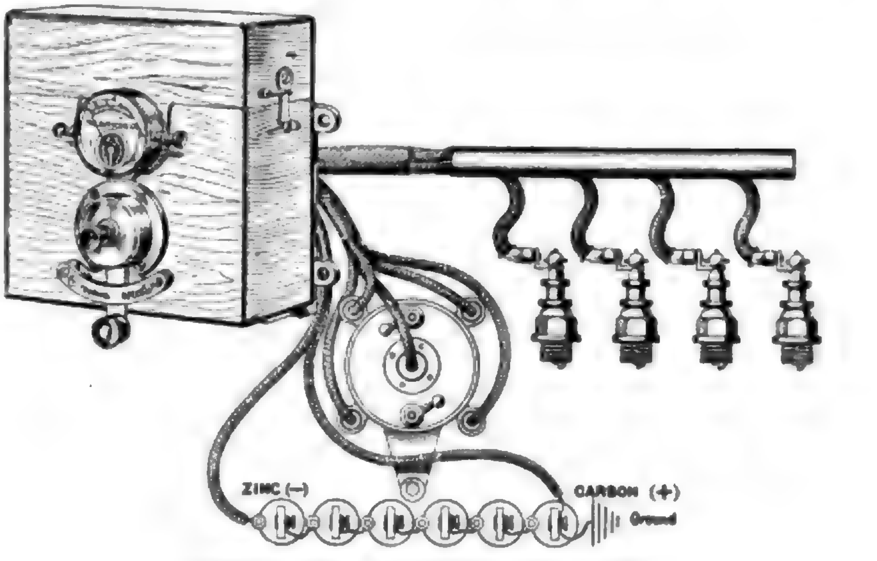
In the Battery saving timer the two sets of segments are therefore of different size, the segments C near the back of the instrument giving a contact of only 15 degrees and the other segments, D, giving a contact of 45 degrees. Ordinarily only the first set of segments (C) is active, owing to the fact that only the corresponding brush, A, is permanently grounded. The other contact brush, B, is carried in an insulated holder, as indicated by the heavy black layer of insulating material between it and the first mentioned brushholder. A pair of brushes F is provided, however, bearing against a central pin on this brushholder, which connect through the cable G to the switch on the front of the coil box, by means of which this brushholder can be grounded. If this is done both sets of contacts are operative, and the contact then lasts for 450 revolutions. The two positions of the switch are marked "Speed" and "Touring," respectively.





Battery Saving Timer.

With engine at rest the coil units are set to draw three-quarters of an ampere. With the engine running and the lever in the "Speed" position (full length timer dwell), the ammeter will read about four-tenths of



Wiring Diagram of Battery Saving Timer.

an ampere. With the foot switch in "Touring" position, the ammeter will read about two-tenths of an ampere, and with this low current consumption the engine is properly fired for all car speeds up to 40 miles an hour, it is claimed.

A New Hess-Bright Magneto Bearing.

The Hess-Bright Manufacturing Company are now offering for general use a new magneto bearing that has been tested out by a season's practical use. This magneto bearing follows in the main the general annular type of which this firm was the originator. Fig. 1 is a cross-section. The inner race is grooved in the usual way, but the outer race is grooved at one side only. The balls are held in a special short steel retainer. A dismembered group of the three elements, inner race, ball retainer with balls, and outer race is clearly shown in Fig. 2.

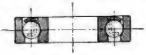


FIG. 1.

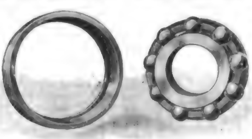


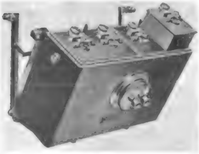
FIG. 2.

Three sizes are at present being regularly furnished:

	Bore.		Diameter.		Width.	
	M/M	Inches.	M/M	Inches.	M/M	Inches.
7882 ...	10	.39370	28	1.10236	8	.31496
7802 ...	15	.59055	35	1.37795	8	.31496
7778 ...	17	.66929	44	1.73228	11	.43307

Worcester Spark Coils.

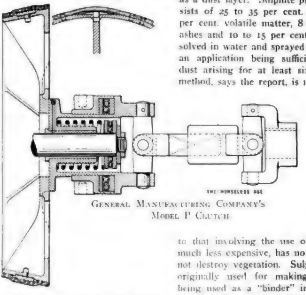
W. H. Leland & Co., Worcester, Mass., have brought out a line of spark coils for general automobile use. The coils are fitted with solid brass mounting, and the vibrators have contact points of iridio-platinum in the form of rivets. Ordinarily the coils are furnished with a plug switch for battery use, but a special magneto switch can be furnished when the coil is to be used in connection with a magneto. A special feature of the coil is a novel method of mounting on the dashboard by means of swinging brackets. This method admits of the coil being mounted on low dashes with curved tops. The swinging brackets are clearly shown in the accompanying cut. In order to remove a unit the coil is swung forward on the brackets, as shown. There are no connections on top of the units, so the units can be removed instantly.



WORCESTER COIL.

The General Manufacturing Company's Cone Clutches.

The General Manufacturing Company, of Elkhart, Ind., have placed on the market a line of cone clutches comprising several different designs and various sizes of each. A sectional view is shown herewith of the Model P clutch. The cone proper is cast of aluminum and is faced with the so called J-M special covering, composed of woven brass wire, with asbestos and canvas weave, made in one piece to fit the cone. It will be observed that a number of spring plungers are provided to cause the cone to engage first at a certain number of points. The main housing of the clutch is of cast steel, while the shifting cover and the shaft bushing are made of hard phosphor-bronze. The clutch is connected to the change gear by means of two universal joints of simple design, with a square slip joint between them The clutch spring is entirely enclosed and bears against a ball thrust collar. The shifter yoke also contains a ball thrust collar.



GENERAL MANUFACTURING COMPANY'S MODEL P CLUTCH

The Plymouth Motor Truck Company Failure.

In connection with the bankruptcy proceedings against the Plymouth Motor Truck Company, of Plymouth, Ohio, to which we referred in our last issue, we learn that A. M. Trago, a Plymouth banker, has been appointed receiver, and his bond has been fixed at $10,000. The truck company a short time ago made a proposition to the Norwalk, Ohio, Chamber of Commerce to remove to that city. The petition for a receiver was made by the J. B. Fate Company, who state that on June 12 they loaned the truck company $5,500, but received a promissory note, due and payable on demand, for only $2,500. The $2,500, it is alleged, was payable on November 1, and the $3,000 on November 30. It was further alleged in the petition that the truck company owe other creditors amounts aggregating $30,000, which they are unable to pay. The petition stated that the company had contracts for a large number of cars, but could not possibly build them unless a receiver was appointed and given court authority to proceed with the business.

Sulphite Pitch as a Dust Layer for Roads.

Consul George E. Eager, of Barmen, Germany, in his report on sulphite pitch or selpech, describes its application to roads as a dust layer. Sulphite pitch, which consists of 25 to 35 per cent. coke, 50 to 60 per cent. volatile matter, 8 to 12 per cent. ashes and 10 to 15 per cent. water, is dissolved in water and sprayed over the roads, an application being sufficient to prevent dust arising for at least six weeks. This method, says the report, is much preferable to that involving the use of oil or tar, is much less expensive, has no odor and does not destroy vegetation. Sulphite pitch was originally used for making briquettes, it being used as a "binder" in place of coal tar pitch, by reason of its higher burning temperature, its hardness and the fact that it can "bind" coke dross and gravel which the tar pitch cannot do.

Google

COMMUNICATIONS

A Remarkable Case of "Starting on the Switch."

Editor Horseless Age:

I believe that the following unusual experience is both interesting and instructive, because it at first thought seems impossible, and I have found but one garage man who knew of such an occurrence. About a week ago my Cadillac four cylinder missed just a little on the road. The miss was not at all bad, so, being near home, nothing was done. Once in the garage my friend and I removed all four plugs, took them apart and cleaned each part thoroughly. We then reassembled them and screwed them back into the motor. As there was no reason to hurry, I suppose we spent at least fifteen or twenty minutes on the job. I then threw on the switch, preparatory to cranking for a test run, and the motor started on the switch. We could hardly believe our eyes and ears, but there was Mr. Motor running as nicely as it ever did. Here is a demonstration which proves that starting on the switch does not depend on the compression. This motor had no compression whatever and yet started when the spark was produced. It demonstrates that the esential element in starting by the switch is the mixture—and that the mixture may leak past rings and valves until it drops to the ordinary atmospheric pressure, and still be sufficiently explosive to throw the motor over if ignited. It is the common belief that if a motor stands several hours and then starts on the switch such starting demonstrates a high degree of perfection in the fit of the rings and valves, and the retention of the mixture under pressure, i. e., under compression. That belief cannot stand analysis, in the face of the above described occurrence, though of course a mechanically tight cylinder will start by the switch more often than a leaky one.

E. H. Baldwin.

Action of Commercial Gasoline on Galvanized Tanks.

Editor Horseless Age:

We have discovered a very remarkable condition of affairs, viz., that galvanized iron gasoline tanks are being corroded on the inside by the action of gasoline. The zinc seems to be disintegrated and is thrown off as a reddish precipitate. This, of course, opens the joints and eats away the coating around the rivets, so that galvanized tanks are very likely to leak when being used continuously as gasoline reservoirs.

We found that such action did not take place when a pure block tin coating was used instead of zinc. This led us to look into this matter still further and we wrote to several of our chemical friends.

We have not yet arrived at a satisfactory conclusion of the matter, but quote from a letter just received from one of our interested parties which might be of value as a topic of discussion in your columns.

Will you please introduce this topic for a discussion to throw some light on the question as to why a galvanized iron tank gives off a reddish grit or dirt when used with gasoline and why a tin coating is so much superior? We have never noticed dirt or grit or trouble from tinned tanks, and are exceedingly interested to know what is the reason of this.

Our customer writes us as follows:

"In replying to your several letters will say that we have run up against some surprising facts in our chemical research for the cause of the action of gasoline on zinc and galvanizing.

"We were aware and have always known that pure gasoline will not attack any metal; but we knew from the action we had observed within the last five or six years that there was some foreign substance in gasoline that positively would attack zinc, but yet did not attack tin, and will say in our going into the matter found the cause, but have not our proofs in such a way as to a positive conclusion. However, for your confidential information, will say that a great percentage of gasoline we have now is not the regular distillation of petroleum, but is manufactured gasoline from the heavier oils.

"We will go into this thoroughly when we see you, but at present we will only say that it is the acid in the gasoline that attacks the zinc. This may be citric, sulphurous or sulphuric, but nevertheless after it is poured through the air into the tanks and shaken around there is no question but what some sulphuric is shown, which very readily attacks the zinc and causes the action which we have described."

Janney, Steinmetz & Co.

Ball Bearing Crank Shafts.

Editor Horseless Age:

The use of ball bearings on crank shafts of gasoline motors is not a question of engineering possibility—that is settled by the fact that thousands of motors are successfully and satisfactorily equipped with and running on ball bearings. Such use ranges from motorcycles to torpedo boat motors. In the former case the load is one of a relatively few pounds. In the latter case the load per bearing runs up to 14 tons.

But it is not engineering feasibility alone that is a determining feature. There is also the question of cost. That is best considered in the light of the fact that the ball bearing crank shaft is the regular practice for a considerable number of years of many builders of automobiles.

With the feasibility from an engineering and from a cost standpoint thus proven by the best of all tests, practice, there is the question of durability. This again is definitely proven by the continued use, year after year, of the ball bearing crank shaft by the builders of four and of six cylinder motors of from 15 to 50 horse power, as well as of the smaller motorcycle engines.

There remains the question of noise. Every builder of anti-friction bearings knows and every candid and reputable one will tell his clientèle that the only absolutely quiet bearing is a plain sliding journal well oiled. That does not mean that the ball bearing is necessarily noisy; quite the contrary. We have such bearings in use on organ blowers where even the slight hum of the electric motor must be masked. What it does mean is that sounding box constructions and all sound magnifying constructions must be avoided. There is even a very decided indirect benefit, since the most efficient mountings and mechanisms happen to be those that are without such sound magnifying or resonant effects. The cutting out of ball bearing noise has thus frequently resulted in the cutting out of noise producing elements generally. Some builders find ball bearings noisy in their motors, others do not so find them. The difference lies in the motors and usually in some rather small and apparently unimportant structural details. The writer agrees to find the cause and remedy the matter for any motor whose builder is sufficiently interested to send it to him for that purpose and to do that work free of all charges.

The ball bearing is in itself a new element of mechanism; possibly this should be modified into "relatively" new; relative as compared with the antiquity of the plain journal; but absolutely new where knowledge of correct construction, material, workmanship and application is concerned. It is so trite an experience as almost to require no statement even that before any new thing is generally adopted there will be much trial, abandonment and retrial, and then final general adoption. The ball bearing is no exception. In its various forms it is daily going into use by the many thousands. It may therefore be conceded, notwithstanding its relative youth, that the ball bearing has, as our French cousins would say, "arrived."

The crank shaft use of the ball bearing is in an earlier stage, that of trial, success by many, failure by a few, retrial and in many cases final adoption. The instances of definite failure are almost none. The cases of dissatisfaction because of failure to recognize or unwillingness to properly adapt other conditions to the requirements of the ball bearing are more numerous. In this connection a very general trait of humanity is interestingly brought out, since such trouble is experienced by the better automobile builders, whose self reliance prompts them to ignore the advice, aid and experience of the ball bearing specialist. On the whole, though there are defections among the users of ball bearings for crank shafts, there are more accessions.

This communication is prompted by the receipt of a letter from the Pope Motor Car Company, from which I quote:

"On page 759 of *The Automobile* of November 20, 1908, appears an interview ——, in which he says: 'The other is the abandonment of ball bearings for crank shafts in favor of plain bearings in notable instances.' Now, our Pope experience with ball bearings in the crank shaft has been that by the use of these ball bearings all bearing trouble in the crank has been eliminated. When we adopted this style of bearing it was with us more or less of an experiment, and was watched with a great deal of interest, but we have yet to replace our first ball bearing in a crank shaft. This is probably due to the peculiar construction which we employ, and which construction is patented, and that is casting steel plates integral with the engine base, so that when the steel yoke and engine base are machined to carry the bearings the ball bearing is carried on a steel cradle or yoke, which extends its whole diameter.

"If any of the foreign makers have had trouble with ball bearings in the crank case it must have been due to inferior bearings or inferior mountings, and we believe that in justice to the ball bearing crank shaft and yourselves you should take some extended notice of ——— criticism and refute his statements of facts as they exist in this country."

It was not my original intention to say anything on this question of ball bearings for crank shafts. I know that the ball is rolling, and that, though there will be occasional halt and slowing down, the essential desirability of the ball bearing crank shaft, coupled with the already fairly considerable and in every way satisfactory and successful use, will give it an increasing momentum. The logic of events and not anything that I can do or say will govern. But it did seem to me that the request of a pioneer user such as the Pope Manufacturing Company could not be ignored. The virtual command of a second letter, "We think that what you ought to do, for your own sake and for the sake of hundreds of other users of cars, and also manufacturers who are using your bearings, is to come out with a strong statement," could not be ignored.

HENRY HESS.

Charge Distribution.

Editor HORSELESS AGE:

The article by Mr. Bickford, relating to the action of gasoline in the induction pipe, brings to the writer's mind an experience he once had with a four cylinder, two cycle motor. This motor was set on a slight incline, the front being perhaps 2 inches higher than the rear.

The trouble with the outfit was that the rear pair refused to fire, although when set level everything worked beautifully. Everything pointed to carburetor trouble, so, in order to learn precisely what was going on, a piece was cut out of the induction pipe on each side of the carburetor and covered with transparent celluloid. This revealed an astonishing state of affairs. Owing to the incline the rear pair got far more raw fuel than the front pair, and the gasoline could be seen running along the pipe in a regular stream. The front engines seemed to be running on a mixture that was perfectly vaporized.

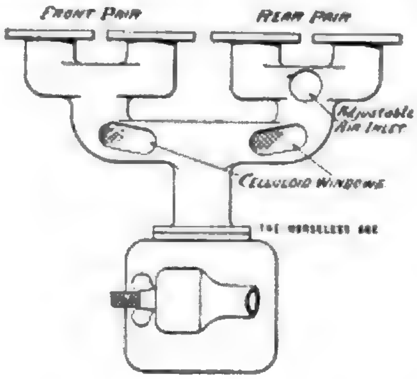
This meant that a special inlet for pure air had to be fitted to the rear pair. This had to be hand regulated, as at different speeds more or less air was required. In connection with this new air inlet another trouble arose.

Owing to the action of the two cycle suction (which is, of course, very quick and sharp) the gas would be set rapidly in motion for an instant, but when the piston covered the port again the gas, having once been set in motion, refused to stop, and would therefore rush out of the easiest exit, which was the extra air inlet.

Gas escaping from this opening prevented a cover of any sort being put over the engine, as a spark would no doubt have ignited any gas which would have been sure to accumulate. I fail to see why all motors set on an incline are not effected by the action mentioned.

Mr. Bickford rightly says that either of two things (which he describes) tends to momentarily slow the engine on opening the throttle while the motor is turning slowly, but should he not add that the increase in volume of the charge is more difficult to compress, and the flywheel may not have enough stored energy to meet the extra demand?

H. B. GREENING.



Says Deafness Should Not Bar a Man from Driving an Auto.

Editor HORSELESS AGE:

I have been a reader of THE HORSELESS AGE for more than five years, and have found much to interest and instruct me in caring for and running an automobile. I have been much worried over Mr. Huddy's proposed automobile legislation in last week's issue for New York State.

I have run an automobile for six years, and in that time I have never frightened a horse so that it ran away. I never had an accident, and never have had to be towed in but once, and then it was on account of broken balls in the bearings. In fact people tell me that I am the safest driver in the city. I am quite hard of hearing, and Mr. Huddy's proposed law would bar me from running my auto; but I assure you that if anything went wrong with my engine I would know of it as soon as a person with acute hearing.

There is an old engineer at Binghamton, lately laid off by the Erie Railroad, on account of the age limit. He is quite hard of hearing, and has always been so, and yet all of his life he has been one of the Erie's most trusted engineers, and has most always had the fastest trains.

I also knew a man who was very deaf who ran Erie freight trains as conductor for thirty-five years, and he told me that in all his life he never had a train accident that cost the company $100, a most remarkable record for any man to show.

Mr. Charles Thomas, of our place, the inventor of the Thomas shock absorber, is quite hard of hearing, and yet you would be as safe riding with Mr. Thomas as with any other man you could select among auto drivers.

Here is one more instance. A noted doctor of Waverly is very hard of hearing, and some years ago he was traveling in the West. He talked with two men at a way station. These men boarded the train, and later went out on the platform and laid their plans to hold up the train. One of the men said to the other: "Be careful, that old man will hear you." "Oh," replied the other, "he is so deaf he could not hear it thunder." But the doctor did hear, and told the conductor, and two desperate train robbers were caught.

I have made a long letter, but I do not wish to bore you with it. Am of the opinion, however, that a little deafness or much deafness ought not to bar a man from running his auto, as he can tell by the sense of touch or feeling if anything goes wrong. He is ever on the alert, and in most cases would be a safer driver than one who had good hearing to depend on.

I think the auto driver has no more rights than the driver of any other vehicle, and should be just as liable, and that the law should be enforced, but I know that it is not. But to bar a man on account of his hearing would be an injustice to me and many others who obey the law.

S. D. BEACH.

Arrested and Fined for Exceeding the Four Mile Per Hour Limit.

Editor HORSELESS AGE:

I enclose a copy of an affidavit from my chauffeur. Is there any redress for such outrages?

A CONSTANT READER.

(ENCLOSURE.)

STATE OF NEW YORK, ss.:

Before me came James Dougherty, to me personally known and known to be the person who signed this affidavit, and being duly sworn deposed and said, that on the first day of December, 1908, he was driving a White steamer automobile, with C. de P. Field, his wife and Howard James as passengers, and when nearing the curves and bridge near Echo Lake, in the County of Westchester, he slowed down the automobile so as to reduce the speed to 6 miles an hour when taking the curves and crossing said bridge, accelerating the speed to about 10 miles an hour after passing said curves and bridge. That his occupation is that of chauffeur, and that from experience in driving automobiles with odometers and speedometers he feels competent to properly judge of speeds. That about half-past twelve o'clock, noon, on the said first day of December, 1908, some man unknown to him ran a rope with a red cloth on it across the road, and Samuel Purdy came up and arrested him, got on the automobile and directed him to the house of Ogden S. Bradley, a justice of the peace, who fined him, the said Dougherty, ten dollars for taking the aforesaid curves and crossing the aforesaid bridge at a speed exceeding a mile in fifteen minutes. That C. de Field paid the said Justice Ogden S. Bradley, under protest, ten dollars, asking a receipt, which the said Ogden S. Bradley refused to give. That he was ignorant of any State law limiting the speed of automobiles to one mile in fifteen minutes on curves and crossing bridges. That he was informed that the supervisors of several townships, including that containing Echo Lake, had been consulted requesting a statement of the speed limits allowed in the said township, and that the lowest speed mentioned was 10 miles an hour. That the said Ogden S. Bradley acknowledged that his assistants were unable to catch those driving automobiles at a rapid rate, and that he feels it a hardship to be arrested and fined when he was endeavoring to do his duty and obey the laws.

(Signed) James Dougherty.

Sworn to before me, a Notary Public, this 7th day of December, 1908.

(Signed) James J. Echingham,
Notary Public, N. Y. Co., 41.

[Your chauffeur should have demanded a trial at the time he was arrested and about to be fined. He was entitled to adjournment of the proceedings in order to procure counsel and prepare his defense. The speed limit at curves is 4 miles an hour. The fact that the defendant was ignorant of the law constitutes no excuse. Moreover, you had no right to demand a receipt from the justice of the peace.

In all probability, if your chauffeur had requested an adjournment and a jury trial of six, he would have been able to put in a substantial defense on the merits. If the evidence against your chauffeur was not based on a stop watch or a speedometer his chances would have been fairly good for an acquittal.

There is hardly anything which you can do now, considering that the incident is closed, and also considering the fact that the defendant did not demand a respect for his rights. There is hardly any doubt, however, but what the complaint under which he was prosecuted is defective, in which case you could obtain a reversal of the fine upon appeal to the County Court. This would cost you more than the amount of the fine, but if you wished to stand upon principle you could take this step.—Ed.]

The Most Advantageous Offset.

Editor Horseless Age:

In your Engineering Number of October 2, 1907, on pages 490-49, is an article by F. E. Watts, on "The Most Advantageous Offset." Now, he obtains his results from the piston inertia, as well as from the side thrust. His formula for figuring piston inertia is not clear to me. I think there is some part of the formula which is not explained. He says:

$\frac{F}{a}$ = inertia of reciprocating parts in pounds per square inch of piston area.

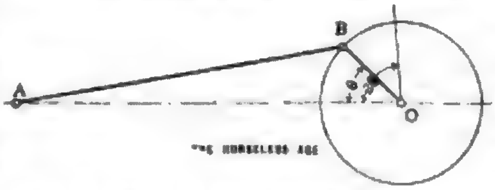
Formula $\frac{F}{a} = .00034 \frac{W}{a} N^2 r\ (\cos.\ \theta + a \cos.\ 2\theta)$.

$\frac{W}{a}$ = weight in pounds of reciprocating parts per square inch of piston area.

N = r. p. m.

r = crank radius in feet.

Now what I don't understand in the formula is the factor a_1 and what angles he uses the cosines of. I would like to get a little information on this, as I am figuring out the inertia of the reciprocating parts on several sizes of motors now. One problem I had was to find the maximum inertia of the reciprocating parts of a 4½x5 inch engine at 2,000 r. p. m. The weight of piston, rings, pin and reciprocating part of rod is 8.75 pounds. I give you this as an example of the problems I have to work on.



One more question I would like to ask is, Why is it necessary to work out the inertia per square inch area of piston? Mr. Watts first divides by a to get $\frac{W}{a}$, then when you get the result you have to multiply by a to get the total inertia. Why not work directly?

Wm. R. Gordon.

[The nomenclature is that usually employed in text books. The reason I did not state what a_1 signifies is that I have used tables for the parenthetical part of the expression for some years.

$$a_1 = \frac{r}{l},$$

where r is the crank radius in feet and l is the length of the connecting rod, also in feet.

θ is the angle which the crank makes with the centre line of the cylinder, or, in other words, with the upper dead centre position. This may be seen by looking at Table 1 in the article referred to, also by looking at Fig. 3, and comparing the inertia lines with the indicator card. The angle 2θ is, of course, twice the angle θ. In using these angles it should be remembered that the largest angle possible with the dead centre is 180 degrees.

Full explanations of the derivation of this formula will be found in Lucke's "Gas Engine Design," Dalby's "The Balancing of Engines," and in many other good works on steam and gas engines. I heartily recommend anyone doing such work with gas engines to buy the first mentioned book because of the many time-saving tables it contains.

The reason for calculating the inertia in pounds per square inch of piston area is that indicator diagrams ordinarily give the cylinder pressure in pounds per square inch, and it is customary to combine their lines with the inertia lines to get the total forces acting on the crank pin in pounds per square inch.—F. E. Watts.]

Generators versus Gas Tanks.

Editor Horseless Age:

Mr. Rushmore's letter in your issue of December 9 seems to call for some reply. Considering Mr. Rushmore's own position, it is decidedly amusing to hear him assume that Mr. Hall must be a heavy stockholder in some storage tank company, to account for Mr. Hall's views on gas tanks; a bad case of the pot calling the kettle black.

In the course of a considerable experience with both gas tanks and generators (the latter not of the Rushmore make, it is true) I have had no trouble whatever with the reducing valves of the gas tanks and a great deal of trouble with generators that refused to generate. Moreover, it seems to me that it is better to have one foot of gas on hand than two feet in the shape of carbide.

G. H. G.

Starting the Motor in Cold Weather.

Editor Horseless Age:

To facilitate starting a gasoline motor at low temperatures I offer the following plan: I have fitted my auto gas tank with a two-way cock with check valves. Gas is piped from one to the lamps as before, and from the other to the intake pipe. By turning on the gas to the intake pipe about as I would to the lamps explosions are secured always upon the second and usually upon the first throw. After allowing the motor to run for a few moments I shut off the gas slowly and the motor then runs upon gasoline. This may be a well known wrinkle, but I have never seen or heard of its use, and offer it for the good of the cause.

H. M. Wheeler.

The next monthly meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building on Tuesday evening, January 12. The paper will be by Carl G. Barth, of Philadelphia, upon "The Transmission of Power by Leather Belting."

Concerning the Paris Show.

The outside appearance of the Paris Show, writes M. P. Maisonneuve, one of our French contributors, gives unmistakable evidence of attempts at economy; moreover, the majority of the stands have the same decoration as last year, and the fact that the commercial vehicles are to be shown in the same building as the touring cars, after the latter have been moved out, proves that the promoters of the show desired to avoid the cost of temporary structures to which they had recourse in previous years. At the moment the question is even being discussed whether a show shall be held in 1909, and whether the Grand Prix of the A. C. of France will be run. The decisions in these respects may have unforeseen results on the French automobile industry, which is already being sorely tried by the crisis in the market.

This crisis, which affected particularly the sale of large cars, has directed the French industry toward a more practical type of vehicle, not to the so called voiturette, the counterpart of the American runabout—the French public not wanting any but four passenger cars—but toward the light car, with motor of moderate power.

The desirable customers in France are those who want a substantial vehicle, with seats for four persons, consuming little fuel and supplies, and as well adapted for use in the city as for touring. It is for this reason that a voiturette will not fill the bill. Speed is a secondary consideration, but the selling price for the chassis must not exceed 7,000 francs.

Being in possession of this data, the manufacturers have brought out the types which they exhibit this year; that is to say, in addition to cars of 24 horse power and more, they continue their models of an average of 12-16 horse power, already built the previous year, and have brought out new ones only slightly different from the latter, but of still lower power, 9-11 horse power, or 8-10 horse power, for instance. Some firms, like De Dietrich and Panhard, build two cylinder cars, but the majority of the manufacturers employ the four cylinder monobloek construction, in which all the piping is cast integral with the cylinder, it being only necessary to connect the carburetor to the inlet ports by a tube several inches long. All inlet and exhaust manifolds are thus done away with.

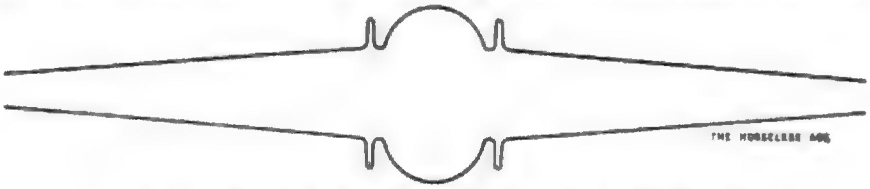


FIG. 1.—NEW FORM OF LIVE AXLE FOR SMALL FRENCH CARS.

These motors have only two bearings for the crank shaft, and some of them have the valves and springs completely covered in by a removable cover. Passages in the bottom wall of these valve housings permit oil from the crank casing to enter the housings, thus lubricating the valve stems in their guides. In this manner the friction and the noise of the valve mechanism are diminished.

With one or two exceptions these small cars are fitted with shaft drive. In the design of the transmission great care has evidently been bestowed upon the features of accessibility and simplicity. The disc clutch is making only slight progress. Many manufacturers use the leather faced cone clutch, which they render smoother acting by placing rubber pads or springs under the leather.

Much progress is being made in the design of rear live axles. The majority of the designers, recognizing that the ordinary type of rear axle is of insufficient strength, have introduced a very heavy modification, either by reinforcing it by a solid yoke, as in the case of the Peugeot live axle illustrated on page 552 of THE HORSELESS AGE of October 21, or by forming the axle housing of two cones of pressed or forged steel, bolted to the differential housing. The single universal joint system is used almost exclusively. With the object of decreasing the size of the differential gear housing, the Delahaye firm fits its new 9-11 horse power motor with a set of reducing gears contained within the motor frame. This firm in its four speed gear boxes obtains the direct drive on the third gear, a practice already adopted by the English Daimler Company.

Leaving this type of car, which obviously constitutes the novelty of this year's Salon, we encounter only very few improvements of any importance. Attention should, however, be called to the very marked tendency in favor of the following carbureting system:

The carburetor is adjusted so as to give a very rich mixture; this mixture is led to the motor through a small pipe; at a few inches from the cylinders this small pipe joins the manifold, which is of the usual size, this manifold containing the supplementary air valve and the throttle valve. The proper mixture is therefore formed only in the manifold.

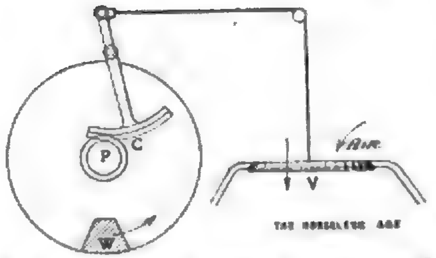


FIG. 2.—DIAGRAM OF ZEDEL VALVE MECHANISM.

In the Zedel car the automatic inlet valve is arranged, as shown in Fig. 2, the valves being placed in the heads of the cylinders. The air inlet valve V is drawn back to its seat by a counterweight W located on the periphery of a small wheel. This wheel is provided with a pinion P meshing with a sector C, which is secured to one end of a double armed lever, the other end of which connects by a cord to the inlet valve V. When the valve is opened by the suction in the cylinder the counterweight W moves in the direction indicated by the arrow, and after the suction ceases the weight W returns to its original position, and this closes the valve. The balls closing the air inlets in the Grouvelle-Arquembourg act on the same principle, but without the transmission by pivots, pinion and sector, which is really a little bit complicated.

Harrisburg A. C. Plans Endurance Contest.

The Harrisburg A. C., in view of the fact that the Glidden Cup contest is to be held in the West next summer, is planning to organize a four days' endurance run for the East. No details have as yet been settled, but it is said to be likely that Philadelphia and New York will be among the night stops. The Harrisburg club will invite the co-operation of a number of other clubs, and thus add to the success of the run. One of the new features planned is to have the official observers report everything done to the tires during the run. The Harrisburg club states that it has "developed" an experienced contest committee, and has in the past enlisted the services of well known automobile experts to act for it as contest officials. It also points to the fact that there were no protests in connection with the two previous endurance contests organized by it.

Business Opportunities.

A request has been received at the office of an American consular officer in a European country from a local engineer expressing a desire to become the agent of some American automobile firm. The consular officer states that he is in good standing and should make a satisfactory representative for firms desiring such a connection. In writing to the Bureau of Manufactures, Washington, D. C., for the address, refer to No. 2,898.

An American consul in western Europe reports that a company has been organized for the purpose of establishing automobile service for the city in which he is located. It is proposed to increase the stock of the company as business grows. The consul has forwarded the company such catalogues of American cars as he had on file, and suggests that manufacturers write direct to the directors of the company, whose address is given in the report. Refer to No. 2,908.

The Tariff Hearing.

WASHINGTON, December 21.—A hearing before the Ways and Means Committee of the House of Representatives was granted on Saturday to W. C. Durant, of the Buick Motor Company, Flint, Mich., who said that the Buick Company is opposed to an increase in the tariff on automobiles, is opposed to the retention of the present tariff, advocating a separate classification, with a duty of 20 per cent., with 50 per cent. duty on automobile parts.

Mr. Durant gave as his reason for advocating reduction of tariff: "The Buick Motor Company is attempting to establish a permanent business. They already have an investment in plant and equipment of $1,450,000. They produced last year 8,796 machines. They contemplate producing next year 18,000 machines. They have employed in their plant, equipment and with their capital, about $3,500,000. The company believes that it would be unwise to encourage a tariff so high that at some future time, when the composition of this committee is quite different, we might not be able to present our case as well, and be obliged to submit to a wholesale reduction of tariff, to our very great detriment."

Mr. Durant denied that the Buick company owns a factory in Canada, but admitted that it had a slight interest in "an institution in Canada," which last year employed a capital of $65,000, and produced 197 automobiles. He made, among other assertions, one that the direct labor in the manufacture of an automobile selling at from $1,250 to $1,500 is about 14 per cent.; denied that his concern buys parts of machines abroad, and explained that his company is attempting to build up a trade in foreign countries.

He referred to the brief submitted by Henry B. Joy, general manager of the Packard Motor Car Company, as very complete, but he took exception to Mr. Joy's presentation, "for the reason that it does not correctly state the facts."

Mr. Durant explained that as a member of the Licensed Association committee he received a circular to the effect that 60 per cent. duty was necessary, and that a very careful scrutiny to prevent the undervaluation on the customs was necessary. On the 28th of November, a few days after he received the circular, he received a telegram asking him if Mr. Joy could represent him at the hearing, and asking him to urge the retention of the 45 per cent. duty. "I took the time to investigate," continued Mr. Durant, "and discovered that the whole plan is to protect, not the American workman, but to protect, in a great measure, extravagant management and enormous profits."

Mr. Durant explained the ability of his company to meet competition from foreign manufacturers as due to the fact that "we are attempting to build cars suited to the needs of the foreign trade," and added, "The foreign markets have been used by the manufacturers of automobiles in past years as a dumping ground, and American product, I am sorry to say, does not stand high."

His reference to the attempt of the Buick Motor Company to build up a foreign trade led later to the following passage between the witness and Representative Boutell:

Mr. Boutell—You have stated here that you contemplated building a factory in Europe; was that erroneous?

Mr. Durant—It is the intention of the Buick Motor Company to obtain a foreign trade.

Mr. Boutell—I asked if it was the intention of the Buick Motor Company or parties having an interest in it to build an automobile factory in Europe?

Mr. Durant—At this moment I could not answer that question yes or no.

Mr. Boutell replied to this that there was no use fencing with the committee, and before any further information was elicited Chairman Sereno Payne dismissed the witness, saying, "We have heard the gentleman for half an hour; we have not been able in the past few minutes to get any facts out of him."

The most interesting development in the course of the hearing was when Mr. Durant repeated his assertion that 20 per cent. represented his idea of what the duty on automobiles should be, in response to a specific question by Chairman Payne.

"I am satisfied," replied Mr. Payne, "that 20 per cent. would be a protective duty on automobiles. The only question is whether we should make it more for the sake of the revenue, and whether it is not a better thing to get revenue out of than most anything on the list."

"If it is a question of revenues," Mr. Durant began.

Mr. Payne replied that that is all there is of it, to his mind; that the committee did not ask Mr. Durant to come and argue; that it was willing to hear him, but that when the committee got at the facts, "we have our own notions how to apply them."

No other witnesses appeared to testify concerning the manufacture of automobiles, and the committee heard witnesses on several other subjects in order to give ample time to a hearing of Andrew Carnegie on the steel tariff at its final session Monday.

Technical Committee's Report on Worcester Endurance Contest.

The Franklin car entered by the Worcester Motor Company, and driven by C. S. Carris, proved the winner of the 200 mile endurance run held by the Worcester A. C. on December 12, having been penalized neither during the run nor in the subsequent technical examination. The report of the technical committee, giving the records of the individual cars, follows.

Rambler, driven by B. A. Robinson:

Loose pet cock on pump	1
Pin loose on spark control	1
Total	2

Cadillac, H. J. Murch:

Loose terminal on dash	1
Loose belt on rear end tie rod to radiator	1
Fastening bonnet	2
Total	4

American Gadabout, D. Lloyd:

Bolt gone, engine pan	1
Nut loose on throttle control	1
Loose grease cup on steering knuckle	1
Loose bolt in hood frame	1
Loose stuffing box on pump	1
Total	5

Knox Touring Car, Albert Dennison:

Loose nut on engine pan	1
Two loose spring clips	2
Two loose spring nuts	2
Loose adjusting collar on steering post	1
Total	6

Lozier Runabout, H. Cobe:

Loose screw in floor plate steering wheel	1
Ignition coil, three loose nuts	3
Ignition coil, one loose nut	1
Loose control head	1
Loose hose connection	1
Total	7

Premier, Ray McNamara:

Loose nut on steering knuckle	15
Loise spring clip	1
Loose dash bolt	1
Small leak in radiator	5
Total	22

Berkshire, E. B. Belcher:

Loose radiator	4
One bolt gone, crank case cover	1
One bolt loose, crank case cover	1
Three loose spring clips	3
Two loose spring bolts	2
Packing gone from exhaust	1
Loose bolt on exhaust	1
Three men two minutes	12
Total	25

Studebaker, Oswald:

Left mud guard loose	2
Left spring link upside down	5
Two loose bolts in left running board brace	2
Three engine frame bolts loose	3
Loose engine pan bolt	1
Loose steering gear joint	7½
Motor stopped five minutes	10
Three spokes broken, wheel brake broken	15
Motor stopped five minutes; eight and one-half minutes lost on control	9
Total	54½

Lozier Touring Car, H. E. Wilson:

Ten spokes in rear wheel broken	50
Nut on right spring clip loose	1
Three loose oil connections	3
Three loose nuts on coil box	3
One spring clip on rear spring loose	1
One terminal loose on magneto	1
Two loose spring clips	2
Left front bearing loose	1
Total	62

The committee in their report compliment drivers C. A. Carris, of the Franklin, and H. J. Murch, of the Cadillac, on having taken the full schedule time to cover their route, and they express the opinion that a majority of the penalization points on other cars were due to the attempt of the drivers to cover the routes in less than scheduled time. Four cars did not finish the course, viz., a White, a Jackson, a Knox sportabout and a Rambler.

Commercial Applications.

The Utility of Motor Trucks on Slippery Streets.

On Friday of last week New York city had its first really bad winter weather. The streets were covered with either a thick slime or deep slush, and the effects of these conditions on horses were in many cases heartrending. The writer happened to be on Duane street, where the truck traffic is particularly heavy, and where conditions in slippery weather are at their worst. As on many of the downtown streets, the paving is composed of "treated" wooden blocks, which, when wetted, soon make a treacherous foothold. Where the writer stood was a slight incline, with a car track in the centre, and without exception the poor horses had to work as if on a treadmill, sometimes not advancing an inch. A striking contrast was furnished by a large electric truck, which went through without a hitch, one truck driver, as he saw it pass, exclaiming: "Those things have us clean beaten on days like this." This driver was quite communicative, and said that he had just driven his team over from Brooklyn, and because of the conditions his horses were not fit to work any more for that day. He said that it was remarkable that the horses kept their feet as long as they did, the nervous strain and racking endeavor having taken all the ambition out of them. Motor trucks very seldom get stalled because of lack of traction, as in most cases the weight makes the tires cut through to a good holding surface. In any case, chains can be put on the driving wheels, thus insuring traction in all cases except where the snow is above the axles, when the truck acts like a plow. Most motor truck owners use their vehicles all through the winter, avoiding those streets which haven't been cleared or where the snow is too deep.

Motor Trouble Wagon for Milwaukee Street Car Service.

The Milwaukee Electric Railway and Light Company, of Milwaukee, Wis., has overhauled an old model touring car into a "trouble shooting" wagon, and its success will mean the replacement of all horse drawn repair wagons by motor vehicles. This company is under the same ownership and management as the Union Electric Railways Company, of St. Louis, which has these wagons in use. John I. Beggs, general manager of both companies, with headquarters in Milwaukee, is deeply interested in the development of the motor car, and has recently purchased a $6,000 French car, with limousine body, for his personal use.

Commercial Notes.

An automobile stage line will shortly be inaugurated between New York city and Lakewood, N. J. A round trip will be made every day, starting from the Hotel Knickerbocker, New York.

Edwin A. George and G. W. Blake, of Wyandotte, Mich., have recently started a motor express and freight service between that point and Detroit, using a number of Grabowsky power wagons.

Taxicabs will be introduced into San Francisco during the carnival parade on New Year's eve. A local firm has ordered four of the cars, and will place them in regular service on the 1st of the new year.

The fire department of Lansing, Mich., recently received a new motor propelled fire engine and hose wagon. The engine has a capacity of 700 gallons per minute, and can throw a stream of water 20 feet higher than a six story building, which seems to be the limit in Lansing.

Wm. Keyser, of Wheeling, W. Va., plans to establish a motor express service between Wheeling and Elm Grove, and has placed an order with a local agent for a 24 horse power, air cooled truck, capable of carrying 3 tons. Mr. Keyser also plans to establish a taxicab service.

What is claimed to be the longest automobile freight line in the United States is that between Croville and Brewster, in Okanogan County, Wash., the distance being 80 miles. Horses were used until recently, the trip being made in two days. The motor vehicles make the trip in about eight hours.

The Scranton Transfer Company, of Scranton, Pa., have ordered ten Thomas taxicabs, which they will operate from the station of the Lackawanna Railroad. Hugh Keenan is president of the transfer company. A number of taxicabs are now being operated in Scranton by the Scranton Automobile Company.

The Scranton Automobile Association has induced the Northern Electric Company to reduce the rate of toll for a round trip by automobile on the Northern boulevard from 25 cents to 20 cents. The motorists asked a reduction to 15 cents, but finally accepted the compromise and will not go to court in the matter.

Sander & Recker, Indianapolis retail furniture dealers, have purchased a 1½ ton gasoline truck for their delivery service in that city. The concern is a large one, but expects to do all of its city delivery work with the one truck. Several other Indianapolis furniture houses are also using trucks with considerable success.

It is reported that motor trucks are coming into extensive use for transferring freight in Minneapolis and St. Paul. Formerly it took two days to get a load of goods from one city to the other, while now the work can be done in one day. The reason the motor trucks were not adopted earlier is that the impression prevailed that they could not be depended upon during periods when the streets were covered with snow, but these fears have now been shown to have been groundless.

Briarcliff Race Plans.

The manufacturers' committee held a meeting in New York on Monday, December 14, as reported in our last issue, and decided to place a limit of 5⅛ inch on the bore of cars for the Briarcliff race, this limit corresponding to that adopted by the recognized national clubs at Paris recently, for the regular international races of the coming season. This decision of the manufacturers' committee elicited much adverse comment, as it barred the Lozier and other stock cars that took part in the contest this year. Another meeting was held on Monday of this week, and then the committee went even further and limited the bore to 4⅝ inches and the weight to a minimum of 2,300 pounds. This would bar practically all the American stock cars which took part in the race last year, and the decision seems to have been taken at the instance of the importers present at the meeting. The committee will request the A. C. A. to ask Mr. Law to change the deed of gift of the trophy so it can be competed for by special machines (under the present deed entrants must have sold or ready for sale ten absolutely similar cars to the one entered), but it is understood that Mr. Law, the donor, who is now in Europe, desires to promote stock car racing only.

Briarcliff Promoters Want Their Money Back.

It will be remembered that the Briarcliff stock car race, held last April in Westchester County, came near being held up by the authorities, owing to tardiness of the promoters in furnishing the $4,600 bond required by State Engineer Skene to guarantee the repair of any damage to the State roads by the racing cars. Mr. Skene after the race returned a little over $500, using the rest of the amount for repairs to the roads. The committee now questions the State Engineer's right to demand the bond, and asks that Mr. Skene show cause why he should not return the whole amount. A hearing on the matter will be held this week. Engineer Skene says he feels that he was within his rights when he demanded the bond.

Trade Literature Received.

The R. E. Hardy Co., of New York City.—Circular of the Moore timer.

The Dayton Rubber Mfg. Co., Dayton, Ohio.—Catalogue of Dayton airless clincher tires.

National Brake and Electric Co., Milwaukee, Wis.—Air compressors for industrial service.

Jackson Automobile Co., Jackson, Mich.—Folder containing specifications of 1909 Jackson models.

The Auto Coil Co., Jersey City, N. J.—Circular of 1908 Model Auto coils and of the battery saving timer.

The Gramm-Logan Motor Car Co., Bowling Green, Ohio.—Catalogue of Gramm-Logan commercial cars.

Packard Motor Car Co., Detroit, Mich.—Folder containing photographs relating to recent building operations of the company.

The H. H. Franklin Manufacturing Co., Syracuse, N. Y.—Folder giving some newspaper comments on the showing of the Franklin cars in the Glidden tour.

LEGISLATIVE and LEGAL

To Make Auto "Borrowing" a Misdemeanor.

Secretary George H. Seeley, of the Minneapolis A. C., is preparing a bill to be presented at the next session of the Legislature, which will make it a misdemeanor for any person to take out the motor car of another without the latter's consent. It is held that at present anybody who takes out a car and drives it around the streets is practically immune from arrest, there being no law on the statute books to cover an offense of this kind. In case the offender damages the car, he may be held for malicious destruction of property, and can be punished for it if he can be induced to plead guilty to the charge. Five high school boys were recently arrested in Minneapolis and admitted that they had "borrowed" and driven forty different machines. They accidentally set fire to one car while trying to start it up, and this led to their arrest. They were charged with malicious destruction of property and put on probation, three of them with a training school sentence hanging over them and the other two with workhouse sentences. There is a law among the revised statutes of Minnesota making it a misdemeanor to unhitch and drive away a horse and providing a fine of $5 to $100, or a workhouse sentence not to exceed ninety days. Secretary Seeley will base his ordinance on the above section of the revised statutes. The ordinance will also cover another offense, that of hiring a car for going to a certain place and then going a much greater distance.

Legal Notes.

The legislative committee of the West Virginia A. A. are framing a bill to be presented at the next session of the Legislature which will be similar to the new Ohio law.

Dr. Charles Wirth, of St. Paul, Minn., has brought suit against the Fawkes Automobile Company to recover $1,000, the purchase price of an automobile which, he claims, was not as represented by the company.

According to Charles H. Ballou, a deputy collector of internal revenue at Utica, N. Y., supply dealers or garage owners who make alcohol cooling solutions, and offer the same for sale, are liable to a special tax, but automobile owners may purchase the alcohol and make the mixture for their own use, without violation of the law.

The city of Anaconda, Mont., has passed an ordinance requiring all automobile owners to take out a license, for which a license fee of $2 must be paid. The ordinance provides for a fine of $100 for violations, and each and every day that the auto is operated without a license is to be considered a separate offense.

Robert Ibelle has brought suit against the Corbin Motor Vehicle Corporation, of New Britain, Conn., to recover $3,000 damages, he having been run over by one of the testers of the firm on October 7 while on his way to school.

The Rajah Auto Supply Company and C. A. Mezger, Inc., of New York city, have filed suits in the Federal court at Indianapolis against Ralph Burton, of Peru, Ind., charging infringement of patents in the manufacture of spark plugs. The case will be heard later.

The test case to determine the constitutionality of the Detroit ordinance under which Alexander Dow, of that city, was arrested for running an automobile in the business district at a speed in excess of 8 miles per hour, has just been decided adversely to the defendant by the Supreme Court at Lansing, Mich.

The Albany, N. Y., law firm of Bender & Hinman has commenced an action against Justice Hoppe, of Poughkeepsie, N. Y., who is said to have carried on a crusade against motorists in that district. The firm is acting for the Automobile Club of America, which is gathering evidence against the justice from its members. Justice Hoppe operated a police trap at Arlington, it is said.

Five Indianapolis boys have been arrested for automobile thefts, and the police will endeavor to send them to the Reform School or some other correctional institution. For some months many complaints have been made of automobiles being stolen for a few hours and abandoned in different parts of the city. Two or three cars have been wrecked. This is the first time the police have ever been able to capture offenders of this class.

The suit of H. H. Hubbard, a St. Paul garage owner, against Charles A. Wolfgang and Earl W. Mooney, to recover $230.71 for damages sustained by one of Hubbard's automobiles while being used by the defendants without his consent, resulted in a verdict for Hubbard against Wolfgang for $86.49. The car in question was rented by an employee of Hubbard, named Michaud, to Wolfgang and Mooney, and was run into a post and much damaged, owing to careless driving by Wolfgang.

At a meeting of the legislative committee of the County Commissioners' Association of Indiana, held in Indianapolis a few days ago, a committee of four was appointed to co-operate with the legislative committee of the Indiana Breau of Goods Roads in drafting a highways bill to be presented to the Indiana Legislature next month. The bill will provide for the creation of a State Highway Commission and the building of all roads under State jurisdiction. The two committees will meet within a few days. John W. McCardle, State Tax Commissioner, has suggested that a special State tax for road improvement be levied in the future.

Club Notes.

The Santa Clara County Automobile Club proposes to hold a four days' show in San José, at which Santa Clara dealers will be the only exhibitors, some time during February.

The New Orleans Automobile Club, of which T. C. Campbell is president and Homer George secretary, is promoting a three day automobile carnival, to be held on the Fair Grounds Track, New Orleans, February 20 to 22, during the Mardi Gras festivities.

Motorists of Allentown, Pa., and neighboring cities met at the rooms of the Lehigh County Agricultural Society on December 8 and decided to make application for a charter for the Lehigh Valley Motor Club. The application was signed by thirty-one persons.

The gold watch offered by the Bay State A. A. to the driver doing the most consistent work in the contest held by the association last September has been awarded to Frank E. Wing, who drove a Marmon car. The award of the watch was decided by the official observers.

The Chicago Motor Club last Saturday elected Thos. J. Hay treasurer, Chas. P. Root chairman of the contest committee, and David Beecroft chairman of the technical committee. F. E. Edwards was elected chairman of the ordinance committee, to succeed Chas. Metzger.

Wisconsin motorists are co-operating with the various associations of clubs in Minnesota to have the Badger and Gopher States included in the itinerary of the Glidden tour in 1909, and if not then, in 1910. The Milwaukee Automobile Club has been fighting for the honor since the last tour, and hopes to land it soon.

The Ulster County (N. Y.) A. C. held its annual meeting on December 14. Philip Elting was re-elected president, Dr. Harvey C. Keator was elected vice president, and Dr. H. F. Meinhardt secretary and treasurer. The good roads committee reported that the work of placing road signs throughout the county had been practically completed.

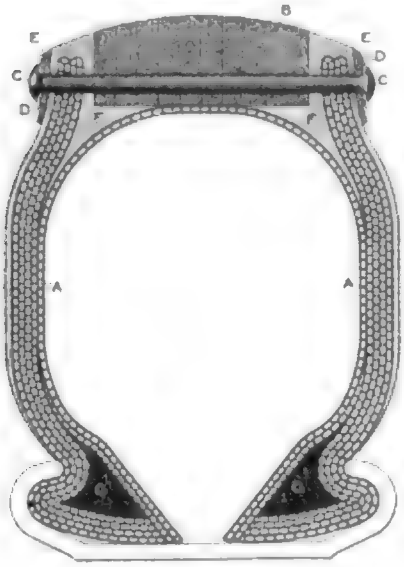
The Elmira (N. Y.) A. C., at a meeting held on December 11, decided to renew its membership in the New York State A. A. and the A. A. A. The following officers were elected for the coming year: Clay W. Holmes, president; F. N. Dounce, vice president; F. H. Rees, secretary; E. B. Crocker, treasurer. The club plans to make an active canvass for additional members at once.

At the last meeting of the San Francisco M. C. a legislative committee, with W. M. Klinger, a well known automobile insurance man, as chairman, was appointed. The club also decided to join the California Good Roads Association, and asked that Fernando Nelson, president of the club, be appointed director of the association. If this is done President Nelson will attend the good roads convention, to be held at Sacramento, as delegate.

OUR FOREIGN EXCHANGES

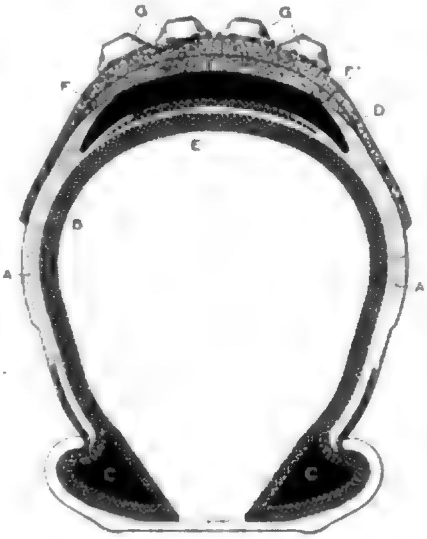
Tire Novelties at the Paris Show.

A number of new tire constructions exhibited at the Paris Salon are described in our French contemporary *Omnia*. The Ripert Company, of Paris, have brought out a pneumatic tire standing quite high above the rim and provided with a novel sort of tread. The principle on which this design is based is that leather resists frictional wear better when placed on end than when applied to the tire flat. The tread consists of a series of chrome leather sectors placed on end and strongly drawn together. The sectional view herewith clearly shows the arrangement. These leather sectors are held together by means of long rivets C, which also pass through flaps formed on the tire itself. Small leather strips E are provided to prevent contact between the rivet heads and the rubber portion of the tire. The sides of the tire are composed of several layers of vulcanized fabric, covered by rubber on the outside. Of these layers of fabric only a single one extends from one clincher to the other, to fix the size of the chamber for the air tube and separating it from the tread. The other layers of fabric are almost flat and end at opposite sides of the leather tread, being traversed by the long rivets C C. The whole is bound together by a mass of rubber F F. The leather tread renders the tire puncture proof, and the "on edge" arrangement of the leather reduces the wear. The puncture proof quality of the tread prevents moisture reaching the fabric, which, as is well known, is a most frequent cause of bursts.



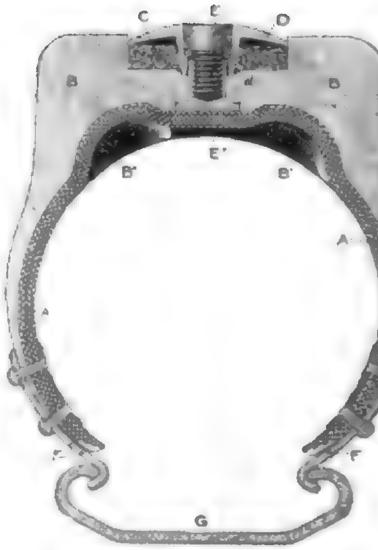
RIPERT TIRE.

Another novelty was the Samson black tread anti-skid tire. This tire has a leather cover consisting of two layers, designed to hold the rivets and to protect the tread portion of the rubber tire. The leather cover is made of black waterproof leather, the black color having been adopted simply as a distinguishing mark and the term "chape noir" has been copyrighted. The leather cover F F is molded with the rubber A before the studs are applied, so as to secure a more intimate joint between the leather and rubber. After the tire with the leather cover in place has been kept in the drying room for several days the conical head steel studs G are applied. These studs (the patent on which has recently been acquired by the Samson Company) constitute a solution of the much investigated problem of placing the steel studs of a non-skid tire after the leather cover has been applied. These studs are provided with extensions in the form of fish hooks which take hold within the leather. They form such a secure fastening means, it is claimed, that it is impossible to dislodge them without tearing away the protector itself. The conical heads are made of steel and hardened all through. Their durability is claimed to be much greater than that of ordinary non-skid rivets, which are only case hardened. The case hardening of these heads usually extends to a depth of only one millimetre, and after this surface layer has been worn off the rest of the head, being of soft metal, wears away very rapidly. This new black tread is fitted to special tire covers made exceptionally heavy to support the strains imposed by a non-skid cover and of a special rubber mixture particularly adapted to being vulcanized to the leather cover.



SAMSON BLACK TREAD ANTI-SKID TIRE.

Another novelty in the tire line has been placed on the market by the Beau firm, of Paris, and consists of a leather bag for carrying inner tubes. The tubes may be properly folded and are protected against all injury, the bag being dust proof. The outer walls are of stiff leather and there are four interior flaps of soft leather. The bag is closed by straps, which permit of strapping it together compactly whether it contains one, two or three inner tubes, and permit of its being carried about handily.



TALASSO "ARTIFICIAL ROAD."

A decidedly novel solution of the tire protector problem is the so called Talasso artificial road. M. Talasso argues that it is the road which does all the damage to the pneumatic tire and it is therefore to the road that we must look for protecting the tire. He has therefore taken a number of paving blocks, placed them around his tire and drawn them together by a tread. Consequently the delicate tire no longer comes in contact with the road. The illustrations herewith show the manner in which this interesting solution of the problem has been carried out. The "paving stones" which we referred to consist of rubber blocks whose profile resembles a horseshoe. The two ends are provided with iron hooks F, which engage with the clinchers of the rim. Within the mass of the rubber are incorporated layers of strong fabric, which insure its rigidity. Twelve to sixteen of these blocks are arranged around the tire and are connected together by a chrome leather tread provided with steel studs and bolted to the centre of each block. The tire itself is completely protected by this supple and strong protector. There are only two objections to this interesting invention, viz., its great weight and the fact that it does not prevent moisture reaching the rim.

The New Renault Self Starter.

It will be remembered that the Renault Brothers firm was among the first to bring out a self starting device, composed of a pair of opposed cylinders, whose pistons worked on racks that meshed with a pinion on the motor shaft. Recently a new design of starter has been brought out by this firm, which is based on the same principle as that first developed by the Saurer commercial vehicle firm of Arbon, Switzerland. There are four essential parts to this system, viz., the air compressor A, the air tank B, the control valve C and the distributor D. The air compressor (a sectional view is shown in the accompanying cut) is of the single cylinder vertical type, and is placed in front of the motor, being driven from the crank shaft of the latter through worm gearing. The crank of the air pump is mounted on ball bearings. The two valves of the air pump are located in the cylinder head, the one on the left, E, being the suction valve and the one on the right, F, the delivery valve. These valves and their springs are completely enclosed within the housings, which should make them almost noiseless. It will be observed that the delivery valve chamber communicates through a small passage G with a chamber above the suction valve chamber, from which latter it is separated by a diaphragm H. This diaphragm is normally in close proximity to the end of the inlet valve stem. When the pressure in the air tank, and consequently in the delivery valve chamber, rises this diaphragm bulges downward, and after a certain pressure has been reached it will press against the end of the suction valve stem and hold this valve open continuously, so that no further compression takes place. The diaphragm therefore acts like an automatic governor, maintaining the pressure in the air tank constant. It is, of course, readily understood that when the pressure in the tank drops, owing to air being withdrawn in starting the motor, the diaphragm will allow the suction valve to seat again, and the pump will then operate again until the normal pressure in the tank has been restored.

The control valve C is placed on the dashboard. This control device really comprises two separate valves, one operated by the thumb wheel I, permitting of shutting off the air tank B, and the other, operated by the hand lever J, enabling the driver to admit air to the distributor D. The valve J is held closed by a spring, and must be constantly pressed upon by the hand as long as it is desired to keep the valve open. The distributor D is fitted to the side of the engine and is driven by an inclined shaft and worm gear from the cam shaft. From the distributor pipes lead to each of the cylinders, and the distributor is so arranged as to place the air tank in communication with that particular cylinder whose piston has last entered upon what corresponds to the power stroke. In order to start the motor it is only necessary to depress the lever J. Air from the tank will then flow into the cylinder ready to receive it to advantage, and the motor is set in rotation. After the piston in the first cylinder to receive the air has reached the end of its stroke, the distributor automatically switches the air flow to the next cylinder in the cycle of operations, and so on. There will therefore be a continuous turning moment developed. However, as soon as a considerable speed has been attained the driver releases the pressure on lever J, the flow of air ceases, a combustible charge is drawn into one of the cylinders and exploded, and thereafter the motor runs explosively in the regular way. Whenever the car is to stand for any great length of time the valve I is closed to prevent loss of pressure from the tank.

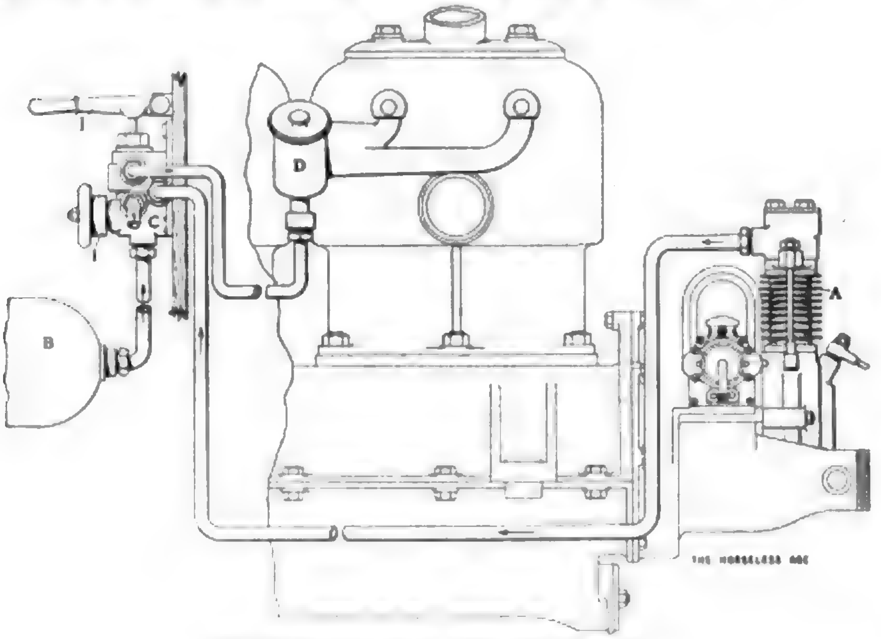
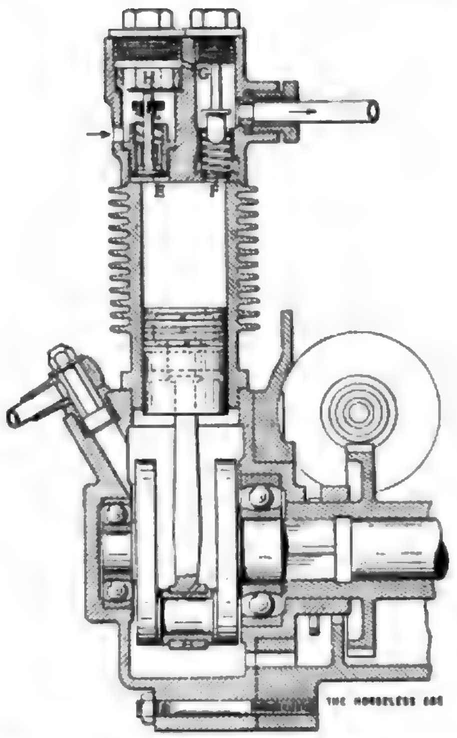


Diagram of Renault Automatic Starter.

European Dates for 1909.

The so called Calendar Congress met at Paris on December 1 and fixed the following dates for automobile events for next year, in addition to a number of motor boat events:

Brussels Show, January 16-25.
Turin Show, January 30 to February 14.
Stockholm-Gothenburg Endurance Contest, February 7- 11.
Vienna Show, March 14-31.
Nice "Week," March 20-28.
Prague Show, April 11-18.
Light Car Race, Sicily, April 29.
Targa Florio Race, May 2.
Austrian Light Car Race, May 6-9.
Swedish Commercial Vehicle Contest, May 10-15.
German Commercial Vehicle Contest, in May.
Stockholm Hill Climb, May 22.
Moscow, Petersburg, Race, May 26.
Barcelona Show, beginning June.
French Grand Prix Race, July 1-3.
Ostend Week, July 13-17.
Ardennes Race and Liedekerke Contest, August 24-27.
German Small Car Trials, August 29 to September 3.
Salon (France) Race, August 29.
Mont Ventoux Hill Climb, September 5.
Bologna Race, between September 11 and September 19.
Semmering (Austria) Hill Climb, September 19.
Rochet-Schneider (Lyon, France) Cup Contest, September 22.
Austrian Commercial Vehicle Contest, October 3-17.
French Commercial Vehicle Contest, October 18 to November 18.



Sectional View of Renault Air Pump.

Resolution Against the Annual Paris Show.

A number of leading French manufacturers held a star chamber meeting on Friday, December 4, to take steps to prevent the annual holding of the Paris show in the future. It is reported that the following points were agreed upon:

"(1.) The undersigned manufacturers engage themselves to submit to the Automobile Club and to the Automobile Manufacturers' Association the proposal not to hold an automobile show during 1909, and to hold a show only every two years hereafter.

"(2.) In case the proposal should be rejected, not to take part during the year 1909 in any show in the departments of Seine, Seine-et-Oise and Seine-et-Marne, and to prohibit the exhibition of their products.

"(3.) In case of a voluntary violation of this agreement to pay to the rest of the undersigned firms the sum of 50,000 francs.

"(4.) The above agreement, in order to be valid, must be signed by at least ten manufacturing firms, whose aggregate annual production, based on that of 1907 and 1908, is at least 10,000 chasses.

"(5.) This agreement remains in force until March 31, 1910, unless dissolved before that date by a three-quarter majority."

The question of participation in foreign shows is also being considered by the French manufacturers, but as no advices regarding next year's show plans in London and Berlin had yet been received, no action could be taken in respect to this matter at the meeting. The above mentioned agreement was subscribed to by the following firms: Bollee, Brasier, Bayard-Clement, Darracq, Delaunay-Belleville, Lorraine-Dietrich, Gladiator, Gobron, Mercedes, Panhard-Levassor, Peugeot, Peugeot Frères, Renault Frères. Two of the leading tire manufacturers, Michelin and Continental, agreed not to exhibit directly in case a show should be held, and in case some car manufacturers should take part in such a show not to publish any advertisements relating to the cars of such manufacturers.

On Saturday, December 5, a committee of the manufacturers called on General Commissioner G. Rives of the Automobile Show, and informed him of the agreement. M. Rives told the committee that he would submit the demands of the manufacturers to the joint organizing committee, composed of representatives of the Automobile Club, of the Automobile Manufacturers' Association, and of the Automobile and Bicycle Manufacturers' Association. The Runabout Manufacturers' Association planned to hold a meeting on December 7 to decide what attitude they should take with respect to this question.

To Suppress Next Year's Grand Prix Race.

According to the latest advices from Europe the agreement by which manufacturers bind themselves by a bond of 100,000 francs not to participate in next year's Grand Prix race has now been signed by the following firms: Benz, Berliet, Brasier, Bayard-Clement, Darracq, Lorraine-Dietrich, Mercedes, Motobloc, Panhard-Levasser, Peugeot and Renault. While it is definitely stated that these firms have committed themselves to the agreement, it is also announced in a more or less reserved way that the Fiat firm has also at last been won over, after having hesitated at first. The above named firms have submitted a resolution to the A. C. of France, in which it was stated that the automobile, and especially the racing car, has now reached such a high degree of perfection that further races cannot lead to any real improvement; that automobile contests, and especially races, no longer interest the public sufficiently, and that there is no object for the manufacturers to participate in these very expensive demonstrations. The sport committee of the A. C. of France has meanwhile held a meeting and decided that the Grand Prix will be held, provided forty entries are received. It seems practically impossible, however, that such a number of entries can be gotten together, if all the above named firms have actually agreed to abstain, as they include practically all who have run cars in the Grand Prix before.

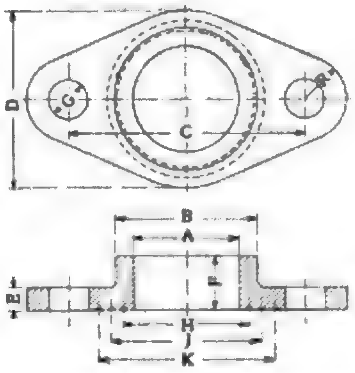
German Standard Flange Connections.

The German Automobile Technical Association has recently issued data of standard flanges which are reproduced in the table herewith. These flanges are intended for connecting either thin walled brass tubes or gas pipes. In the case of brass tubes the flanges are secured in place by soldering, and in the case of gas pipes either by soldering or by screwing them on and then soldering. The dimensions of the flanges for gas pipes are such that they will fit the regular English inch pipe sizes. Each flange is designated by a letter and by a figure corresponding to the size of the tube for which it is intended. Some of the flanges can be used both for a standard gas pipe and a brass tube; in other cases it is necessary to bore the flange out of a larger diameter for one or the other. In the symbol for the flange the letter F stands for gas pipe and M for brass tube; the figure ahead of these letters is the size of the gas pipe in English inches and the figure after the letters the inside of the brass tube in millimetres. Each flange is provided with packing grooves, the smaller ones having two and the larger ones three of these grooves. In the table all the dimensions are given in millimetres (1 millimetre = .040 inch). It would seem that our organizations occupying themselves with the standardization of automobile parts might do well to also give some attention to this widely used detail. As international are even better than national standards, it might not be a bad idea to adopt these German standards if no objection can be found to them.

Cylinder Pressure Indicator.

A pressure indicator for registering the maximum pressures attained in the cylinders of internal combustion engines has recently been put on the market in England. The instrument consists of a pressure gauge, which indicates pressures in pounds per square inch up to 350 pounds, and a plug for screwing into the cylinder. This plug contains a disc valve, the function of which is to allow the gas to pass in one direction only. The gauge may be secured to either the engine or dash permanently, or can be attached when the test is made, it being connected to the plug by suitable piping. With one cylinder engines the connection is direct between the plug and gauge, but with multi-cylinder engines a distributing manifold is used by which any cylinder may be placed in connection with the gauge by a diaphragm cock, the other cylinders being shut off, leads from the cylinder plugs running to the diaphragm cocks, and one lead running from the manifold to the gauge. For indicating compression pressures the ignition in the cylinder under test is cut off. For indicating explosion pressures the cylinder is allowed to fire regularly. This instrument is called the "Aerometer," and is manufactured by Negretti & Zambra, 88 Holborn viaduct, London, England.

According to recently published statistics, there were in use in Belgium in 1906 2,951 automobiles and 4,295 motorcycles, and in 1907 3,262 automobiles and 4,002 motorcycles, an increase of 311 and a decrease of 293 respectively.



German Standard Pipe Flanges.

	A.	B.	C.	D.	E.	F.	G.	H.	J.	K.	R.
F M 8	10	1.	30	20	4	8	6.5	14	17	—	7
F M 10	12	16	32	22	4	8	6.5	16	19	—	7
F M 12	14	18	34	24	4.5	9	6.5	18	21	—	7
F M 15	17	22	37	28	4.5	9	6.5	20	24	—	7
⅜ F 18	20	27	45	34	4.5	10	7.5	26	30	—	8
½ F 22	24	31	50	38	4.5	10	8.5	30	34	—	9
F M 26	28	35	56	42	5	11	8.5	33	38	—	9
1 F 30	30	39	62	46	5	11	10.5	36	42	—	11
1 F 30	32	39	62	46	5	11	10.5	36	42	—	11
F M 35	37	44	68	53	5	12	10.5	42	48	—	11
1¼ F 40	39	48	74	58	5	13	11.5	46	50	54	12
1¼ F 40	42	48	74	58	5	13	11.5	46	50	54	12
1½ F 45	47	54	82	64	5	14	12.5	52	56	60	13
1½ F 45	45	54	82	64	5	14	12.5	52	56	60	13
F M 50	52	59	88	70	5.5	15	13.5	57	61	65	13
F M 55	57	67	96	78	5.5	16	14.5	65	69	73	14
F 62½	73	83	118	94	5.5	17	16.5	80	85	90	16
F 63	85	96	134	110	6	20	16.5	94	99	104	16

MINOR MENTION

The Stilson Motor Company, Springfield, Mass., is installing new machinery, and plans to shortly employ seventy-five additional men.

The Auburn Automobile Company, Auburn, Ind., has recently completed an office and showroom building, 60x160 feet, at a cost of $18,000.

The B. F. Goodrich Company, of Akron, Ohio, opened a Southern branch at 64 South Prior street, Atlanta, Ga., on December 15. It will be in charge of E. V. Wilkinson.

The Buick Motor Company will have no exhibit at either of the New York shows this winter, but will have a display at its New York branch during the time of the shows.

It is reported that an officer of the War Department has been detailed to select two cars for the use of President Taft's family after their occupancy of the White House in March next.

A race meeting scheduled for the Tanforan Track at San Francisco on December 6 proved an utter failure. The majority of both the entrants and the officials did not put in an appearance.

The Speedwell Motor Car Company, of Dayton, Ohio, have broken ground for a new building, 50x100 feet, for use as a paint shop. They are also erecting a 12,000 gallon water tank for fire protection.

The Auto Motor Company, of Boston, Mass., has established a sales agency at 10 and 12 Park square, to handle the Pennsylvania car. The company is composed of M. A. Dykeman and James T. Nelson.

The Roberts Motor Company, formerly of Clyde, Ohio, have begun operations in Sandusky, Ohio. About fifteen families moved from Clyde to Sandusky with the firm, which starts work in Sandusky with twenty-five men.

The H. H. Franklin Manufacturing Company inform us that the brakes on their seven passenger touring car, weighing 2,650 pounds, have a combined frictional surface of 340.8 inches. Both rear hub and transmission brakes are fitted.

The Oakland Carriage and Implement Company, Oakland, Cal., has added an automobile department and taken the agency for the motor buggy made by the International Harvester Company, of Chicago, for Alameda and Contra Costa counties.

The Columbia Tire and Top Company, Boston, Mass., have opened a new factory at 31 Irvington street. The company have recently brought out a new wind shield, which automatically locks itself in both the folded and the extended positions.

A company has been formed in Grand Rapids, Ind., under the title of the Starter Manufacturing Company, to manufacture the automatic motor starter invented by J. Watson Fitzgerald, of that city, about a year ago. The company is incorporated for $40,000.

The Baker Motor Vehicle Company, of Cleveland, Ohio, have recently completed an addition to their plant.

The Ford Motor Company has presented a Model T to the West Side Young Men's Christian Association Automobile School, for use in its road instruction work. The car will be delivered in January.

The factory committee of the Anderson, Ind., Board of Trade has approved the building plans of the Rider-Lewis Automobile Company, which is to locate in that city. The plans will be submitted to contractors and bids will be opened on January 1.

The Regal Motor Car Company are making an addition of over 50,000 square feet of floor space to their plant. They expect that this addition will enable them to turn out some 2,000 cars in 1909. They are at present running day and night to get out demonstrators for their agents.

Thomas B. Jeffery & Co., the same as last year, will not exhibit at either of the two shows in New York city next month, but will have a private exhibit at their New York branch, 38 and 40 West Sixty-second street, which will remain open from December 31 to January 23, inclusive.

The residence of Thomas B. Jeffery, of Kenosha, Wis., was considerably damaged by fire on December 10. The fire is supposed to have originated from a defective flue. Insurance to the amount of $9,000 was carried, and Mr. Jeffery's valuable collection of curios, etc., was not damaged.

The Cameron Motor Company of New York will move on January 1 into its new general sales offices at 231 West Fifty-fourth street, which will be in charge of Harry W. Doherty. We are informed that the Cameron Company plans to build 2,000 four and six cylinder cars during the coming season at its two factories, in Beverly, Mass., and New London, Conn.

The Sharp-Arrow Automobile Company has been incorporated in Trenton, N. J., to manufacture the Sharp-Arrow car. Fred J. Sharp has been elected president and general manager of the company; F. W. Bennett, secretary, and J. B. Farlee, treasurer. The company is at present operating in a shop on Beatty street, in Trenton, but is looking for a suitable location.

The plant of the Dolson Automobile Company, Charlotte, Mich., which was sold at public auction on December 14, was purchased by three Charlotte banks to protect their loans. It is stated that the banks have received proposals from two manufacturing companies for the purchase of the plant. The Times Square Automobile Company of Chicago bought the stock on hand for $1,500.

It is reported, but not confirmed, that the Eagle Chandelier Company, of Chicago, is closing negotiations for the lease of the plant of the defunct Visible Typewriter Company at Kenosha, Wis., now used by the Petrel Motor Car Company as a factory. The Petrel company only a few months ago entered the building. The plant was sold at receiver's sale a short time ago to George A. Yule, of the Badger Brass Manufacturing Company, of Kenosha.

The name of the new Rambler branch at Watertown, Wis., is the Copeland-Roach Motor Company. The partners are Theodore B. Roach, assistant manager of the Rambler Garage Company, of Milwaukee, branch of Thos. B. Jeffery & Co., Kenosha, Wis., for Wisconsin, and W. F. Copeland, Rambler agent for Jefferson County, Wisconsin.

The management of the Grand Central Palace Show announces that the list of exhibitors includes the names of seventy-seven manufacturers of complete automobiles and 230 makers of accessories. It is expected that sixty-six distinct types of pleasure cars and eleven makes of commercial vehicles will be exhibited.

John J. Carton, of Flint, Mich., attorney for the Buick Motor Company, informed the Ways and Means Committee on December 14 that the tariff on automobiles might safely be reduced to 20 per cent. He said he understood that the Olds Motor Works were willing to have it reduced to 25 per cent. His opinion was that the lower duty would net the Government increased revenues.

The Buick Motor Company, of Flint, Mich., have purchased the agency for their cars in Wichita, Kan., from the J. H. Butts & Sons Implement Company. The Wichita branch will be made a distributing centre for southern Kansas and Oklahoma, and will be placed in charge of E. P. O'Neill, of Kansas City. The agency will remain for the present in the old location on South Lawrence avenue, but it is the intention to erect a new building specially suited for the purpose inside of a year.

The second car to be assembled by the Russell-Deibler Motor Car Company, of Berlin, Wis., is completed, and was purchased by Frank Russell. It is a four cylinder, 40 horse power car, with close coupled body, four passenger, and equipped with Rutenber engine. The car was designed by Nelson Johnson, superintendent of the company, and the parts were made in various factories, excepting some of the principal steel work. It is intended to form a stock company and build cars on an extensive scale.

Testimony in the bankruptcy proceedings against the Shoemaker Automobile Company was taken in South Bend on December 11, Dr. C. M. Eisenbeiss and Wilson Rose, of Elkhart, appearing before Referee Lambert. The object was to ascertain the names of subscribers to the stock of the defunct company, who were to be forced to pay assessments on their subscriptions to meet a large deficit. The witnesses testified that the memoranda of the stock subscriptions had been either lost or destroyed, and it seems that it will be impossible to obtain any money from these parties.

The Bristol Engineering Corporation. Bristol, Conn., will shortly complete its first taxicab, the body for the machine having recently arrived.

We have received a copy of "The Girl and the Motor," by Hilda Ward, 120 pages, cloth, illustrated. Published by the Gas Engine Publishing Company, Cincinnati, Ohio. Price $1. It is a narration based on the author's personal experience with a motorboat and an automobile.

The first automobile show will be held in Portland, Ore., in the Amory Building, at Ninth and Couch streets, March 8-13. The show will be in charge of Dr. C. B. Brown and W. F. Lipman, and will be conducted as a general sport show, the exhibits comprising, in addition to automobiles, motorboats, fishing and hunting outfits.

Garage Notes.

D. C. Meyer, Milwaukee, Wis., has opened a garage on S. Washington street.

C. A. Hunter, Concord Junction, Mass., has opened a garage at 28 Commonwealth avenue.

Fred Burkhalter will open a garage in Horton, Kan. He has the agency for the Buick and E-M-F.

The Ford Auto Co., of Allentown, Pa., will open an agency in the Rink property at 943-947 Hamilton street.

The Bell-Munson Automobile Co., Atchison, Kan., will erect a new fireproof garage, 44x150 feet, on Kansas avenue.

H. Torman, Anamasa, Ia., opened a garage and repair shop at 113 Ford street on November 19. He is negotiating for an agency.

Henry Frederick, a carriage dealer of Loraine, Ohio, who recently secured the agency for the Buick, plans to build a garage next summer.

The Wells-Farmer Automobile Co., Horton, Kan., will open a branch house in Hiawatha, Kan., under the management of J. C. Farmer.

The Marinette Auto Co., Marinette, Wis., has discontinued business through the foreclosure of a chattel mortgage. The effects will be sold by the sheriff.

The F. & D. Motor Car Co., New York city, has filed plans for remodeling the two story automobile showroom at Seventh avenue and Forty-ninth street.

The Chalmers-Detroit Auto Co., of Iowa, who are now located at Lychfield, a suburb of Waterloo, expect to move to the downtown district of Waterloo next spring.

L. L. Heller, of Binghamton, N. Y., has taken over the garage of the Sterling Motor Car Co. on Water street in that city. He handles the Ford and Marmon cars.

William Wieland and August Senn, Marshfield, Wis., have formed a partnership under the name of Wieland & Senn, and will operate a garage and machine shop on East Fourth street.

A fire which destroyed the Secor Cunningham Garage at 1824 Prairie avenue, Chicago, on December 11, resulted in the death of Roy K. Carr, a chauffeur, his wife and six months' old child.

The Kansas City Taxicab Co. is reported to have secured the agency for the Bartholomew Co., of Peoria, Ill., having contracted for twenty-five cabs, fifteen touring cars and ten roadsters.

The Lackawanna Vulcanizing Co. have opened a tire and tube repair shop at 318 Linden street, Scranton, Pa. Jacob Bessmer is president, Lee White manager, and Alfred Anderson secretary.

The Wilmington Automobile Co., Franklin dealers in Wilmington, Del., have opened a new garage at the corner of Delaware avenue and Tatnall street, with a frontage of 83 feet and a depth of 114 feet. The office, show room and stock room face Delaware avenue. Large storage space, a machine and repair shop, are provided on the first floor, while the second floor, which is reached by means of an elevator, offers additional garage facilities.

A number of Chicago automobile men are negotiating for a property on Second and Locust streets, Dubuque, Ia., with the object of establishing a garage and motor livery business there.

Walter D. Strong, of Pittsburg, and Messrs. Francey, of Toronto, have purchased a building site in Steubenville, Ohio, on which they will erect a one story brick garage. The site is located on South Fifth street.

H. A. Thayer, a garage man og Marinette, Wis., plans to build a motor delivery wagon for the Lauerman Brothers Co., of that city. If the car proves a success a company will probably be formed to manufacture it.

The Pence Auto Co., of Minneapolis, Minn., has decided to erect an eight story instead of a six story building on Hennepin avenue, which will add $20,000 to the cost of construction, formerly estimated at $140,000.

The Standard Auto Company recently incorporated at Rockford, Ill., held a meeting on December 9, and elected the following directors: Dr. E. C. Lofgren, D. W. E. Park, Dr. P. G. Laon, Swan O. Widell and John Wester.

The Schwaebe-Atkinson Motor Co. has been formed at Los Angeles to handle the Premier car in southern California. Louis H. Schwaebe, president, was formerly city auditor, and Robert Atkinson, manager, was formerly connected with the White Garage in Los Angeles.

Leslie Patterson, Stephen Kiss, Dr. Wilmer Kipe, W. S. Neff and J. Howard Houk, Indiana, Pa., have formed a company to handle the Buick car in that vicinity. They have rented the garage of the Indiana Electric Company, which will be enlarged so as to accommodate fifteen cars.

The S. H. Peterson Automobile Co., of Chicago, have recently moved from 2253 Cottage Grove avenue to 1229 Michigan avenue, and have taken the agency for the Waverley electric and Gyroscope gasoline cars. Mr. Peterson was formerly in charge of the repair department of the Woods Motor Vehicle Co., and is therefore well informed with regard to electric vehicles.

New Incorporations.

Central Motor Car Co., Los Angeles, Cal.—Capital, $25,000.

Stanley Motor Carriage Co., Newton, Mass.—Capital, $9,500.

Auto Supply Co., Neenah, Wis.—Capital, $10,000. The officers are: President, F. E. Ballister; secretary and treasurer, F. A. Leavens.

Western Reserve Motor Co., Cleveland, Ohio.—Capital, $50,000. Incorporators, J. D. Price, Robert D. Cason, E. T. Smith and C. H. Gunde.

Prospect Heights Auto Co., Brooklyn, New York. —Capital, $125,000. Directors, R. L. Kelley and L. C. Howard. To manufacture and sell motors.

Bell Carburetor Co., Aurora, Ill.—Capital, $12,000. Incorporators, H. H. Evans, E. R. Conklin, C. E. Bell and F. W. Kelly. To manufacture auto parts.

Van Guard Manufacturing Co., Joliet, Ill. (successor to the Steinhart-Jenson Co.).—Capital, $25,000. To manufacture automobile wind shields and accessories.

Hickman-Lauson-Diener Co., Milwaukee, Wis.—Capital, $20,000. Incorporators, Isaac G. Hickman, Claus P. Lauson and Walter H. Diener. To deal in automobiles.

Citizens Taxicab Co., Columbus, Ind.—Capital, $50,000. Incorporators, Francis J. Wallace, J. Carr Brown, Frank L. Smith, George H. Jackman and William Hoerz.

Wander Motor Car Co., Kansas City, Mo.—Capital, $35,000. Incorporators, E. F. Ettwein, L. A. Ettwein and H. N. Strait. To manufacture and deal in automobiles.

West Medford Automobile Co., Medford, Mass.—Capital, $20,000. President, Alphonso E. Kenney; treasurer, Charles E. Hall. To carry on general automobile business.

Albert Lea Motor Co., Albert Lea, Minn.—Capital, $50,000. Incorporators, Bert Skinner, Frank M. Crane, Alfred Christopher, Albert Watland and Charles E. Paulson.

Ford Automobile Co., Paterson, N. J.—Capital, $10,000. Incorporators, Robert W. Bates, George M. Dorwart and Jacob Van der Clock. To manufacture automobiles, etc.

Eureka Taximeter Cab Co., New York, N. Y.—Capital, $25,000. Incorporatoros, H. M. Browne, F. W. Mills and E. J. Forhan. To manufacture, deal in and rent automobiles.

Summit Motor Car Co., Summit, N. J.—Capital, $5,000. Incorporators, Howard H. Day, Rosalie Nelson and Harry Baldwin. To manufacture automobiles, bicycles and supplies.

Merchants Automobile Co., Cincinnati, Ohio.—Capital, $10,000. Incorporators, Edward Stang, William E. Day, Thomas J. Leonard, Gerritt J. Fredriks, Jr., and Louis H. Capelle.

Dubied Machinery Co., New York, N. Y.—Capital, $5,000. Incorporotars, Paul E. Dubied, Paul A. C. Dieu, John B. Pruyn and Henry Escher, Jr. To deal in knitting machines and automobiles.

Cable Pneumatic Tire Co., Jersey City, N. J.—Capuital, $500,000. Incorporators, John F. Scannell, Frank A. Magowan and Grant Lambright. To manufacture automobile tires and other accessories.

Atlantic Motor Co., Greensboro, N. C.—Capital, $25,000. Incorporators, H. L. and L. H. Hopkins and Thomas S. Beal. To manufacture and deal in automobiles and machinery and carry on livery business.

Starter Manufacturing Co., Grand Rapids, Mich. —Capital, $40,000. The officers are: President, W. W. Annable; J. Watson Fitzgerald, secretary-treasurer. To manufacture self starting and other automobile devices.

Worthing-Clark Automobile Co., Fond du Lac, Wis.—Capital, $20,000. Incorporators, George W. Worthing, E. W. Clark, Anton Hoenisberg, John W. Immel and G. H. Stanchfield. The company is a consolidation of three garages.

Trade Personals.

Elliott S. Church, of Newton, Mass., recently with the Hills Motor Co., of Philadelphia, has joined the sales department of the George J. Dunham Co., Boston, Mass.

O. R. Hastings, who was connected for several years with the Standard Motor Car Co., San Francisco, Cal., is now with the Winton Motor Carriage Co.'s branch in the same city.

Robert Drach, formerly foreman of the Schrieber Motor Car Co.'s shop in Milwaukee, has been appointed manager of the new garage to be erected by Kopmeier Brothers Motor Car Co.

H. D. Church, of the Alden Sampson Co., manufacturers of motor trucks, recently visited San Francisco to look over the opportunities for introducing vehicles of that type into the city, where hitherto very few have been used.

Charles R. Newby, formerly of the Oldsmobile department of the Indiana Automobile Co., Indianapolis, Ind., has been elected vice president and sales manager of the State Auto Co., State agents for the Oakland car in Indiana.

Eugene N. Foss and the Locomobile Co. of America have been enjoined from occupying a building in Newbury street, Boston, Mass., at the instance of adjoining property holders, on the ground that the use of the structure as a garage was a violation of restrictions in the deed. The building, which was erected by Foss, has already been vacated, the Boston branch of the Locomobile Co. being now located at 589 Boylston street.

New Agencies.

Leeds, N. Dak.—M. L. Strong, Mitchell.

Ishpeming, Mich.—E. R. Nelson, Franklin.

Florence, S. C.—Brown & Ingman, Franklin.

El Paso, Tex.—P. L. Abel Cycle Co., Franklin.

Easton, Pa.—Easton Automobile Co., Franklin.

Corsicana, Tex.—Corsicana Motor Co., 125 North Tenth street, Franklin.

Elizabeth, N. J.—Elizabeth Automobile Co., 14 Westfield avenue, Franklin.

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Modern Cylinder Design and Some Reasons for Lack of Uniform Practice.

By James McIntosh.

TWIN CYLINDERS.

We will first consider the most common cylinder type found in practice. The twin cylinder unit with the inlet and exhaust valves all on the same side has several points in its favor. First, there is only one cam shaft; second, the number of openings to care for is smaller, provided the usual design is employed, in which the inlet opening is common to both cylinders of each pair, the inlet valves being the inside ones and connected by one common opening on the under side of the valves. This has the effect of aiding carburetion, and also, to some degree, the cooling of the cylinder. The method of fastening the inlet and exhaust pipes is much simpler where bridges or clamps are used in conjunction with studs and set screws. The principal objection to this design is that it is difficult to keep the valve seats cool, owing to the intricate core work, lack of proper water jacketing, and irregular thickness of metal. This method also has the disadvantage of retaining more dead gases than the other types I will mention later.

There is still another fault connected with the location of all the valve chambers on one side, and that is that the cylinder bore will be distorted more easily by irregular expansion. Then, again, it is very poor practice to have only a single thickness of metal between adjacent bores, and this arrangement is now seldom seen, although at one time it was common practice. It, of course, gives a shorter engine. The present practice in twin cylinders is to have the cylinder walls separate and to have the water jackets extend all around the bore.

SEPARATE CYLINDERS.

The separate cylinder system is probably the best, for more reasons than one. Some designers who use that system place the inlet and exhaust valves on the same side and use only one cam shaft. The principal advantage of this system is that if the bore of any cylinder is cut or develops a flaw, it can be replaced separately. This system involves more openings and more complicated piping than the previously mentioned type, and has no advantages over that type other than those mentioned.

With the separate cylinder system the valves may also be placed on opposite sides of the cylinders, in which case two cam shafts are required. This system possesses several features that are of importance, particularly in the case of engines of large power. This arrangement of the valves on opposite sides permits of the use of larger valves than where both are located on the same side. The valve seats will hold their shape better, owing to the greater conformity in the thickness of metal and a more even depth of jacket space, which results from the simplification in the design. In this type of engine there are two pipe openings for each cylinder, manifold pipes on each side of the cylinders, and in the case of a four or six cylinder engine a more elaborate intake manifold is required to properly distribute the gas to the several cylinders.

SCAVENGING.

One other point that deserves mention is that with this valve arrangement the valves can be so timed as to more effectively clear the cylinder of spent gases. This valve arrangement is recognized as good practice generally, and as the best practice for large powers. The valves are so timed that the periods of opening of the inlet and exhaust valves overlap slightly at the end of the exhaust stroke, the exhaust valve being held open until the incoming gas has swept out some of the spent gases that usually remain in the cylinder. The advantages resulting from this scavenging are more effective cooling of the cylinder and the possibility of using a higher compression, with the consequent gain in power and efficiency. Then, again, if the spark plug is located over the inlet valve, it will always keep fairly cool, and it is in the best place to do effective work, for the reason that when the engine is working on small throttle there is always some fresh gas around the inner end of the plug, even if there is none elsewhere in the cylinder.

VALVES IN THE HEAD.

There is still another type of separate cylinder engine in which the valves are both placed in the cylinder head. This arrangement is the most advantageous from the standpoint of minimum combustion chamber wall surface exposed to cooling effects, in proportion to the volume of the compression space. The absence of valve pockets makes this construction ideal in that respect. The necessity of having the valves accessible leads to the use of valve cages, with the attendant difficulty of keeping the valve seats and valves cool, owing to the extra resistance to the conduction of heat from the valve seats to the jacket. Another bad feature of this form of construction is that if a valve should drop into the cylinder, as the result of a breakage of a valve stem or of failure of a spring collar, there is danger of the piston being broken or the cylinder split. In the writer's opinion this construction is not desirable.

TWO CYCLE THREE PORT CYLINDERS.

From the standpoint of simplicity the two cycle, three port engine cylinder is ideal, and this engine is destined to become very popular, owing to the general desire for simplicity. This type of engine is not fashionable for automobiles, and that is all that can be said against it, everything else being in its favor. The fashion in marine motors is entirely different, the large majority of these motors being of the two cycle type, although the two cycle motor has not been developed to the same high standard as the automobile (four cycle) motor. The motor boat industry is growing, and no doubt the two cycle engine will presently come under the eye of the automobile engine designer. Perhaps, also, users will draw attention to the fact that they have a boat and never have any trouble with grinding valves or adjusting valve stem push rods. They may also be expected to enlarge upon the absence of gearing and mechanism. The man who pays the bill will soon learn to appreciate these advantages, and then the designers are certain to get busy; they admit now that the public dictate what they want, and it is getting more so every season.

DIVERSITY IN MARINE ENGINES.

It may be said that no two marine engines are alike, which is a fact. The same was true of automobile engines at the beginning, and there is a reason for this diversity of design. All have a right to their opinion, and that will prevail until a standard design is reached, and the public learn the advantages and disadvantages of different constructions. For instance, the horizontal automobile engine is a thing of the past, and automatic inlet valves are also "back numbers." This is an age of progress, and the progressive manufacturer is the one who gets the business and leads his competitors. The same thing holds true in all branches of industry.

I will give a few reasons which account

for the great variety in design of marine engines. First, the average builder works on a rather limited scale, and depends almost entirely on a local trade. His design may be good enough to suit his customers, and as long as he can do business he will not make improvements unless he can clearly see direct profits in such improvements. He may improve his design to cut down the cost of manufacture, and this may involve an improvement of the engine. Then he may be competing with others in the same field. The average small maker, not having the means to get suitable tools, has to adopt a design which he would not consider if he could bore a cylinder with a solid head, for instance. But he must bore the cylinder in an engine lathe, and is therefore obliged to use a boring bar. Consequently he decides to use a separate cylinder head, as is customary in steam engine practice. Perhaps the foundry he does business with had something to do with the design, and held out for the separate head; so he lets it go at that, and tries to convince the buyer that it is a "good thing," and may even tell him that he could make a cylinder with a solid head, like the other fellow, *if he wanted to,* and do it cheaper. Of course he could—but he does not have the tools.

DETACHABLE CYLINDER HEADS.

Let us see what advantages there are in a detachable cylinder head. First, the cylinder can be bored in an engine lathe, and second, you can take the head off and examine the top of the piston. If you have been in the habit of using more cylinder oil than is good for your engine, you may find the result of your over-zealousness baked on to the piston head and the combustion chamber wall. Perhaps this carbon deposit was the cause of your engine at times continuing to run after the switch was opened. As a means permitting of cleaning the combustion chamber walls of burnt cylinder oil the detachable head is all right, but it is well to caution the user not to break the joint when away from home, else he may only add to the trouble he already has. Remember that it is a poor place to look for a "pound," as the piston, if it ever cleared the cylinder head, cannot well begin to strike it.

The detachable head usually means two joints, an inner and an outer one. The inner joint keeps the jacket water out of the combustion chamber, and the outer prevents the water from leaking out of the jacket. Of the two walls the inner or cylinder wall is always by far the hottest, and no matter what kind of a joint is used the greater expansion of the metal of the inner wall will strongly compress the inside joint, rendering it hard, or the heat will have the same effect directly. So, what is effective as a joint if left alone may not be effective after it has been tampered with, especially if it is put down in the usual way with shellac, to prevent leaks "until sold." We will suppose that both joints are hard, and that the inside joint develops a leak. In that case there will be serious trouble. If a leak develops in the outer joint, the water begins to show on the outside, and the average user will then assume that the nuts are loose, and will get busy with the wrench, and before he stops the leak he will have wrenched off a stud. Then he may decide that the proper thing to do is to take up the one next to it a little more, and perhaps one more stud will be wrenched off. When he gets the engine going (the inner joint being all right it is quite possible that the engine will start), perhaps the next thing to go off will be the cylinder head. All this trouble is for nothing, for that is usually all you can actually accomplish by taking off the cylinder head.

WATER CIRCULATION HAMPERED.

There is another disadvantage involved in the separate head construction, and that is that the water circulation is hampered where it is most required, owing to bridges being cast in the jacket to accommodate the studs. The heavy metal in that neighborhood does not conduct the heat well, and the full benefit of high compression cannot be realized. The ideal cylinder for either a two cycle or a four cycle engine is the one that has no surplus metal in either the inner or outer wall. There should be no unnecessary thickness of metal anywhere, and especially not around the cylinder bore, and the water jacket should be carried to the very closest places, and the metal in the jacket cut down to as near an even thickness as possible, especially around the ports of a two cycle engine. The ports should be completely surrounded with water, especially the exhaust ports, where the hot gases have a tendency to overheat the wall and cause distortion of the cylinder, owing to unequal expansion. Where the metal is thicker the heat will not be properly conducted away, and usually bright spots will develop at these points, and sometimes black places, where the bore is distorted outwardly. Then, again, if the water jacket terminates abruptly at the lower end of the cylinder, there is a tendency for a rib to form at this point. For this reason it is better to taper the jacket so as to decrease the thickness of the water space from the head end to the lower end. It is obvious that in any gas engine cylinder the head end has to dispose of far more heat than the lower end, which latter is exposed to the heat of the burning gases only toward the end of the power stroke, and then the temperature is, of course, not as high as near the beginning of this stroke.

LARGER JACKET SPACE IN TWO CYCLE ENGINE.

In designing a two cycle engine a much larger water space must be provided than in a four cycle engine, owing to the fact that the period of rest between heat absorptions is far shorter in the two cycle engine than in a four cycle engine. In the latter the heat passes into the cylinder wall during one stroke, which is followed by three idle strokes, during which the heat absorbed by the walls has time to pass off. In the two cycle engine there is one idle stroke between power strokes, and the time to dispose of the heat is consequently much shorter. This necessitates either a more rapid circulation of the cooling water or a greater volume of water. The latter alternative is the preferable one, for with a thick water jacket the temperature will be more uniform, less pump pressure will be required, and the circulation will be slower.

SPARK PLUG LOCATION.

In a vertical high compression engine the spark plug should never be located in the centre of the cylinder head, for the reason that in that location the plug will not get the full effect of the water jacket, owing to steam pockets being formed. A better location is on the side of the cylinder, where the boss into which the spark plug is screwed will always be surrounded by water. The best location is obviously on the transfer port side and back of the deflector plate, where the purest gas will always be found, viz., that entering the cylinder last. The plug should preferably be placed at an angle with the horizontal, to keep surplus oil, which might cause fouling of the plug, out of the pocket.

As to the advisability of avoiding the separate or detachable head, this has been discarded by the designers of all good modern engines, in favor of the integral head cylinder. This change has been made at the cost of increased risks in coring the cylinder, but it entails decided advantages from every other point of view, particularly that of improved water circulation.

Speed Governor Contest.

In Austria an automobile law was passed on October 26 which exempts automobiles incapable of exceeding a speed of 25 km (15.6 miles) per hour from certain restrictions. The Automobile Technical Association of Vienna is now organizing a competition for a speed governor which will prevent a car running on level roads from attaining speeds in excess of 25 km. per hour, "continuously, reliably and independent of the will of the driver." A prize of 1,000 crowns is set out, which may be awarded to the best or the several equally good solutions of the problem. The device must comply with the requirements laid down in the law. The Automobile Technical Association will appoint a committee to examine and test the devices submitted. First those devices which from a study of the drawings and descriptions appear to be the most practical will be selected, and the inventors of these will then be requested to submit an instrument in two months' time, after which the practical road tests will be conducted. The prize will therefore be awarded only to devices actually built and not to mere designs. Descriptions, drawings and models remain the property of the contestants. Entries for the contest will be received at the Automobile Technical Association, Vienna IX/2, Severingasse No. 9, until March 15, 1909.

Two Cycle Motors.

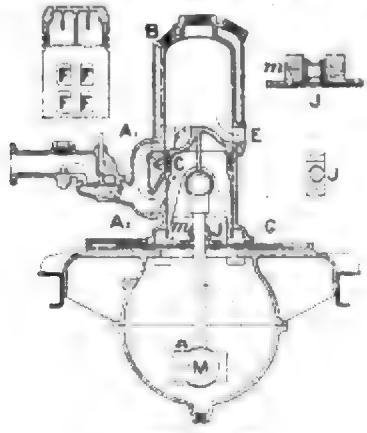
By G. Lumet.

In the following article the writer proposes to describe certain types of two cycle motors which have been submitted to tests with a view to their adaptability to automobiles. The results of some tests are also given, these tests having been made under the writer's personal supervision. The article will be concluded by a few general observations regarding factors that must be observed in the design of two cycle motors.

It should be noted at the beginning that in the types of engines to be discussed the compression pump is in no case independent of the motor proper, and we will therefore not consider the advantages which such an arrangement may offer. It must be taken into account that the manufacturers of two cycle automobile motors have considered it their principal object to produce a simpler type of motor than the four cycle, and also to obtain the same number of explosions with one-half the number of cylinders. This object is, of course, incompatible with the use of independent compression cylinders.

THE PEUGEOT-TONY HUBER MOTOR.

This is a single cylinder vertical motor. It comprises a cylinder in which are formed two series of two ports for the admission of charge and one for the exhaust of burnt gases. The piston is of aluminum, and its head is of special form so as to act as a deflector to the incoming current of charge. A sort of ladle insures that the incoming charge is directed at once toward the top of the cylinder, chasing the burnt gas before it. The piston is provided with two series of two ports, through which the combustible charge enters the compression chamber. The combustible gases are compressed below the piston, in the space comprised between the inner wall of the piston and a slide which separates the cylinder from the crank chamber. The slide has a reciprocating motion in a horizontal plane, which motion is imparted to it by the oscillations of the connecting rod. A ball joint insures gas tightness where the connecting rod passes through the slide.



Peugeot Motor.

Within the chamber thus formed below the piston there is a fixed metallic mass serving the purpose of reducing the volume of the chamber and to thus increase the compression. The combustible gas arriving from the carburetor is distributed through the intermediary of an automatic valve and passes into two different passages leading to the two series of inlet ports.

The ignition is effected by a spark plug. Cooling is insured by a water jacket which encloses the upper part of the cylinder wall and the bottom of the cylinder.

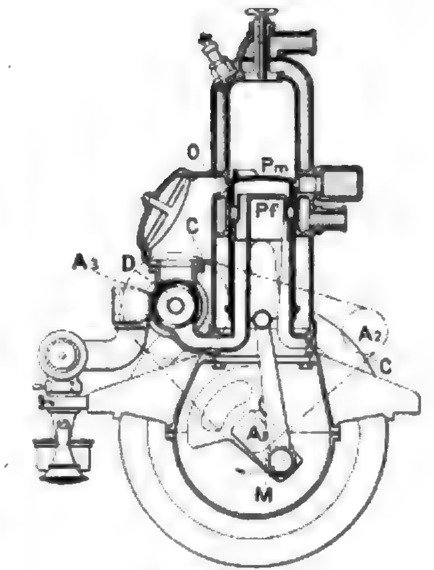
Let us now study the mode of operation of the motor. Suppose that the piston is at the upper end of its stroke, at the moment when the explosion takes place. It is forced downward by the explosion and compresses the gaseous mixture in the compression chamber below the piston. The passages already referred to are then in communication with the compression chamber and with the cylinder respectively. Suppose that the compression chamber is filled with a combustible charge, the latter will then pass from this chamber into the cylinder above the piston. During the descent of the piston the latter has uncovered the exhaust ports just before the inlet ports were uncovered.

The piston now moves up again, closing first the admission port and then the exhaust port, and finally the ports in the piston come opposite the double passages. At that time there is a partial vacuum in the chamber beneath the piston, which is communicated to the inlet passage, thus causing a charge of combustible mixture from the carburetor to be drawn in. It is well to remark that the opening formed in the piston wall is such that the communication between the compression chamber and the inlet passage is always established by either one or the other of the two branches of the inlet passage, while the piston is rising, and in such a manner that the valve is subjected to a gradually varying suction and does not vibrate on its seat.

R. LEGROS MOTOR.

This is a double cylinder vertical motor, the two cylinders operating independently. Each cylinder is provided with ports for the admission of charge and the exhaust of the burnt gases. The movable piston, while reciprocating in the cylinder in the ordinary manner, also moves relatively to a fixed piston, so arranged that it prevents all communication between the crank chamber and the compression chamber formed between it and the movable piston. Within the fixed piston there is a gas passage leading to the rotary distributing valve which is keyed to a shaft. This valve establishes communication either between the carburetor and the passage in the fixed piston, or between this passage and a chamber above the valve.

The shaft for operating the distributing valve and a second shaft for operating the magneto receive their motion from the motor crank shaft through the intermediary of a driving chain passing over three sprockets on the three shafts respectively. Ignition is effected by a high tension magneto. A coil and storage battery are provided for starting the motor. The motor is provided with two sets of spark plugs, each ignition system having its own set of plugs. Cooling is effected by water circulation, a centrifugal pump being used.



Legros Motor.

The motor operates in the following manner: Suppose the piston to be at the upper end of its stroke and to just start on its downward stroke under the influence of the explosion. At the end of this stroke the burnt gases are exhausted. Suppose that the chamber formed between the piston and the inner walls of the movable piston on the one hand and the passage in the fixed piston on the other hand are filled with combustible charge, which latter has been compressed during the down stroke of the piston. At this moment the valve establishes communication between the passage and the chamber above the valve, the charge enters into this chamber, from where, when the piston has nearly completed its downward stroke, it passes into the working cylinder, through the inlet port which is then uncovered.

Upon entering the cylinder the current of charge is projected upward by the deflector, whereby the burnt gases still remaining in the cylinder are forced toward the exhaust port and through it into the exhaust pipe. The piston then moves up again, closing the inlet and exhaust valves and carrying the combustible charge before it. While the piston thus moves upward the valve places the carburetor in communication with the passage, and under the influence of the partial vacuum created by the motion of the piston the combustible charge is drawn into the pasage and into the chamber comprised between the two pistons.

This motor is lubricated automatically by means of a multiple lead oiler with a sight feed adjustment for each lead. The crank chamber is provided with an oil gauge for determining the level of the oil therein.

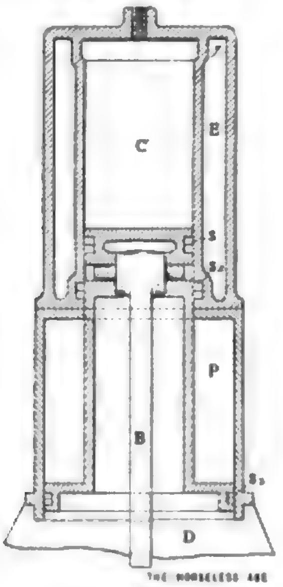
These two motors took part in the two cycle motor contest conducted at the laboratory of the Automobile Club of France. Following are the results of the tests made on these motors during this contest:

Form of Test.	Motor.	Average Speed. R. P. M.	Average H. P.	Fuel Consumption. Kg. P. H. P.-H.
Full load, six hours	Peugeot	1401.3	12.86	0.397
Full load, six hours	Legros	967.5	12.25	0.500
Half load, three hours	Peugeot	1427.6	6.40	0.69
Half load, three hours	Legros	921.25	5.40	0.75
No load, three hours	Peugeot	900	....	2.96 kg. p. hr.
No load, three hours	Legros	920	....	3.9 kg. p. hr.

Peugeot-Tony Huber, single cylinder, 140x140 mm.; Legros, two cylinder, 100x120.

THE COTE MOTOR.

This motor has two cylinders and is valveless. Each cylinder contains one piston, and the two pistons are connected to cranks at 180 degrees. The cylinders have a double bore, and the pistons two corresponding diameters. In the upper portion, which corresponds to the smallest bore, the working cycle takes place; in the lower bore, which is of the largest diameter, the charge is compressed. The upper portion of the double piston is thus a motor piston and the lower portion a pump piston.



Cote Motor.

The two cylinder motor is based on the compound principle. The left hand pump furnishes a combustible charge to the right hand cylinder. The relative volumes of the pump and working cylinders are so calculated as to insure a very complete charge in the working cylinder at each stroke. The burnt gases are exhausted through ports uncovered by the piston, and the charge is also admitted through piston uncovered ports. Each section of the piston is provided with piston rings, and in addition packing rings are placed in a groove cut in the inner wall of the working cylinder near its lower end, to insure gas tightness between the working cylinder and the pump cylinder.

The motor is supplied with charge by a single carburetor, and the exhaust gases are led into a manifold. Ignition is effected by means of a high tension magneto. The working cylinder is surrounded by a water jacket, but the head of this cylinder has no jacket. The flywheel is placed outside of the crank chamber. The crank shaft has two bearings only. The writer made some tests on one of these motors at the laboratory of the Automobile Club of France, and the results are given in the table below:

Test of Cote Motor.

R. P. M.	Effective H. P.
1,131	15.07
1,161	16.32
1,161	16.32
1,167	16.41
1,164	16.41
1,164	16.41
1,320	18.14
1,416	22.08
1,464	24.36
1,332	18.33
1,056	15.71
1,044	15.42

Two cylinder motor of 100 mm. bore, and 110 mm. stroke.

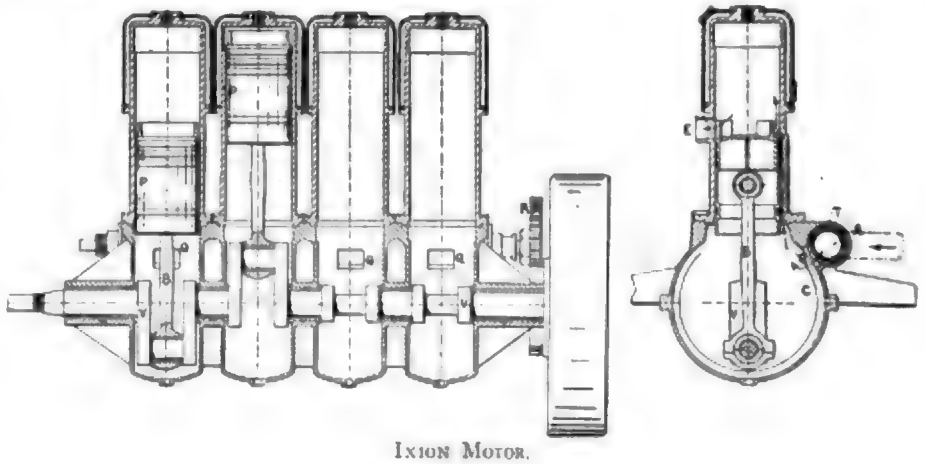
IXION MOTOR.

The Ixion motor is made in one, two and four cylinder types. It is valveless and the precompression takes place within the crank chamber, which has a separate compartment for each cylinder. This arrangement makes it necessary, of course, that a four cylinder motor of this type should have a five bearing crank shaft.

In this motor the charge is drawn into the crank chamber through a hollow crank shaft which serves the function of a rotating valve. The motor operates as follows: During the first stroke the charge is sucked into the crank chamber, and in the cylinder the charge is compressed. During the down stroke the explosion takes place, and toward the end of the stroke the burnt gases are expelled, at the same time that the charge is transferred from the crank chamber to a by-passage into the cylinder. It should be noted that the burnt gases, owing to their abrupt expansion after the explosion, are already partly exhausted at the moment the inlet port begins to open, and the new charge to arrive under the pressure in the crank chamber. In the case of a single cylinder motor the gases drawn in by the piston are compressed by the latter during the downward stroke; at the end of the stroke the piston uncovers the transfer port and permits the gas to enter the cylinder on top of the piston. For a four cylinder motor, however, the distributing valve referred to above became necessary. The gases from the carburetor pass, therefore, first into this rotating distributing valve, which is driven by a toothed pinion meshing with a gear crown fixed to the flywheel. From the valve the gas passes into the crank chamber through an orifice for each one of the sections of the chamber, corresponding to the separate cylinders. The combustible mixture is then forced by the piston into the transfer passage and from there into the upper end of the cylinder, at the moment when the port at the upper end of the transfer passage is uncovered by the piston. A deflector is provided on the piston head, to deflect the incoming charge upward.

A four cylinder motor is supplied with charge from two carburetors by means of the distributing valve described. The burnt gases are exhausted through a separate pipe for each cylinder. The ignition is effected by jump spark. Each cylinder is provided with an integral water jacket which covers not only the side walls of the cylinder but also the head of the same. The flywheel is enclosed within the crank chamber.

The writer attended a test made on a four cylinder motor of this type with a bore of 120 mm. and a stroke of 150 mm. The motor gave 40 horse power at a speed of 800 revolutions per minute. This same power is obtained normally from a four cycle motor of the same size, but it must run at a higher speed of revolution, about 1,000 revolutions per minute, which, together with a stroke of 150 mm. (6 inches).



Ixion Motor.

corresponds to a piston speed of 1,000 feet per minute. Consequently the same power is developed in a two cycle motor at a piston speed of 800 feet per minute.

The question of piston speed is an important one in connection with a two cycle motor. In a four cycle motor this factor is limited only by conditions of lubrication, but in a two cycle motor it depends upon the conditions under which the charge is introduced into the cylinder. In fact, in this type of motor the burnt gases must be pushed out of the cylinder by the incoming fresh charge, and the exhaust ports must be closed in time to prevent the fresh charge from escaping through them.

In the writer's opinion this point involves the most difficult problem in connection with the two cycle motor, and it also explains the high fuel consumption which is sometimes noted in this type of motor. The following comparison explains the phenomenon observed: Suppose we take a broom and sweep the dust covering the floor of a room through the open door. If we move the broom slowly we may sweep the dust out without passing the broom beyond the door. On the other hand, if we move the broom rapidly, the chances are that it will be moved beyond the door opening. The comparison may, however, be carried still farther. If the dust be given a very strong impulse by moving the broom violently it may be swept out of the room without moving the broom beyond the door. This example, in the writer's opinion, furnishes the best solution of the two cycle motor problem, so as to obtain a low fuel consumption at high linear speeds. The gases arriving in the working cylinder from the pump should be under a considerable pressure, so as to give a very strong impulse to the burnt gases, in which case the exhaust port may be closed comparatively early, so as to prevent the escape of the fresh gases through it.

In the writer's opinion it is now possible to build practical types of two cycle motors to run at low piston speeds, motors with a limited stroke, with a piston speed of about 800 feet per minute, but more is to be accomplished, and higher piston speeds should be aimed at; the speed should be gradually increased, as in the four cycle type of motor, certain examples of which, used on racing cars, now attain piston speeds of 2,400 feet per minute. The two cycle motor already offers numerous advantages, such as simplicity, ease of maintenance, improved balance and more uniform torque, and if the piston speed were increased it would also have the advantage with respect to power delivered per unit of weight.

In concluding this discussion the writer would say that the problem of increasing the power per unit of weight, so far as compatible with low fuel consumption, is evidently more complicated in the two cycle than in the four cycle type of motor, but its solution is possible, and investigations with the object of solving the problem are well under way.

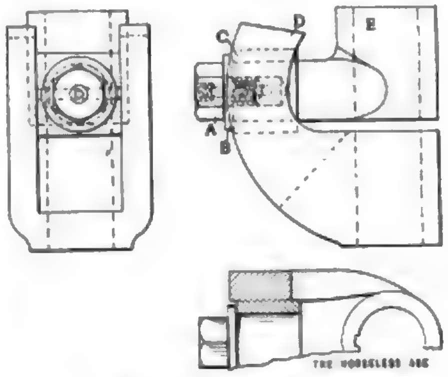
Transmission and Control.

By J. M. Kupel.

An article of this kind should be impartial, and should perhaps treat of as many kinds of mechanism of this nature as possible, but in the present article the writer will confine himself to one or two kinds of mechanism with which he has become familiar in his own experience. All statements made are based on personal experience, and the results obtained from the mechanism described have been very satisfactory. The article will be divided into four sections, as follows: 1, the coupling, that part of the transmission which connects the clutch and motor; 2, the clutch; 3, the speed change gear; 4, control.

THE COUPLING.

Various methods are employed to connect the clutch to the motor crank shaft, more or less successfully. The connection should under no condition be rigid, on account of the flexibility of the chassis frame. To avoid the undue strains which a rigid connection between the motor and the clutch would throw upon the crank shaft, as well as the clutch shaft, many different kinds of so called universal couplings have been invented, some of them very elaborate indeed. I would recommend the use of the coupling shown in detail in the accompanying drawings, which I have found very successful. It consists of a camlike fitting D, either drop forged or of a good grade of steel casting, fitted to the crank shaft of the motor. The arm of this fitting is slotted to receive a brass block C, which fits in the slot so that it is free to move endwise. A hole is drilled through the block to receive a pin, which is the continuation of another fitting E, which is keyed to the clutch shaft. The size of the motor will in every case determine the proportions of the parts of this coupling. Care should be exercised not to make them too small. I mention this especially because the tendency in automobile practice seems to be in that direction. It should always be kept in mind that the automobile is subjected to more severe strains than a locomotive. The latter has its road prepared for it very carefully, while the former must travel over the surface of the ground as it finds it.



Flexible Coupling.

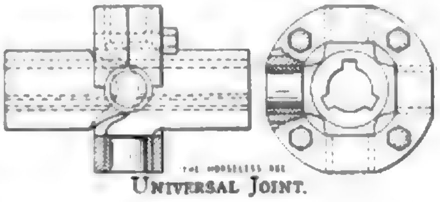
The cut explains the construction of this coupling. A is a cap screw, and B a washer to keep the brass block in place. Another coupling of the flexible type, also illustrated, has proven very satisfactory. It consists of two knuckles joined together by a brass coupling in the manner of a plain, common coupling. The knuckles are provided with trunnions of suitable size, according to the power they are expected to transmit. Holes are drilled through the coupling at right angles to one another, the size of these trunnions. The coupling is taken apart, the knuckles are inserted into the holes, and the coupling is again put together. Four cap screws are used for that purpose.

THE CLUTCH.

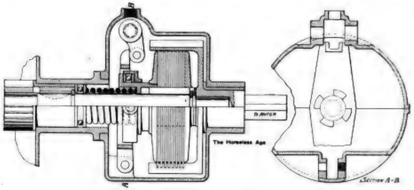
To construct a flexible and durable clutch is no very easy matter, as several conditions have to be taken into account to determine its proportions. The size of the motor is first to be considered; then the weight of the car; next the available room, and last the material. I have found that for a four cylinder 4¼x5 motor a clutch of 1,100 square inches contact area, engaged by a spring exerting a pressure of 450 pounds, meets the requirements. The outside diameter of this clutch is 12 inches, the inside diameter 6 inches with twelve contact faces. The disks are of cold rolled hard steel 1 1/16 inches thick, and the clutch is operated in light oil. In case smaller disks have to be used the number of contact faces have to be increased in proportion. The drawings show the principle of this clutch.

SPEED CHANGE GEAR.

The same considerations that determine the proportions of the clutch must govern the design of the transmission gear. The power which the motor is capable of developing must be transmitted through the gears to the rear axle, hence the size of the teeth of the gears must be in proportion to the horse power developed. The gears have to be shifted from one position to another, which indicates a coarse tooth or a tooth of large pitch. I have found by comparison that a five pitch tooth, or an even coarser one, operates a good deal easier with less clash and less danger of broken gears than any of the finer pitches, say seven or even six pitch. The space between the teeth is of course much wider in a five pitch gear than in a gear of six or seven pitch, and one gear can be meshed



Universal Joint.



Multiple Disc Clutch.

with the other much easier. The body of the tooth is also much stronger, and it is therefore better suited to stand the shock of the impact of shifting without harm. The ends of the teeth on the engaging side should be well rounded. The width of the face of the gears is an item which has to be well considered. If, for instance, one inch should be considered ample for the face of the primary counter gear, the intermediate gear should be at least of 1¼ inch face, and the slow speed gear not less than 1½ inches.

In the illustration the keys on the main transmission shaft, which carries the sliding gears, are integral with the shaft. The countershaft gears are fastened to the shaft either by keys, as illustrated, or to a flange turned integral with the countershaft, as conditions will permit.

The tendency seems to be to use what are known as anti-friction bearings, either roller or annular ball, but it is my opinion that, especially in the case of the ball bearings, the results are very far from being satisfactory. The large diameter of the outside race of ball bearings makes the transmission case very cumbersome. Again, the load which the bearing has to sustain has to be resisted by the shaft which carries it, and the latter, owing to the nature of the bearing, is abnormally small, so that in a very short time the inner race becomes loose on the shaft because the material under it gives way under the pressure. Then it comes to pass that, instead of a ball bearing, one has a solid bearing of very small proportions. The shaft will turn inside the inner race, and the ball bearing will be out of commission.

My opinion, based on a number of years of experience in this line, is that a well proportioned babbitt bearing gives better satisfaction. Of course, where great loads are to be carried, and where the inner race of the ball bearing can be of ample size, fastened to the shaft in such a way that it cannot come loose, I would prefer a ball bearing. But in a transmission where the load is comparatively small, only the weight of the shaft and the load from the side thrust of the gear, the friction produced on the bearings is negligible, and a solid bearing fills the bill very satisfactorily, at a very small fraction of the cost of a good ball bearing. The drawings show a transmission which gives very good service, and which does not require any undue attention in operation. It has two speeds forward and one reverse, transmitting the power from a four cylinder 4½x5 inch motor without trouble. The gears are case hardened, and of a steel known as manganese steel. This steel, while not the best for gears, gives very good service, and has the advantage of being easily handled in machining as well as in hardening.

CONTROL.

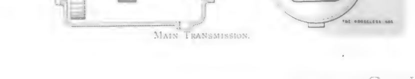
An ideal control system would be one in which the shifting of a single lever would release the clutch, shift the gears and engage the clutch again without any further operation of a foot or other lever. But in handling an automobile one very often has to release the clutch without shifting the gears, and therefore it becomes necessary to operate the clutch by a separate lever. The problem has often been attempted to produce a mechanism which would not permit the shifting of gears without first releasing the clutch, and there are today several such mechanisms on the market. But, although at the first glance such a mechanism seems to be just what is wanted and desired, it will be found when in use to cause trouble of a nature not looked for. It often happens that while shifting the gears, especially when starting or backing, the gears are not in the right position, and it becomes necessary to engage the clutch to start the gears. In most of such construction it will be found impossible to engage the clutch under such conditions, because the very principle does not permit it. It is true this statement presents an extreme case which does not often occur, but it is very annoying when it happens, and it does happen.

After all, these interlocking devices are of use only until the beginner has learned to operate lever A before lever B; after that it becomes a nuisance, and in most cases is done away with.

The system of control illustrated in the cut is of the simplest possible kind. A check lock is provided inside the transmission case, which holds the sliding gears securely in the position required, either engaged or neutral. The transmission being progressive, only a single lever is required to shift the gears; all the connections are substantial, durable and simple. The clutch is released through a foot lever, which at the same time acts as a slight brake, checking the motion of the clutch shaft, and permitting the shifting of gears without clashing.

This system of control will be found very convenient when operating a car in crowded streets, when it is necessary to move very slowly and intermittently. The car responds to the action of the foot lever in a manner which is surprising to those not used to this kind of control. The illustration of the multiple disk clutch shows the method by which it is operated.

Negotiations are at present being carried on between this country and Germany regarding a new treaty on patent laws. Under the existing law Germany insists upon certain rules which jeopardize the returns from the inventions of such Americans as do not observe these rules. The negotiations with Germany, if they reach a successful issue, will probably be extended to other countries. In the end it is the hope of the United States that patents the world over may be respected without question of nationality. There is no intention, according to State Department officials, of embarrassing the new English patent laws by conducting negotiations with Germany at this time.



Main Transmission.

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Taxicab Fares and Profits.

Stories of exaggerated profits made in the business have been given wide publicity in connection with the promotion of taxicab companies in this country. Thus, one New York newspaper only last week printed an article to the effect that one company had earned 113 per cent. profits in one year. It is understood that this statement first appeared in a letter sent out to investors by one of the New York companies. Prospects of such enormous profits are a strong bait to the unwary investor, and there can be little doubt that the company which issued these letters is preparing to place additional stock. Statements have also repeatedly been put into circulation to the effect that the taxicab business in the various European capitals is extremely prosperous. Anyone who is seriously interested in the question is advised to read our recent Taxicab Number, which contained special articles on the taxicab situation in London, Paris and Berlin. It is well known that Berlin experienced a regular taxicab crisis about a year ago, when many of the small operators were obliged to stop their services, and in some instances the cabs were attached by the sheriff on account of inability of their owners to pay instalments due on the purchase price. In Paris, too, the business has been anything but prosperous, as is shown by the heavy slump in the quotations for taxicab stocks. In London the taxicab is little older than in New York, and little can be learned from the British capital at present as to the profitableness of motor cabs.

In view of the above facts any statements of enormous profits in the taxicab business abroad are pure misrepresentations. No doubt some of the promoters of taxicab companies in New York are playing the old game of quickly developing a seemingly very prosperous business, making a good showing during the first year's operation before competition has asserted itself and before the rapid depreciation of the vehicles is heavily felt, and then selling out to the public on the strength of this showing. It is hardly necessary to emphasize the harm which such promotion methods will do to the legitimate business. It will give the entire taxicab business a black eye and cause investors to shun it for years to come, after the misrepresentations have once been exposed and the boom has collapsed.

But these methods will also react injuriously on the business in an indirect way. No sooner had the statement of a 113 per cent. profit been published than a New York alderman announced that he would introduce an ordinance which would limit the permissible rates of fare to about one-half the present rates. There could be no objection to this proposal if the companies actually made more than 100 per cent. profit annually, but this is far from being the case. We are convinced that the present schedules allow of no more than a reasonable profit, if everything is taken into consideration. New York taxicab rates are about twice as high as those of European cities, but the regular cab fares and street car fares are also about twice as high here, so that taxicab fares do not seem excessive. If the threat of cutting the legal taxicab fares should thwart the obvious scheme of deceiving the public into buying large blocks of taxicab stocks under a misapprehension as to the actual earning capacity of these cabs it would have served a good purpose; but if the legal fares should actually be cut to about 50 per cent. of what they are now, the taxicab business in this city would be practically killed.

Varying Practice With Respect to Equipment Furnished With Cars.

While it is quite a difficult problem for the intending purchaser to decide upon the relative merits of different cars offered at about the same price, the choice between such cars is rendered even more difficult by differences in the equipment included in the regular selling prices. In the case of the new low priced four cylinder cars the differences in the fulness of their equipments are especially confusing. This is the more unfortunate, as the cost of an equipment, including lamps, magneto, special tires and the like, forms a much larger factor in the total expenditure for such a car than for an expensive vehicle. A magneto or an acetylene generator costs as much for a cheap car as for an expensive car, but their cost bears very different ratios to the cost of the two vehicles themselves.

A certain manufacturer of low priced touring cars may quote a very attractive price for his cars—lower than most others—but when the specifications are read it is seen that not even oil lamps, but only the lamp brackets, are included, and that the tires are of smaller section than will give most economical results. Another manufacturer may list his car at a price perhaps $300 higher than the former, but include a high tension magneto, oil and gas lamps, tires of a half inch larger section, and some other conveniences. When the prospective purchaser comes to figure up the cost of this equipment he is likely to find that it is worth just about the $300 difference in price between the two machines.

All degrees of equipment, ranging from next to nothing to a full line, are included among the announcements of different manufacturers, and considerable figuring is required on the part of the intending purchaser in order to put these different cars on a basis where they can be fairly compared as to price.

It is, of course, very convenient to buy a car fully equipped, as the trouble of looking up accessories is thereby obviated; but individual requirements are so diverse that, no matter how carefully a manufacturer selects his equipment, he cannot please all customers. If a car is sold without equipment the purchaser can use his own discretion as to what accessories he will add and what makes of magneto, lamps and so forth he will purchase. The car manufacturer, of course, acts merely as a dealer, so far as these accessories are concerned, but he buys them in large quantities at wholesale prices, and, as he seldom tries to make much money on them, the customer probably secures them more reasonably than if he bought them himself separately. Probably the most convenient course, as regards the intending purchaser, would be for each manufacturer to list his car with no equipment at all or with only the equipment necessary to enable the car to be operated legally—the oil lamps and horn—and then to specify the extra cost attendant upon the fitting of a magneto, extra sized tires, gas lamps and so forth. It would make little difference just what was included in the "standard equipment" so long as it were generally understood and conformed to. By the universal adoption of some definite practice in this matter the list price of any car would mean the price of the car itself, and much confusion would be avoided.

Deafness as Disqualification for Driver's License.

In our last issue a reader protested against barring persons from driving automobiles on account of defective hearing. He contends that safe automobiling is not dependent upon freedom from deafness, and he cites several instances of railroad engineers who are "hard of hearing," but who have never had a single accident in their long years of experience on locomotives.

In considering this argument it must not be forgotten that there is the greatest difference between running a steam engine on rails and operating a motor vehicle on the public avenues of travel. A railroad locomotive does not have to be steered, and it is run upon tracks laid upon a private roadbed, not a public highway, where horses and wagons are traveling, people are walking and crossing, and children are playing. Moreover, the railroad engineer is surrounded by signaling devices for securing safety of travel, such as block signal systems, which require only good eyesight. Hearing hardly constitutes an essential qualification of the operator of a power vehicle run upon tracks; at least his hearing need not be so keen as that of the chauffeur or other automobile driver.

The automobile driver must have good hearing in order that he and his car may not be a menace to other users of the road. A large majority of warnings of danger incident to travel on the public highways are first perceived by the ear. Take, for example, the meeting of vehicles at corners and intersections of streets where the view is obstructed. Ordinarily, upon approaching such places, an audible warning is given; but of what use is the sounding of the horn if it cannot be heard by a person in the danger zone? The same situation exists when overtaking and passing. The driver of the automobile in advance has no warning of the approach of the rear vehicle, unless the horn is sounded and heard. Without horns or other suitable signal devices, the automobile could not be allowed on the roads and streets. Such signals are ineffective in the case of those persons unfortunately lacking the ability to hear. Reference is being made here not to those who have merely defective hearing, but to persons who are rightfully called "deaf," and who are unable to hear ordinary conversation without artificial aid. It is admitted that fair eyesight is the most important qualification of the automobile driver, except a disposition to be careful, but fair hearing should also be required.

Friction in Steering Mechanisms.

With the idea of reducing the effort required in steering, and possibly also to reduce wear and the necessity for adjustment, many manufacturers have fitted ball thrust bearings at the upper end of the steering pivots and in the steering gear. It is now claimed by some that the use of these antifriction thrusts causes cars to steer too readily, making them "tender" and rather dangerous in an emergency. For this reason some makers are considering the advisability of using hardened steel washers instead of ball bearings for these thrusts.

For a heavy car the load upon the steering pivots is rather heavy to carry on plain washers, unless they are considerably larger than it is customary to make them, so it is probable that attempts to discard ball thrusts in such vehicles may not prove successful.

The thrust load in the steering gear itself depends upon a number of factors, prominent among which is the angle of the worm or screw on the steering shaft, supposing the gear to be of the common worm and sector or screw and nut types. In many cases the thrust cannot be large, and as the movement is comparatively slow it would seem that the use of ball thrusts was unnecessary.

However, the important requirement in a steering gear is not so much that it turn with very little friction as that it turn with the same friction every time, under otherwise identical conditions. Uniformity of friction is the result sought, and this can perhaps be best obtained by the use of ball bearings. One of the worst accidents that can happen to a car is locking of the steering gear, and though this is much less frequent than anyone who reads the newspaper accounts of automobile accidents would suppose, it is common enough to be considered in design.

It would be most interesting if makers and users would publish their experiences in the use of steering systems equipped with plain and ball thrust bearings.

"Standard" Tread.

In descriptions of automobiles the distance between the centres of the tires on opposite sides of the car, where they bear on the ground, usually called the wheel "tread" or "gauge," is often referred to as "standard." The question at once arises, what is meant by a "standard" tread—that is, how many inches does it represent? It will be found by actual measurement that the distances specified as standard vary from 54 to 56½ inches; perhaps the most common measurement is 56 inches.

In many parts of the country it is necessary to have a car which will "track" with the steel tired horse drown vehicles which form the ruts in the roads. There is likewise some confusion in the tread of these vehicles. Buggies and surreys are often built with a tread of 56 inches (narrow track) and 62 inches (wide track); these measurements are from outside to outside of tires. Since the tires generally range from ⅞ to 1¼ inches wide, the smallest inside measurements would be 53½ and 59½ inches, respectively. Heavy farm wagons have treads of 54 or 60 inches, measured from centre to centre of tires. The more usual tire widths run from 1½ to 2 inches, making the inside widths for 2 inch tires 52 and 58 inches. Of course, tire widths on these heavy wagons run as high as 8 inches, but the widths quoted are most common.

The narrower treads mentioned obtain in most parts of the country, but wide track wagons are common in the South and in some parts of the West and Southwest. We think there are other "standards" besides those mentioned.

In view of these conditions anyone buying an auto to be used much of the time upon country roads will be well advised to determine the distance apart of the ruts in his part of the country. It will also be advantageous for manufacturers to definitely state in their catalogues and other advertising literature the width of tread they furnish.

Who Is to Blame?—An Automobile Is a Machine; Give It the Care a Machine Needs.

By Charles D. Smith.

Who is to blame? Is it you, Mr. Manufacturer, or is it you, Mr. Owner? To blame for what, Mr. Owner? For "knocking," refusal to pay repair bills, incessant fault finding with the man who looks after your best interests (whether he be a brass polisher, floor man, garage or repair shop foreman or superintendent), for literally tearing to pieces Mr. Manufacturer's advertising, selling, repairing and manufacturing policies. If you do any of these things, Mr. Owner, you are to blame. You immediately cry, "Why, am I not the aggrieved party?" Let us see if you are.

INCOMPETENT OWNERS.

First, are you a "knocker"? You have always been a broker, baker or candlestick maker—anything but a mechanical man. You buy a car; have a few minutes' or a few hours' instruction in the method of operating it and the adjustment of a few of the most important parts. But it is safe to say that, with your limited knowledge of anything mechanical, and the hundred and one new features coming to you suddenly, you have forgotten nine out of ten of the things you were told, even before you have driven your car one mile. Then some little thing (very trivial to the expert) goes wrong. You say "It's the machine." Sure, it was the machine; perhaps the fault of the manufacturer, and perhaps the way you have cared for the machine. But you, Mr. Owner, ninety-nine times out of a hundred, will go back to the repair man and swear by blue streaks (and sometimes blue cuss words) that the machine has never been right since you had it, and that you are entitled to a new one.

Mr. Dealer or Mr. Repairman listens to these kicks; but does he swear back? Seldom (audibly). He has expected this from you; he has had it from 95 per cent. of his customers before you, during the first few weeks' experience with their first car. You are so mad you will hardly let him explain to you that he had already cautioned you, for example, against the coming of cold weather; that your carburetor might need slight change in its adjustment; that you should use some kind of anti-freeze solution in your water circulating system a little before you expected freezing weather. You have forgotten he told you to oil certain joints or connections in this or that place, and that you should always keep your tires pumped up.

Have you, Mr. Owner, ever neglected any of these different things, or maybe all of them, and taken it out of someone's hide for your indiscretions? Be frank with yourselves, you owners of automobiles—'fess up; most of you have. If so, then you are to blame.

Have you been fair to the manufacturer? No, you have taken out your hammers and pounded him to a mass of jelly. Why? Because you are not fair with him or with yourselves. You, perchance, did not want it known that you were not proficient in taking care of your machine.

What have you done? Gone to your club, to your business, among friends and acquaintances, and told them what a poor car you have. The result is that the dealers and manufacturers, who are really your good friends, lose not only your business but that of whomever you may have influenced against your particular make of car.

But suppose, Mr. Owner, you are a man who can be convinced; that you have brought your car in and Mr. Dealer or Mr. Repairman has convinced you that the trouble you have is your fault—what then? This may be the tenth time you have had this same trouble, and the dealer may feel it is time he began to make charges for time or parts. You refuse to pay the bill; say the trouble should not have happened; that "my car has been run only one month, two or three months" (as the case may be), "and is practically, if not quite, a new car. Why should I pay? I am being 'done.'" But you do not stop to consider that you are presented with such bills because you have forgotten, or because you did not know. If so, why should Mr. Dealer or Mr. Repairman be held up for bills you justly owe?

LIBERAL TREATMENT BY REPAIR SHOP.

Think this over, Mr. Owner. You may have had this charge made against you the fifth or tenth time you came in for your repairs (true, only slight, but they cost Mr. Dealer and Mr. Manufacturer something). But, Mr. Owner, did they charge you the first four times in one case, or the first nine times in another? Be honest now; have they not been very good to you, and in all justice should you not walk up to the desk and pay your bill? You owe it honestly; so be fair with the other fellow and do not get out your hammer and start an anvil chorus, telling Mr. Dealer or Mr. Manufacturer that if he wants his money he can sue for it. Pay up, Mr. Owner. They can't keep your car in shape indfinitely with no charges being made against you.

ABUSE OF MACHINES.

By this time, Mr. Owner, you are thinking, "This does not mean me. My trouble was that I had a spring break while I was driving along a smooth boulevard." Of course you did; but do you remember that several days before you drove over some very rough country roads, or ran your front wheel into a bad hole in the street? That was when your spring started to go; the weight of the car was too great for the remaining uninjured spring leaves, and the spring finally let go while you were driving on a good road. You may have your car overloaded today, or have had since the trouble started; but now is the time Mr. Manufacturer "gets his," because the spring gave out on a smooth street. You did not think of your overloaded car, or the bad roads, or the ride of the other day, did you, Mr. Owner? No; well, don't lay it up against anyone but yourself.

TESTS BY MANUFACTURERS.

You say it was not a spring—it was a front axle. The same ride that broke the other fellow's spring may have been the cause of your broken axle. Don't kick too hard, Mr. Owner. The manufacturer has driven the first one, two, and often three, cars made of this same model many thousand miles under conditions that at times were beyond reason. The axles on these cars did not bend. They had also been tested with tons of pressure at the factory.

TINKERITIS.

So I might go on down the line; and let me tell you, right here, Mr. Owner, ninety-nine times out of a hundred you are to blame. You have come back with the statement that you are a mechanical man, that you have had several cars and are experienced. Quite right. But do you have trouble? Yes? Well, perhaps you are troubled with "tinkeritis." Nearly as many owners are troubled with this disease as there are owners who do not know. A great many people are overzealous in attention to their machines. Let me tell you that the man with the "tinkeritis" habit is the hardest to deal with the auto man comes in contact with. Usually he knows. He does not give the repair man or the manufacturer or any of his experts the credit of being as well acquainted with machines as he himself.

WHAT THE AMERICAN MANUFACTURER HAS DONE.

Did you ever stop to think that the first American automobile was sold in 1898—less than eleven years ago? Do you remember what a crude looking machine it was? Not much like the present day luxurious car. Was it you, Mr. Faultfinder, Mr. Knocker, or Mr. Tinkeritis who brought about this wonderful change? No, it was the manufacturer and the men whom you have kicked against.

MAKERS' PROFITS—COST OF PARTS.

Let me tell you there are not twenty automobile manufacturers who have made a large amount of money, and they only from the fact of having done an enormous business. The successful manufacturer's profits have been no more per piece than those of the manufacturer who has barely kept his nose above water—but the former had the advantage of a large business. Why, then, should he charge less for his parts if this is so? The amount of money lost by special machine tools, jig and fixtures becoming obsolete is almost unbelievable.

EXTENSIVE EXPERIMENTATION BY MANUFACTURERS.

Is the disgruntled man who is always saying that this or that manufacturer does not know his business, does not know how to build an automobile because he did not put such and such a mechanism on his latest model, and who always has the proper solution for making such models better, aware that the manufacturer against whom he is kicking for not having these certain devices was in the majority of cases the first maker to use the device he is howling about—that the manufacturer tried it long ago and found it inferior—a detriment rather than the valuable asset you believe it? Are you aware that the older and larger manufacturers have expensive experimental rooms and laboratories to keep up, and that they are continually building motors and cars that are never put on the market; that they are building new devices of all descriptions, hoping to get some strong feature that will be of immense service to you in your pleasure? In these laboratories dozens of coils, magnetos, timers, carburetors and other accessories are tried—not for an hour or a day but for months. All this is done, Mr. Owner, that you may have the enjoyment that comes of a first class car; and the manufacturer is giving you just what you are looking for—a first class car. In fact, he is giving you a mechanical production that is far superior to anything else as a means of locomotion.

THE MECHANICAL STATUS AND BURDEN OF THE AUTOMOBILE.

Remember that your automobile travels under the vilest conditions, is handled brutally at times, yet gives you continually dollar for dollar in value if it is handled and cared for with a reasonable amount of intelligence. The manufacturer is entitled to the credit of giving you a good, high class automobile—and he has done it in less than eleven years.

Take the next best in locomotion—the locomotive. Have we built up in seventy-five years a locomotive that can compare with this eleven-year-old child? No. How many of you have boasted that you have taken your beloved wives, children and friends on trips from one to four thousand miles and never touched a wrench to your car from the time you started until you returned? Could you ride behind a locomotive, of which most of us are proud, without a wrench being used on it in a like number of miles? I guess not.

INCOMPETENT CHAUFFEURS.

Let me caution the man who hires a low salaried chauffeur. The cheap man is the curse of the industry. The manufacturer pays big wages to turn out a high class, finished product. Why, then (if you must have a driver), do you hire a cheap man to destroy the machine of excellence? You may rest assured that if this man whom you are paying low wages is a valuable man he would be getting the top notch wage. He would go after it, as any other man would reach out for the best. You may believe you are saving money with your cheap man. But let me tell you he is taking the life out of your car very rapidly, and the money from your coffers more rapidly still. Stop going around to your dealer or manufacturer, telling them your troubles, that they should make good this or that thing on your car. It is not their fault—you are to blame; you have a cheap man on your car.

THE LOCAL EXPERT AND FACTORY WORK.

We know the man who writes to the factory: "Your repairs were received and were not right. We have the best automobile expert in the State in our town, and he says this and that part is wrong, etc." Ought he to be the arbiter, Mr. Owner? He may look after or be familiar with from five to twenty-five different makes of cars. Can he be proficient on all of them? Well, hardly; maybe on none of them. The manufacturer, on the other hand, has his men trained for one make of machine, of his manufacture. You may be very sure that when your repairs come back to you they are about right. The men in the factory repair department are not men who are here today and somewhere else tomorrow. They are usually men of some years' standing with their company; not only that, but they usually know their business.

WHO'S TO BLAME?

Now, Mr. Manufacturer, are you to blame? I really believe that you seldom are. You know that Mr. Knocker is wrong, because you have the names of hundreds of customers who are driving with the best results the same type machine that is complained of. Perhaps the satisfied users have had more trouble than Mr. Knocker, only they know what a machine should and can do.

GARAGES AND FACTORY COMPLAINTS.

You, too, Mr. Faultfinder, when you go to a garage do not try to have the men get your car out ahead of the four or five other customers waiting for theirs. They are just as important as you. Do not stamp around and make everyone feel unpleasant, as no one is to blame because you came in a little later than someone else and have to wait a few minutes.

Let me say to you, Mr. Owner (who may be the big noise in your locality), that when you write to the manufacturer and ask him to send you a bill of goods, don't kick if they come to you C. O. D. The manufacturer has probably never heard of you, and is not to blame because you have not previously established your credit with him.

AN ORDINARY BUSINESS PROPOSITION.

Now, Mr. Owner, look the situation squarely in the face; size it up like any other business proposition; take into consideration that the automobile industry to date has produced less than twenty money makers; that you have the best means of locomotion in the world, and you will see that the automobile manufacturer is not a grafter, after all, but a business man, who is using every means at his command from the smallest item up, whether it be his garage, manufacturing, repairing or selling departments, for your pleasure, as your pleasure means his business. You are the gainer, Mr. Owner, so why not be fair with the manufacturer? The manufacturer is not working a 10 cent game with a dollar comeback. So be fair with him. Learn to care for your car properly and it will then give you satisfaction.

Some Improvements in Pleasure and Commercial Cars.

By G. S. Granlund.

All designers try to keep their engines as compact as possible. In order to do this connecting rods are, as a general rule, made shorter than they ought to be, which increases the piston thrust on the cylinder walls. The wear may be very small if the engine is thoroughly lubricated, but if it runs dry for any reason it will not be long before the cylinder will be worn so much as to be unable to hold compression.

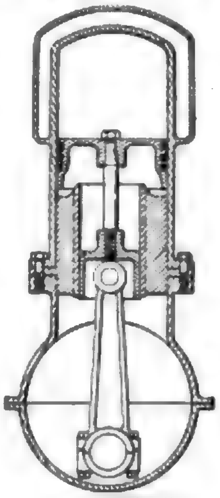


Fig. 1.

In steam engines this is guarded against by making the connecting rod long and by adding guides and crossheads. The only single acting internal combustion engine using this construction is the Diesel oil engine. This engine will outlast any gas engine having pistons of the trunk type. It would, however, be difficult to incorporate this idea into engines of pleasure cars, as it would either decrease the road clearance or else increase the height of the bonnet. On commercial cars this would be no great handicap, as the few pounds of extra weight would not be detrimental. The construction of such an engine is shown in Fig. 1.

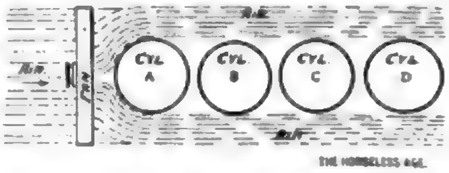


Fig. 2.

AIR COOLING.

That air cooling possesses advantages if it is effective is undeniable. In the first place

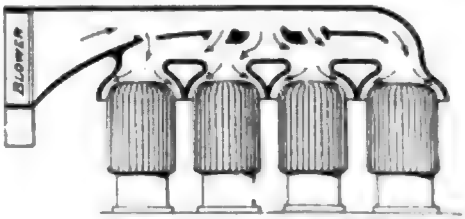


Fig. 3.

it lightens the engine, and in the second it eliminates the pump, radiator and water. But air cooling becomes of no real value if one or two cylinders are cooled and the others remain hot. There are several makes of good cars which have a fan placed in front of their four or six cylinder engines, as shown in Fig. 2. It is quite obvious that cylinder A will be cooled for at least half its circumference. Cylinder B will also lose a little heat, but cylinders C and D will become so hot as to burn the lubricating oil. The writer has a remedy for this, which is illustrated in Fig. 3. The fan is made in the form of a blower, and the air is delivered through a sheet metal casing, G, to the top of each cylinder. The radiating webs or fins are longitudinal to the axis of the cylinder, instead of concentric, as in the cars referred to.

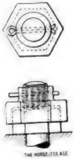


FIG. 4.

LOCKING NUTS.

Castellated nuts certainly look well, but they are a difficult and expensive means of keeping bolts from loosening. Sometimes the holes in the bolts for the cotter pins must be drilled in the most cramped and awkward positions. Also, from 25 to 50 per cent. of the total number of threads are useless for holding. In Fig. 4 is shown a cast or drop forged piece, having a hole slightly larger than the diameter of the bolt. In this piece is a hexagonal depression which fits the nut. The bolt can have the hole for the cotter pin drilled in the department where it is made, while a corresponding hole is drilled in the lock. The cotter pin is then inserted as shown.

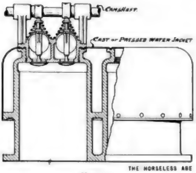


FIG. 5.

SEPARATE WATER JACKETS.

Difficulties develop in casting "block" cylinders on account of distortion. Trouble is also experienced in supporting the water jacket cores. These difficulties may be overcome by using a pressed jacket, as shown in Fig. 5. The valves would, of course, be placed in the head.

Hand Adjusted Brakes.

By Chester S. Ricker.

About three years ago the makers of the Mercedes and Fiat cars exhibited chasses with hand adjustable brakes, but until this year only this class of cars have been so equipped. By hand adjustable brakes I mean such as do not require tools of any description, not even a pair of pliers, for adjusting. This is an excellent refinement, for brakes which are loose are of no more use than the cheapest and crudest, although they may be of the best design.

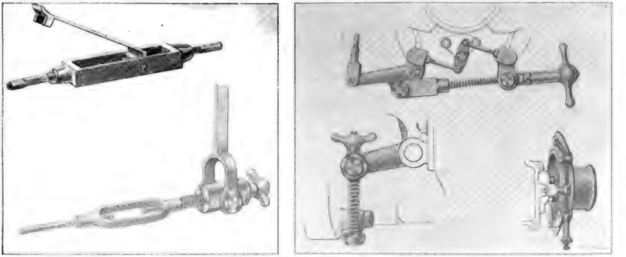
Now one cannot deny that the average driver, although he knows the possible consequences, will let his brakes go until it is absolutely necessary to adjust them. But can one blame him when the only adjustment is located (as is common) under the body in a place difficult of access, and probably exposed to the weather so that it soon rusts fast?

Usually the designer who is careful enough to provide large brakes will have them easily adjustable. However, too many manufacturers still use too small brakes, which wear quickly and need more frequent taking up. The brakes which are undersized should have easy adjustment, for they will require it so often, but unfortunately they do not have it.

This year at the Olympia (London) Show there were quite a number of cars, not only high but also low priced ones having hand adjustment for their brakes. This trend is especially commendable, since it includes the lower priced cars, which are often taken care of by their owners.

Two types of adjusting devices were shown, which I will term the turnbuckle type and the wing nut type. The former was applied exclusively to the rear brakes, where a rod connects the actuating lever and the lever on the brake drum. There were two cars shown with this arrangement, the Hotchkiss and the B. S. A., and in both these devices were applied on a rod which came outside of the frame, and were unobstructed. I have shown the two for the sake of contrast. One illustrates the simplest and the other one of the more elaborate types. After seeing the Hotchkiss, which is certainly the acme of simplicity, one cannot claim that such a device either costs too much or adds too much complication. On the other hand the B. S. A. is quite complicated, being a combination of both a turnbuckle and a wing nut. Both cuts, I think, are self explanatory.

For the transmission brakes the wing nut type seemed to be used exclusively. This



HOTCHKISS. B. S. A. ARGYLL. DE DION. DARRACQ.

HAND ADJUSTMENTS FOR BRAKES.

device consists essentially of a wing nut with two small Vs on the under face corresponding to two V grooves in the bearing surface. These serve to keep the nut from rotating. To keep the nut against the bearing surface, even when the brake is released, a spring is provided. This will become clearer if the cuts of the De Dion and Argyll are examined. The De Dion adjustment, like the B. S. A., seems to be over elaborate.

Digressing a moment, it will be noticed that on the De Dion a device is provided to insure that the two brake shoes move equal distances, and also that they wear equally, but it is questionable whether this latter object is realized. Both the De Dion and Darracq have the clamping shoe type of brake, which is quite prevalent on the Continent. Although a rather complicated adjustment is used on the former, this type of brake lends itself to more simple devices, as the illustration of the Darracq indicates.

For the band or expanding type of brake, where only a single lever is used, the adjustment can be made very simple. The best example of this was shown on the Argyll. The pedals are mounted on the transmission case directly, and the wing nut is applied on the short arm of the pedal. This, without doubt, is the simplest method, but it is limited to this class of brakes.

The brake adjusting devices shown serve only to illustrate this trend across the Atlantic. From early descriptions of 1909 models it is evident that there will be exhibited at the coming shows several American medium priced cars which have this convenience. In conclusion I would make a plea for the general adoption of hand brake adjustment, since it is both a convenience and a safeguard.

Automobiles in Christmas Charities.

Following their annual custom, the automobile manufacturers and owners of Indianapolis placed their cars at the disposal of the newspapers of that city to carry out their Christmas charity work. The plan was followed with excellent results in former years, and this year was no exception.

The city has two regular newspaper Christmas charities. The first of these is the Santa Claus Fund conducted by the Indianapolih *Star* for supplying toys, candy, books, hosiery, etc., to unfortunate children; the other the Old Folks Christmas Cheer and Winter Warmth Fund, conducted by the Indianapolis *News*. The latter fund supplied baskets of food to unfortunate aged people.

About 1,200 sacks were distributed through the *Star's* charity, while 250 baskets were sent out by the *News*. These deliveries were made by twelve motor trucks and eight touring cars, respectively. The deliveries were made in about half the time formerly required by horse drawn vehicles and there was an additional good feature in that there was no expense.

On Christmas afternoon a dozen touring cars were placed at the disposal of the *Star* for the purpose of carrying inmates of the Indiana Institute for the Blind to the public institutions, where they sang Christmas carols. Hospitals, workhouses, the county jail and the city police station were the institutions visited.

Tool Drawing System of an Automobile Factory.

During a recent visit to the factory of the E. R. Thomas Motor Company the writer's attention was called to their system of making tool drawings. As this system is very economical, both in respect to the work required in making the drawings and the labor used on the tools, an outline of the methods employed will doubtless be of interest to many readers.

All shop drawings are made on 8x10 sheets, using a good quality of white paper—not drawing paper, but more in the nature of a heavy typewriter paper. The first drawing made for the shop is a freehand assembly sketch on one of these sheets. This sketch is merely a picture, being a freehand perspective drawing made in rather close proportion to the tool. On account of long practice the sketcher does a most creditable job. Under the white paper on which this pencil sketch is made are placed two sheets of a special carbon paper. One of these makes a copy on another sheet of white paper; the other makes a copy on tissue paper. The original sketch is retained in the tool drafting room, the copy is sent to the tool makers, and the tissue goes to the tool crib, where it is handy in case the tool is lost or misplaced.

In case the tool, jig or fixture is a simple one this drawing is the only one needed, and all the dimensions, notes, etc., are made on it. Where the work is more complicated and the making of the tool includes different kinds of labor, such as lathe, milling and bench work, a set of details are also made. These details are not drawn in perspective but are made in the third angle projection, which is now almost universally used in drawing rooms. While they are made the same general shape as the pieces they represent they have no definite scale, so that the workman is obliged to follow dimensions, since there is nothing for him to measure. Each of these detail pieces is designated by a letter, and the letters are shown on the assembly.

Only one copy is made of the detail sketches.

It will be seen that by the use of this system the work in the tool room can be divided among the different classes of operatives, each having a drawing of his own to work with, so that it is possible to come as near manufacturing as can be done in tool work.

Where there are a series of tools of similar shapes but different sizes, such as a set of broaches, a sketch is made in one corner of a sheet and its dimensions are lettered. The dimensions for the entire set are then tabulated at the other side of the sheet, using these letters for column headings.

Of course all complicated tools require preliminary layouts of centre lines and some of their principal points. These are made to scale on ordinary drafting paper with Universal drafting machines.

Occasionally a particularly complicated, nice, or unusual tool is required which is a little beyond the possibilities of this system. In such a case a scale drawing on brown paper, similar in every way to those commonly used for tools, is made and sent into the shop. But it is surprising to see the variety of work which is well taken care of on the little 8x10 inch sheets.

The economy in drafting room labor is best shown by the fact that a few men have turned out drawings for over 8,000 tools during the past year and a half.

In an early issue the writer expects to describe some of the tools made by this system.

Buffalo A. C. Elects.

At the annual meeting of the A. C. of Buffalo held on December 20, John M. Satterfield was elected president to succeed Frank B. Hower. The other officers elected were: Laurens Enos, vice president; Harry Thorp Vars, treasurer; Dai H. Lewis, secretary; E. R. Thomas, E. H. Butler, George C. Diehl, J. N. Byers, M. M. Wall and George P. Urban, directors.

Among the different committee reports presented was one by George K. Birge, advocating the construction of an automobile boulevard between Buffalo and Niagara Falls. The club some time ago appointed a committee to take the necessary legal steps, and this committee is drawing up a bill which it expects to have ready in time for presentation to the next Legislature. What is considered the best route starts from Delaware Park and runs north to the line of Ellicott Creek, thence along the creek to the bridge on Town Line road, along the Erie Canal through Martinsville, along Sawyer's Creek, along Bergholtz Creek to Cayuga Creek, thence west along the road running parallel with the Mile Line road to Packard's road and Niagara street, Niagara Falls, terminating at a point opposite the Niagara Falls Power Company's plant. The route is 22½ miles in length, and 3 miles of new road will have to be built. There are two possible ways in which the boulevard may be built. One is to have the State designate it as a State highway and build it with State funds, and the other is to go before the Legislature with a bill authorizing the appointment of a commission with power to create parks and boulevards to the State Park at Niagara Falls.

According to the report of Secretary Dai H. Lewis the club now has a membership of 1,525, an increase of 400 during the past year. It is a matter of pride with the club that of the sixty-six arrests for auto speeding during the past year only seven were members of the club.

Road Clearance of Automobiles.

By Albert L. Clough.

The matter of road clearance is an important one, as any lack in this respect leads to one of two results. It either prevents a car which is deficient in this regard from being used over the rough roads of certain districts, thus restricting its sphere of usefulness, or, if such car is driven over roads of this description, there is a serious likelihood of its being injured or even completely disabled.

As generally understood, road clearance means the vertical distance from the lowest portion of the chassis to the perfectly plane surface upon which all four wheels of the car are resting. If the car is running over a perfectly flat roadbed it will safely travel over an obstruction rising from this flat roadbed equal in height to the clearance, but if the roadbed is not perfectly plane it may not do so.

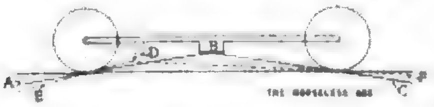


Fig. 1.

Most manufacturers in their printed matter give figures as to the road clearance of their various models, but often this data is very loosely stated. The statement that a particular car posseses 12 inches clearance means very little, as it does not convey any idea as to what part of the car—axle, flywheel or gear box—approaches thus closely to the roadbed, nor does it take into account other factors upon which the practical value of the stated clearance vitally depends.

Fig. 1 is a diagrammatic illustration drawn to scale, showing a car with a wheel base of 140 inches and a 10 inch clearance measured at a point on the chassis midway between the axles. When the car is traveling over a perfectly flat highway a stone or other object 10 inches in height is the limit which can be passed over without striking. Suppose the car is traveling over the sharp knoll A B C, each slope of which has a gradient of 14 per cent., or one part in fourteen, it will be observed that the car will just scrape the roadway, and if there is a rise of more than 10 inches in the roadway from the point of contact of each pair of wheels to the point midway between them, the car will strike. A stone rising from the crest B of the knoll shown in the diagram would be struck by such a car.

Fig. 2 represents a car of 90 inch wheel base and possessing the same 10 inch clearance, the lowest portion of the chassis being, as before, midway between the axles. The car is represented traversing the same steep knoll as in Fig. 1. In this case there is ample clearance, nearly 4 inches. To figure the exact clearance, allowance should be made for the shortening of the actual straight line distance between the first and rear wheel contacts when the car is on a grade of this kind, but the comparison is perfectly valid without this.

DEPENDENCE ON WHEEL BASE.

It should be perfectly plain from these two figures that a clearance allowance which is very ample for a car with short wheel base may be dangerously small for a vehicle of very long wheel base. The long car when traversing a water bar or knoll "straddles" much more of the same than does the short car, and the vertical height of the road irregularity "straddled" by the former is much greater than in the case of the latter.

In comparing the roadability of two cars, as regards their clearances, the inches of clearance per foot of wheel base length furnishes a criterion which is of more value than the clearance figures alone, but this criterion is not a fair one unless the clearances considered are those of parts similarly located as regards the fore and aft length of the chassis.

In addition to traversing knolls and water bars automobiles frequently run on crowned or cambered roads and often over rutted highways. As cambered roads are commonly crowned at the rate of one-half inch to the foot, and as the customary tread or gauge of motor cars is 4.7 feet, the road surface is often 2.3 inches higher at the fore and aft centre line of the chassis than in the wheel tracks. Fig. 3 represents the rear elevation of a car of 10 inch clearance on an ordinary crowned highway, and it is apparent that its clearance, though nominally 10 inches when measured with the car standing on the shop floor, is really but about 7.7 inches along the longitudinal centre line. On deeply rutted roads the effective clearance may be very much less and in extreme cases nothing at all. Returning to the example illustrated in Fig. 1, if the road is cambered according to custom, and the 10 inch clearance used in this example is of a portion of the mechanism located at the centre of width of the chassis, the reduced effective clearance of 7.7 inches will still further restrict the steepness of the water bar or knoll that the car can safely traverse to one which has a slope of 11 per cent. on each side.

Of course these "peaked" water bars as diagrammatically represented here are not met with in practice, but the writer believes that a farmer, working out his taxes, can make something which comes pretty near equaling them in point of effectiveness.

REDUCED BY LOADING CAR.

Road clearance as stated by the manufacturer may be measured with the car loaded or unloaded. If the former is the case the actual clearance will be reduced by the flexure of the springs when the car is carrying its full complement of passengers. In Figs. 1 and 2 it was assumed that no sudden flexure of the springs and downward motion of the body occurs when the car strikes the knoll or water bar. In practice such downward movement of the body always does occur under these circumstances, but in a long car both springs do not necessarily deflect under the inertia effect of the car weight at exactly the same instant, and the downward motion of the central portion of the chassis is not usually so great as that of the ends. The centre of the car shown in Fig. 1 may conceivably move down 2 inches at least when such a hummock, as shown, is being traversed at speed. If at the same time the road profile is rounding, the clearance would be reduced to 5.7 inches and the grade of the two sides of the hummock could hardly exceed 8 per cent. without involving danger of the cars striking it. Occasionally the action of the springs is so timed as exactly to conspire with the highway contour and make the car "bump" the road, when were matters a little differently adjusted no striking would occur.

If the lowest portion of the chassis, where the clearance is measured, instead of being at the centre of the chassis length be near one end, the practical value of this clearance is greatly increased. Referring again to Fig. 1, the lowest portion of the chassis is represented at D instead of at B, its clearance on level ground being 10 inches as before. The dotted lines E D F represent the same water bar as do the lines A B C, but it is seen that in this case the car has abundant effective clearance.

The danger that any part will be struck in passing over a water bar is proportional to its nearness to the centre of the wheel base, assuming that the parts considered have an equal clearance when the car sets on the level. The camber of the road surface affects equally all parts along the longitudinal axis of the chassis.

AXLE CLEARANCES.

At the axles there is no more danger of striking when traversing a "bunker" than when runing on the level. However, some manufacturers make a point of quoting their axle clearances. Such information is of interest, but data as to the clearances of vital parts nearer the centre of the chassis length would be of more value to the intending purchaser. One is sometimes informed by an agent that "our front axle" is the lowest point of our car and has such a clearance," but it should not be inferred from such a statement that the flywheel or gear box may not "bump" the road, although they are an inch or so higher on the chassis.

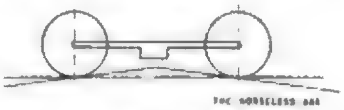


Fig. 2.

It is the effective clearance of the vital parts of the power plant and transmission system which is the most important matter, and different arrangements of these elements offer different degrees of advantage in this respect. Nothing of a disabling nature results if the exhaust pipe or sodpan is struck, but if the flywheel or gear box strikes a stone or other resisting portion of the roadway pretty serious damage is likely to result. Many are the cars of foreign build which, when employed for touring over rough American roads, have suffered bent crank shafts or broken gear cases, to say nothing of punctured gasoline tanks of the pressure type. The flywheel is generally, but not always, the part of the power and transmission plant which has the smallest clearance, and its position on the chassis is of great importance as regards its freedom from liability of striking the road. The further it is placed from the centre of the chassis, or, in other words, the nearer the front it can be placed, the better. If it is to be mounted to the rear of the engine the shorter the engine is the nearer the flywheel comes to the front axle and safety. The longer the engine the greater is the danger to which the wheel and its connected parts is exposed. The crosswise mounted opposed engine is very good in this respect. the block type of four cylinder comes next, followed by the other four cylinder types. The six cylinder motor, on account of its great length, is the worst of all, and if its flywheel be at the rear it may approach dangerously near the centre of length of the chassis. Fortunately the six cylinder engine can run steadily with less flywheel capacity than can the other types, and a smaller wheel diameter can be successfully used.

FLYWHEEL IN FRONT.

The location of the flywheel at the front of the engine—a practice now followed by quite a number of manufacturers—is most excellent, so far, at least, as the clearance question is concerned. When so placed it comes but slightly back of the front axle, and its diameter may safely be made so liberal that its lower edge comes hardly higher than the axle when the springs are at their extreme downward position. As the value of each pound of weight put into the flywheel increases with the square of its distance from the axis, the large diameter safely permissible in the forwardly mounted construction allows a wheel of great energy storage capacity to be used and enables the car to be run very slowly on the high gear, as well as rendering accidental stalling very unlikely. Very often, however, saving in weight is considered more important than an increase in the rotary stability of the engine and a lighter wheel is used, though it may be of the full allowable diameter. There is no doubt that the increase of wheel base which has been and is still going on, coupled with the necessity for reasonable flywheel clearance and the desire to reduce car weight, has resulted in some very scanty rearwardly mounted flywheels being used. As these wheels must be of small diameter in comparison with those of the forwardly mounted type, their steadying power per pound is rather low, and rather than use a wide faced, heavy wheel the capacity of the wheel is often reduced to a point at which the motor runs unsteadily at low speeds and is likely to stall, upon clutch engagement, unless speeded very high.

GEAR BOX CLEARANCE.

It is by no means always the case that the flywheel is the lowest portion of the power and transmission plant. The gear box may, in some designs, come as close as or closer to the roadway than the flywheel.

Even though its clearance is no less than that of the flywheel it is, as a rule, more liable to strike the ground, on account of its being nearer the centre of car length than the flywheel in most transmission systems. If the gear box is a separate unit it is usually located very nearly at the longitudinal centre of the chassis. In case a large degree of angularity is tolerated in the propeller shaft the gear box may be kept quite well up, but if the straight line drive is embodied in the design and the axis of the transmission system slants downwardly and to the rear, the gear box is brought decidedly lower and into a more vulnerable position. In a few makes of car the axle housing, the drive shaft housing and the gear box form a single unit slanting downwardly and to the rear from the single universal joint at the back of the engine. In this type the rear end of the gear box is brought decidedly low, and being usually very near the fore and aft centre of the chassis, is often more likely to be bumped than any other vital portion of the car.

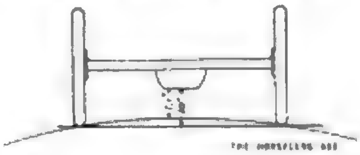


FIG. 3.

When the gear box is integral with the engine crank case it is fairly well forward and not so liable to be struck as if located nearer the chassis centre, assuming the same clearance when the car is standing on the level. If this form of unit power plant is provided with a front mounted flywheel the gear box is brought still further forward and in a safer position. If the gear box is integral with the rear axle housing it is in a much safer position in regard to liability of striking the road than one would at first think. Being so close to the rear axle the danger of striking when the car "straddles" a water bar is almost entirely absent, and if the front axle clearance is made as small as that of the bottom of the gear box the latter is practically safe.

BEST COMBINATION.

Looking at the matter from the standpoint of safeguarding the vital moving parts from striking the road the combination of a forwardly mounted motor with its flywheel in front and a rear axle gear box assembly seems to offer the greatest advantage.

Wherever and however it is to be mounted a compact gear box with a small vertical overall dimension is advantageous as regards clearance. A great many gear sets are being made with the lay shaft and through shaft in the same vertical plane. An attempt to reduce unduly the height of such a box results in the use of too small gears and too small a difference between the highest and lowest gear ratio—a defect which is very common among cars otherwise of good design.

LARGE WHEELS.

It is perfectly obvious that clearance may be made just as ample as necessary or desirable by the use of large wheels and by carrying the body with its mechanism well above the axle line. Everyone knows that if clearances are at present less than they might well be made that it is the result of giving too much consideration to the question of vehicular stability.

The stability question is twofold. In traversing curves centrifugal force acts at the vertical centre of gravity of the whole car and tends to raise from the ground the wheels on the inside of the curve. The higher the centre of gravity is above the roadway the greater is the moment of the centrifugal force and the greater the tendency toward overturning the car. The magnitude of the centrifugal force increases with the speed, and the overturning tendency depends solely upon speed radius of curvature of the path and the height of the centre of gravity, being independent of car weight. A car with a low centre of gravity can be run around a curve of given radius, without danger of upsetting, at a greater speed than can a car of higher centre of gravity. More stress, however, is placed upon this fact by the average motorist than its importance deserves. It is of real moment only to the racer or the speed maniac. At any speed which a reasonable user of the highway ever cares to take a curve the question of upsetting from centrifugal action need not be considered, nor need the question of the height of the centre of gravity ever trouble him as far as the danger of overturning is concerned.

SIDE SWAY.

The body of an automobile being mounted upon springs, resting upon the axles, is not rigid in a plane perpendicular to and crosswise of the road. While the particular function of vehicle springs is to give the body motion in a vertical plane lengthwise of the road, they are also resilient in a vertical plane at right angles to the path of the car. When they yield in this latter plane the body sways sidewise. Spring suspensions which include a platform spring for the purpose of giving the running gear flexibility are specially prone to side sway. In rounding curves, centrifugal force, acting upon the vertical centre of gravity of the spring supported parts of the car, tends to tip the body on the springs toward the outside of the curve, and the magnitude of this tendency is not only a function of vehicle speed and road curvature, but is directly proportional to the distance between the vertical centre of gravity of the spring supported parts and the spring seats upon the axles. Even at reasonable speeds, if a car have limber springs, the side sway around curves is quite noticeable, and in following "snaky" ruts the swaying is decidedly objectionable. There is sometimes a sort of pendulum action set up which causes the swaying to persist disagreeably. The closer, then, that the vertical centre of gravity of the body and its attached parts can be brought down toward the spring seats on the axles, the less tendency toward this swaying there will be. This is the centre of gravity consideration which is of most importance to the ordinary careful user. Happily, a compliance with this requirement does not directly restrict road clearance, as large wheels can be used to secure the clearance desired without affecting the relationship of the spring supports and the centre of gravity of the body.

ELIMINATING SIDE SWAY.

The elimination of side sway is being worked out by the use of flat springs, by dropping the frame side members below the upper spring supports, by the use of the drop frame and by the expedient of locating the side frame members beneath the axles and working the springs in the opposite sense from the conventional. At the same time, by the use of large wheels up to 42 inches or more, the road clearance is being maintained at a point which seems at least to be accepted as sufficient by the majority of buyers, even if it may not be as great as will provide full security against damage to the car when very rough roads are being traversed.

Auto Goggles Dutiable at 50 Per Cent.

The Board of United States General Appraisers decided last week that automobile goggles come under the heading of "goggles" of the Dingley tariff, and are dutiable at 50 per cent., instead of 35 per cent., as claimed by a number of importers. The latter contended that automobile goggles should not be classed in the same rating as ordinary goggles used for street wear, but this contention General Appraiser Sharretts overruled on the ground that the law cannot make any difference between the classes of users. The board held that it is immaterial whether goggles are worn by automobilists or by pedestrians, their use being in both instances the same, namely, to keep dust and other obstructions out of the eyes of the users. Under these circumstances the claim for lower duty was denied and the collector's assessment affirmed.

Among the importing firms affected by the decision are A. G. Spalding & Brothers, the American Thermo Ware Company, Manassah Levy & Co., Saks & Co., and P. H. Petry & Co., all of New York.

A light agricultural motor competition is to be held at the Winnipeg Industrial Exhibition from July 7 to 17, 1909. The tests will comprise plowing, hauling, belt driving and brake tests. Particulars may be learned by addressing A. W. Bell, general manager Industrial Exhibition, Winnipeg, Canada.

Forecast of the Palace Show.

In looking over the list of exhibits for the Palace Show one is struck with the almost total disappearance of the much vaunted six cylinder motor, there being but three, or at most four, makers to show such cars. On the other hand, the popular four cylinder motor is by no means the only surviving type, as the two cylinder vertical and two cylinder opposed will be well represented, the former by importers and the latter by American makers. The single cylinder vertical motor will also be seen in two exhibits. In connection with this reduction in the number of cylinders there is a strong tendency in the direction of lower horse power, motors of 7, 8, 10 and 12 horse power being shown in quite a number of exhibits. The "big car" will be shown chiefly by the importers and a few American makers, but it is safe to say that the average horse power is something below 30.

Prices are much lower than those at the shows held last January and in October, 1907. The entry into the market of several firms marketing a fairly large car for $1,500 and less, during the past eight months, is in a measure responsible for this. One large company has also in that period brought out a runabout for $500, which has also had its effect upon prices. The importing firms have reduced the prices on their cars, and incidentally will show cars of 8 to 20 horse power, where formerly 30 to 90 horse power machine were shown. The American maker is by no means behindhand, as will be seen by the number of 16s and 20s at moderate prices.

Regarding types of cars, the light touring car, which designation is more or less a misnomer, will be extensively seen, the runabout of moderate and low power running it closely in point of numbers, however. The motor buggy makers will have but few additions to their ranks for this show and practically are in the same position as last year. The closed car with landaulet body is now very popular and will be seen in nearly every car exhibit. The limousine has lost ground somewhat, which can also be said of the "gentleman's roadster" type of body. Accessories are not seen in the profusion upon cars as was the case in former years, although they are finely represented by makers and dealers in the exhibits in the upper floors. Wheel bases have been reduced to practical lengths for all cars; some of the imported machines, however, still having the rather abnormal lengths used on the Continent. Frames will be in general straight, the drop frame having declined in popularity during the past year.

The high tension magneto will be seen to have put the battery and coil system of ignition into the background on a great majority of cars, even on some of the popular priced ones. The special ignition systems, on the other hand, will be shown on more cars than previously. Several novel jump spark systems will be shown which will be well worth examination. The low tension magneto has lost considerable ground and will appear on but three or four models. The master coil and multiple coil systems of ignition seem to be about equal in numbers, as is also the case with accumulators and dry cells as sources of ignition.

Regarding clutches, the multiple disc type will not be seen in such numbers as formerly, the cone, with or without inserts, being in the majority. The expanding shoe and contracting band types will also be seen, their adherents having continued their use as in previous years. The friction type of change gear and the planetary systems will be well represented, but the selective type of sliding gear will be in the majority. Three forward speeds are generally fitted, the four speed gear box being seen almost only on imported cars. Shaft drive will predominate, with single chain and side chain in about equal numbers. Several special types of rear axles will also be shown, such as the De Dion, Merchant & Evans, etc. Both forged and cast front axles are to be seen, and one exhibit will show a pressed steel front axle of channel section. There will be a number of cars shown fitted with three-quarter elliptic or full elliptic springs in the rear, although the large majority of cars will be fitted with semi-elliptic springs al laround.

Commercial vehicles will be represented by fewer firms than in the show of last year, 2 and 5 ton trucks being shown in the greatest numbers. Light delivery wagons will also be shown, chiefly by makers of runabouts or motor buggies. Chasses fitted with ambulance, patrol, chemical apparatus and coal hopper bodies will be seen in the commercial department, with one or two vehicles adapted to rural free delivery service. The details of power plant and transmission practice remain the same as in preceding years, the planetary and individual clutch gears perdominating. Double chain drive is almost universal on commercial vehicles.

Mutual Insurance Company.

Representatives of Austrian automobile clubs, manufacturers' associations, etc., met at Vienna on November 22, and unanimously resolved to immediately commence the organization of a mutual insurance society. A schedule of premiums has been issued. These vary with the horse power type of car, and according to whether the car is to be driven only by the owner or also by a chauffeur.

The British Royal A. C. is organizing a headlight competition, the rules for which are now being formulated. It has been decided to provide for four classes, according to the candle power of the naked flame, viz., 5 candle power and less, 5 to 10 candle power, 10 to 20 candle power, 20 candle power and over. This classification has been decided upon after a series of tests on actual headlights made by Dr. W. Watson, F. R. S.

Cars to Be Exhibited at the Palace Show December 31, 1908, to January 6, 1909.

Maker.	Price.	Type of Car.	Weight.	Wheel Base.	Rear Wheel and Tire Sizes.	Seating Capacity.	Frame.	Cylinders.	Bore and Stroke.	Cooling.	Lubrication.	Ignition.	Clutch.	Change Gear.	No. of Forward Speeds.	Steering Gear.	Horse Power.	Drive.
W. H. Kiblinger Co......	$450	Buggy	1,100	69	44x2	2	Wood	2 hor. opp.	4½x3¾	Air	Splash	H. T. battery	......	Planetary	2	Worm and nut	18½	Double chain
Maxwell-Briscoe Motor Co.	500	Runabout	1,100	82	28x3	2	P. S.	2 hor. opp.	4x4	Water thermo-siphon	Splash	H. T. battery	......	Planetary	2	Worm and segment	10	Shaft
Reo Motor Car Co.......	500	Runabout	1,100	78	28x3	2	P. S.	1 hor. opp.	4½x6	Water	Splash	H. T. battery	......	Planetary	2	Worm and segment	10	Chain
Brush Runabout Co......	550	Runabout	900	74	28x3	2	Armored wood	1 vertical	4x4	Water thermo-siphon	Splash	H. T. battery	......	Planetary	2	Worm and segment	7	Double chain
Holsman Automobile Co..	550	Runabout	815	65	44x1½	2	Wood	2 hor. opp.	4x4	Air	Splash	H. T. battery	......	Cable	2	Direct	12	Double cable
W. H. Kiblinger Co......	550	Runabout	1,150	78½	44x2	2	Wood	2 hor. opp.	4¾x4¾	Air	Splash	H. T. battery	......	Planetary	2	Worm and segment	16	Double chain
W. H. Kiblinger Co......	600	Runabout	1,150	89	44x2	2	Wood	2 hor. opp.	4¾x4¾	Air	Splash	H. T. battery	......	Planetary	2	Worm and segment	16	Double chain
Holsman Automobile Co..	700	Runabout	980	75	44x1½	2	Wood	2 hor. opp.	4x4	Air	Splash	H. T. battery	......	Cable	2	Direct	12	Double cable
Holsman Automobile Co..	800	Surrey	1,055	75	44x1½	4	Wood	2 hor. opp.	4x4	Air	Splash	H. T. battery	......	Cable	2	Direct	12	Double cable
Buckeye Mfg. Co........	800	Runabout	1,350	95	30x3	2	P. S.	2 hor. opp.	5x4	Water	Splash	H. T. battery	......	Friction	..	Worm and segment	20	Single chain
Maxwell-Briscoe Motor Co.	825	Runabout	1,150	84	30x3	2	P. S.	2 hor. opp.	4½x4	Water thermo-siphon	Splash	H. T. magneto	......	Planetary	2	Worm and nut	14	Shaft
Ford Motor Co..........	850	Touring	1,200	100	30x3½	5	P. S.	4 vertical	3¾x4	Water	Splash	H. T. magneto	......	Planetary	2	Worm and segment	20	Shaft
Jackson Automobile Co...	850	Runabout	1,600	96	30x3½	2	P. S.	2 hor. opp.	5x4	Water	Splash	H. T. battery	......	Planetary	2	Worm and segment	16	Shaft
Buckeye Mfg. Co........	875	Surrey	1,400	95	30x3	4	P. S.	2 hor. opp.	5x4	Water	Splash	H. T. battery	......	Friction	..	Worm and segment	20	Single chain
Cartercar Co............	1,000	Runabout	1,200	94	32x3	2	P. S.	2 hor. opp.	4¾x4½	Water	Splash	H. T. battery	......	Friction	..	Gear and sector	18	Single chain
Holsman Automobile Co..	1,000	Coupé	1,100	80	44x1½	2	Wood	4 hor. opp.	4x2½	Air	Splash	H. T. battery	......	Cable	2	Direct	26	Chain
Mitchell Motor Car Co...	1,000	Runabout	1,700	92	32x3½	2	P. S.	4 vertical	4x4	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and segment	20	Shaft
Reo Motor Car Co.......	1,000	Roadster	....	96	32x3½	2-4	P. S.	2 hor. opp.	4¾x6	Water	Splash	H. T. battery	......	Planetary	2	Worm and sector	20	Chain
Oakland Motor Car Co...	1,200	Runabout	1,700	100	32x3½	3	P. S.	2 vertical	4½x5	Water	Splash	H. T. battery	......	Planetary	2	Worm and sector	20	Shaft
Atlas Motor Co..........	1,250	Runabout	1,500	90	30x3½	2	P. S.	2 vertical	4½x4½	Water	Splash	H. T. battery	Band	Sliding gear	3	Worm and sector	22	Shaft
Jackson Automobile Co...	1,250	Touring	2,000	104	32x3½	5	P. S.	2 hor. opp.	5¼x5	Water	Splash	H. T. battery	......	Planetary	2	Worm and sector	20	Chain
Buckeye Mfg. Co........	1,250	Roadster	1,500	110	30x3½	4	P. S.	4 vertical	4x4	Water	Splash	H. T. battery	......	Friction	..	Worm and sector	28	Belt
Overland Automobile Co..	1,250	Roadster	1,700	105	32x3½	3	P. S.	4 vertical	4x4½	Water	Splash	H. T. magneto	......	Planetary	2	Worm and sector	30	Shaft
Regal Motor Car Co.....	1,250	Touring	1,900	105	32x3½	5	P. S.	4 vertical	4x4	Water	Splash	H. T. magneto	Cone	Sliding	3	Worm and sector	30	Shaft
Cartercar Co............	1,350	Roadster	....	103	32x3½	3	P. S.	2 hor. opp.	5½x4½	Water	Splash	H. T. battery	......	Friction	..	Worm and sector	24	Chain
Maxwell-Briscoe Motor Co.	1,350	Runabout	1,700	96	30x3½	2	P. S.	2 hor. opp.	5x5	Water thermo-siphon	Splash	H. T. magneto	Multiple disc	Sliding	3	Worm and sector	20	Shaft
Mitchell Motor Car Co...	1,500	Touring	2,300	105	32x4	5	P. S.	4 vertical	4¼x4½	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	28	Shaft
Moline Automobile Co....	1,500	Touring	2,010	106	34x3½	5	P. S.	4 vertical	3¾x4½	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and sector	24	Side chains
Pullman Motor Car Co...	1,500	Runabout	1,750	102	32x3½	2	P. S.	4 vertical	3¾x3½	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and sector	20	Shaft
Dayton Motor Car Co....	1,500	Roadster	1,700	103	32x3½	3	P. S.	4 vertical	3¾x4½	Water	Mechanical	H. T. battery	Cone	Selective sliding	3	Worm and sector	20	Shaft
Cameron Car Co.........	1,500	Roadster	1,650	112	32x3½	3	P. S.	6 vertical	3¾x3½	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and sector	30	Shaft
Jackson Automobile Co...	1,600	Roadster	2,300	110	32x4	4	P. S.	4 vertical	4½x4½	Water	Splash	H. T. battery	Multiple disc	Sliding	3	Worm and sector	30	Shaft
Oakland Motor Car Co...	1,600	Runabout	2,025	112	34x4	3	P. S.	4 vertical	4½x5	Water	Splash	H. T. battery	Multiple disc	Sliding	3	Worm and sector	40	Shaft
Renault Frères..........	1,750	Runabout	929	77	28x3½	2	P. S.	4 vertical	3x4¾	Water thermo-siphon	Mechanical	H. T. magneto	Cone	Sliding	3	Worm and sector	8-10	Shaft
Buckeye Mfg. Co.........	1,750	Touring	1,900	105	32x3½	5	Wood	4 vertical	4½x5	Water	Splash	H. T. magneto	......	Friction	..	Worm and sector	25	Belt
Maxwell-Briscoe Motor Co.	1,750	Touring	2,100	104	32x4	5	P. S.	4 vertical	4¼x4¼	Water	Splash	H. T. magneto	Disc	Sliding	3	Worm and sector	24	Shaft
Atlas Motor Car Co......	1,800	Runabout	2,000	110	30x4	3	P. S.	3 vertical	4½x4½	Water	Splash	Atwater Kent	Band	Selective sliding	3	Worm and sector	33	Shaft
Midland Motor Co.......	1,800	Toy tonneau	2,000	110	34x3½	4	P. S.	4 vertical	4¼x5	Water	Splash	L. T. magneto	Disc	Selective sliding	3	Worm and nut	35	Shaft
Mora Motor Car Co......	1,850	Touring	2,000	110	32x4	5	P. S.	4 vertical	4x5¼	Water	Splash	H. T. battery	Cone	Selective sliding	3	Bevel and sector	28	Shaft
Mitchell Motor Car Co...	2,000	Touring	2,700	122	34x4	7	P. S.	4 vertical	4¾x5	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	35	Shaft
Overland Automobile Co..	2,000	Touring	2,800	116	34x3½	5	P. S.	6 vertical	3½x4½	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	35	Shaft
Pennsylv'a Automotor Co.	2,000	Runabout	2,200	110	32x4	2	P. S.	4 vertical	4¼x4¼	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	28	Shaft
York Motor Car Co.......	2,000	Touring	2,250	106	34x4	5	P. S.	4 vertical	4½x4½	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	30	Shaft
Dayton Motor Car Co....	2,000	Touring	2,200	105	34x3½	5	P. S.	4 vertical	4x5	Water	Mechanical	H. T. battery	Cone	Selective sliding	3	Worm and nut	35	Shaft
Midland Motor Co.......	2,250	Touring	2,650	112	34x4	5	P. S.	4 vertical	4½x5¼	Water	Splash	H. T. battery	Disc	Selective sliding	3	Worm and nut	30	Shaft
Nordyke & Marmon......	2,400	Roadster	1,975	112	34x3½	3	P. S.	4 vertical	4½x4½	Water	Splash	H. T. magneto	Ring	Selective sliding	3	Worm and nut	32	Shaft
Acme Motor Car Co.....	2,500	Runabout	....	96	34x4	2	P. S.	4 vertical	4½x5	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and nut	25	Shaft
Moline Automobile Co....	2,500	Touring	2,500	116	36x4	5	P. S.	4 vertical	4 7-16x5	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and sector	35	Shaft

Cars to Be Exhibited at the Palace Show December 31, 1908, to January 6, 1909—Continued.

Maker.	Price.	Type of Car.	Weight.	Wheel Base.	Rear Wheel and Tire Sizes.	Seating Capacity.	Frame.	Cylinders.	Bore and Stroke.	Cooling.	Lubrication.	Ignition.	Clutch.	Change Gear.	No. of Forward Speeds.	Steering Gear.	Horse Power.	Drive.
Dayton Motor Car Co....	2,500	Touring	3,000	113	34x4	5	P. S.	4 vertical	4⅜x5	Water	Mechanical	H. T. battery	Cone	Selective sliding	3	Worm and nut	45	Shaft
National Motor Vehicle Co.	2,750	Touring	2,000	115	34x4	5	P. S.	4 vertical	4⅜x4½	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and nut	35	Shaft
Renault Frères..........	2,750	Landaulet	....	100	32x3½	4	P. S.	4 vertical	3x3½	Thermo-siphon	Mechanical	H. T. magneto	Cone	Sliding	3	Worm and nut	8-10	Shaft
Mora Motor Car Co......	2,750	Touring	2,700	118	34x4	5	P. S.	4 vertical	6x6	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and nut	60	Shaft
Austin Automobile Co....	2,850	Roadster	2,250	122	36x3½	3	P. S.	6 vertical	4½x4½	Water	Splash	H. T. magneto	Disc	Selective sliding	3	Worm and nut	60	Shaft
Charron, Ltd............	2,850	Landaulet	2,000	108	32x3½	4	P. S.	4 vertical	3¼x4¾	Water thermo-siphon	Splash	H. T. magneto	Cone	Sliding	3	Worm and nut	8-10	Shaft
York Motor Car Co......	2,850	Runabout	1,900	104	34x3½	2	P. S.	6 vertical	3¾x3¾	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and sector	30	Shaft
Isotta Fraschini.........	2,800	Runabout	1,660	82	34x3½	2	P. S.	4 vertical	2½x4	Water	Splash	H. T. magneto	Disc	Selective sliding	4	Worm and sector	10	Shaft
Moon Motor Car Co......	3,000	Touring	2,700	112	34x4	5	P. S.	4 vertical	4½x4½	Water	Splash	H. T. magneto	Disc	Selective sliding	4	Worm and sector	30	Shaft
Hol-Tan Co.............	3,000	Runabout	2,000	112	34x4½	2	P. S.	4 vertical	3 9-16x4	Water	Mechanical	H. T. magneto	Disc	Selective sliding	4	Worm and sector	16	Shaft
Pennsylv'a Automotor Co.	3,000	Touring	2,800	114	34x4½	5	P. S.	4 vertical	4½x5¼	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and nut	35	Shaft
York Motor Car Co......	3,000	Runabout	2,300	106	36x4	2	P. S.	4 vertical	5x5¼	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	40	Shaft
Crawford Automobile Co.	3,000	Touring	....	114	34x4	5	P. S.	4 vertical	4½x5	Water	Splash	H. T. battery	Disc	Selective sliding	3	Worm and nut	40	Side chains
Acme Motor Car Co......	3,200	Touring	3,100	108	34x4	5	P. S.	4 vertical	4¾x5	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and nut	30	Shaft
Charron, Ltd............	3,250	Touring	3,000	110	34x4½	5	P. S.	4 vertical	4x4¾	Water	Splash	H. T. magneto	Cone	Sliding	3	Worm and nut	15-20	Shaft
Nordyke & Marmon......	3,500	Roadster	3,250	114	34x4½	3	P. S.	4 vertical	5x5	Water	Splash	H. T. battery	Disc	Selective sliding	3	Worm and sector	45	Shaft
Mora Motor Car Co......	3,500	Roadster	2,950	105	36x3½	3	P. S.	6 vertical	4x5¼	Water	Splash	H. T. battery	Cone	Selective sliding	3	Worm and sector	42	Shaft
Premier Motor Mfg. Co..	3,500	Roadster	2,900	124	34x4	3	P. S.	4 vertical	4½x4½	Water	Splash	L. T. magneto	Disc	Selective sliding	3	Worm and sector	45	Shaft
National Motor Vehicle Co.	3,700	Touring	3,000	125	36x4½	5	P. S.	4 vertical	5x5	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	40	Shaft
American Motor Car Co..	3,750	Roadster	2,750	110	36x4	2	P. S.	4 vertical	5½x5½	Water	Splash	H. T. battery	Cone	Selective sliding	4	Worm and sector	50	Shaft
Austin Automobile Co....	3,750	Roadster	3,200	118	36x5	3	P. S.	4 vertical	5½x5½	Water	Splash	H. T. battery	Disc	Selective sliding	4	Worm and sector	50	Shaft
Panhard & Levassor......	4,000	Touring	....	113	34x4½	5	Armored wood	4 vertical	3¾x5⅛	Water	Splash	H. T. magneto	Disc	Sliding	4	Worm and sector	15	Shaft
Simplex Motor Car Co...	4,000	Touring	3,500	117	36x5	5	P. S.	4 vertical	5x6	Water	Splash	H. T. battery	Disc	Selective sliding	3	Worm and sector	50	Shaft
National Motor Vehicle Co.	4,200	Touring	3,100	130	36x4½	7	P. S.	6 vertical	4¾x4¾	Water	Splash	H. T. magneto	Cone	Selective sliding	3	Worm and sector	50	Shaft
Welch Motor Car Co.....	4,500	Touring	3,450	125	36x4½	7	P. S.	4 vertical	4⅝x5	Water	Splash	H. T. magneto	......	Individual clutch	3	Worm and sector	50	Shaft
Austin Automobile Co....	4,750	Roadster	3,500	134	36x4	3	P. S.	6 vertical	5½x5½	Water	Splash	H. T. magneto	Disc	Sliding	4	Worm and sector	90	Shaft
De Luxe Motor Car Co..	5,000	Touring	3,750	121	35x5	7	P. S.	4 vertical	5x5¼	Water	Splash	H. T. magneto	Ring	Selective sliding	4	Worm and sector	60	Shaft
Panhard & Levassor......	5,100	Touring	2,800	118	38x5	5	P. S.	4 vertical	4x5⅛	Water	Splash	H. T. magneto	Cone	Sliding	4	Worm and sector	18-30	Shaft
Renault Frères..........	5,250	Touring	2,850	120	35x4½	5	P. S.	4 vertical	3½x4¾	Water thermo-siphon	Splash	H. T. magneto	Cone	Sliding	4	Worm and nut	14-20	Shaft
Isotta Fraschini.........	5,500	Touring	3,200	119	34x3½	5	P. S.	4 vertical	4 1-16x5¼	Water	Splash	H. T. magneto	Disc	Selective sliding	4	Worm and sector	18-24	Side chains
Chadwick Eng. Works...	5,500	Touring	3,500	130	36x5	5	P. S.	6 vertical	5x6	Water	Splash	H. T. magneto	Ring	Selective sliding	4	Worm and sector	60	Side chains
Renault Frères..........	5,750	Toy tonneau	2,850	121	36x4¾	4	P. S.	4 vertical	4x5¾	Water thermo-siphon	Mechanical	H. T. magneto	Cone	Sliding	4	Worm and nut	20	Shaft
Isotta Fraschini.........	6,000	Touring	....	123	36x4¾	5	P. S.	4 vertical	4⅛x5¾	Water	Mechanical	H. T. magneto	Disc	Selective sliding	4	Worm and sector	30	Shaft
Charron, Ltd............	6,000	Touring	....	122	36x5	5	P. S.	4 vertical	4½x5½	Water	Splash	H. T. magneto	Cone	Sliding	4	Worm and sector	30	Side chains
Panhard & Levassor......	6,500	Touring	3,750	128	36x5	7	Armored wood	4 vertical	4 15-16x5½	Water	Splash	H. T. magneto	Cone	Sliding	4	Worm and sector	45	Side chains
Isotta Fraschini.........	9,400	Touring	3,780	128	36x5	7	P. S.	4 vertical	6x6¼	Water	Mechanical	H. T. magneto	Disc	Selective sliding	4	Worm and sector	65	Side chains
Panhard & Levassor......	9,700	Touring	3,800	135	36x5½	7	Armored wood	6 vertical	6 5-16x5½	Water	Mechanical	H. T. magneto	Cone	Sliding	4	Worm and nut	65	Side chains

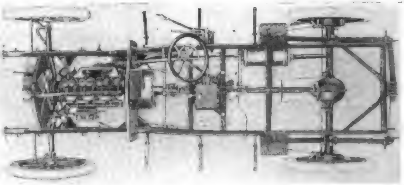
Commercial Cars.

Maker.	Price.	Type of Car.	Weight.	Wheel Base.	Rear Wheel and Tire Sizes.	Load Capacity.	Frame.	Cylinders.	Bore and Stroke.	Cooling.	Lubrication.	Ignition.	Clutch.	Change Gear.	No. of Forward Speeds.	Steering Gear.	Horse Power.	Drive.
W. H. Kiblinger Co......	$475	Mail wagon	....	60	44x1½	900	Wood	2 hor. opp.	4⅛x3¾	Air	Splash	H. T. battery	......	Planetary	2	Worm and nut	13½	Side chains
Brush Runabout Co......	600	Delivery	950	74	32x2	950	P. S.	1 vertical	4x4	Water	Splash	H. T. battery	......	Planetary	2	Worm and nut	7	Side chains
Holsman Automobile Co..	700	Delivery	1,060	75	44x1¼	900	Wood	2 hor. opp.	4x4	Air	Splash	H. T. battery	......	Cable	2	Direct	12 4-5	Double cable
Maxwell Briscoe Motor Co.	1,400	Delivery	1,700	90	30x4	900	P. S.	2 hor. opp.	5x5	Water thermo-siphon	Splash	H. T. battery	Disc	Sliding	2	Worm and sector	20	Shaft
Grabowsky Power Co.....	2,800	Truck	2,900	102	34x3½	2,000	P. S.	2 hor. opp.	5½x5	Water	Splash	H. T. battery	......	Planetary	2	Worm and sector	30	Side chains
Mack Brothers Motor Co.	3,750	Truck	7,000	126	36x4½	4,000	P. S.	4 vertical	5½x6	Water	Splash	H. T. battery	......	Individual clutch	3	Worm and nut	50	Side chains
Mack Brothers Motor Co.	4,650	Truck	8,500	127	36x5	8,000	P. S.	4 vertical	5½x6	Water	Splash	H. T. battery	......	Individual clutch	3	Worm and nut	50	Side chains

NEW VEHICLES AND PARTS

The Cadillac Thirty.

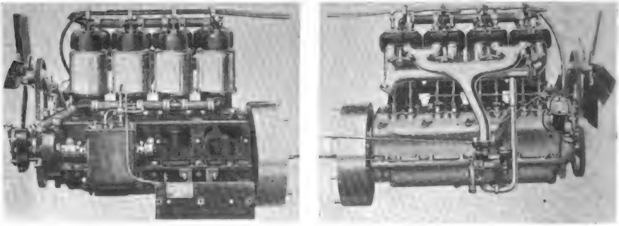
The factory of the Cadillac Motor Car Company at Detroit, Mich., is at present running day and night producing a large number of these five passenger cars. As this is one of the low priced models, which are proving so popular this season, it will be described in considerable detail.



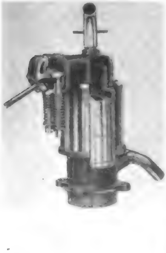
Cadillac Chassis.

THE MOTOR.

This is of the type employed on all Cadillac cars, with individual cylinders, copper water jackets and separate heads, the latter being secured by right and left threaded nipples. It has a 4 inch bore and a 4½ inch stroke. The valve ports are 1½ inches in diameter. The valves have gray iron heads riveted to shouldered steel stems. The lift of the inlet valve is five-sixteenth inch, and that of the exhaust valve eleven-thirty-second inch. The valves are operated by straight push rods adjustably mounted in pieces of case hardened steel, which slide in gray iron guides; hardened rollers at their bottoms contact with hardened and ground cams. The cams are secured to their shaft by taper pins. The cam shaft, oil and water pumps are driven by spur gears.

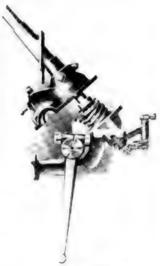


Left Side. Cadillac Thirty Motor. Right Side.



Cylinder and Piston.

Cadillac Thirty.



Steering Gear.

The connecting rods are forged, have a uniform I-section, and are 8½ inches long. The lower ends are bushed with bronze lined with babbitt. Similar bushings are used in the five bearings of the crank shaft, which have two bolts each and are all supported on the bottom portion of the gray iron crank case. The crank shaft is a drop forging with bearings and pins 1½ inches in diameter.

Fuel feed is by gravity from a 14 gallon gasoline tank under the seat. Cooling is by a vertical tube radiator, the water circulation being by a gear pump. Standard ignition is by quadruple coil, although a bracket has been provided for attaching a magneto.

The motor is set on an angle, with its rear end lowered so as to bring the propeller shaft practically in line with the crank shaft. Nevertheless it is oiled by splash; the oil is supplied by a lubricator on the side. It is of the double pump type, one pump supplying a large sight feed on the dash and the other forcing the oil into the crank case. A double set of pockets are cast in the side of the crank case. The lower series is so arranged that each catches the splashing oil from a compartment and transfers it into the next

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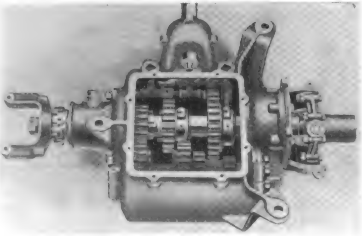
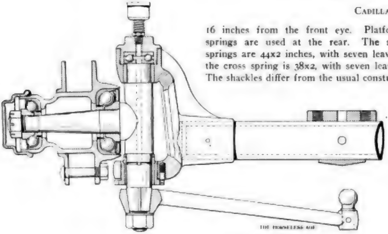


Cadillac Transmission.



Steering Knuckle of Cadillac Thirty.

higher compartment. This would soon fill the front compartment too full, but an overflow is provided there which allows the excess oil to run back to the rear compartment. The upper series of pockets drain on to the crank shaft bearings.

CLUTCH.

A leather faced pressed steel cone of 12½ inches largest diameter is forced into a gray iron seat secured to the flywheel. This seat is cut at several points, and the lips formed by cutting are sprung inward so as to act as springs, giving gradual engagement. Connection to the change gear is through a double sliding forked joint.

CHANGE GEAR.

Three speeds and a reverse are provided on the selective sliding system. The gears are riveted to flanges on the secondary shaft while the sliding shaft is of square section and hardened. Both shafts are mounted on annular ball bearings. The case, cover and the side plate which encloses the shifting mechanism are of gray iron.

To the rear of the case is bolted a horizontally split spherical socket, inside which fits a bronze zone, which is secured to the enlarged forward end of the propeller shaft housing. The universal joint consists of two forged forks with hardened integral pins, turning in bronze bushes clamped in a split ring. Grease can be introduced into this housing from outside the frame through a flexible tube.

AXLES.

The rear axle construction is well shown by the drawing. It should be noted, however, that the ball bearings on which the driving bevel is mounted are adjustable through small openings above them, and are positively locked in adjustment. The front axle is tubular, with the spring seats pinned and brazed in place. The wheels are mounted on three-quarter inch and nine-sixteenth inch balls.

SPRINGS AND FRAME.

The front springs are semi-elliptic, 36x2 inches, with six leaves. The axle is perched 16 inches from the front eye. Platform springs are used at the rear. The side springs are 44x2 inches, with seven leaves; the cross spring is 38x2, with seven leaves. The shackles differ from the usual construction in having an inch steel ball, resting in finished seats, between the links. Each spring is held by three clips or by two clips and two central bolts. A plate is placed upon the top of the spring and holds the clips in place. Spring eyes are bushed with hardened steel and have hardened steel pins fitted with grease cups.

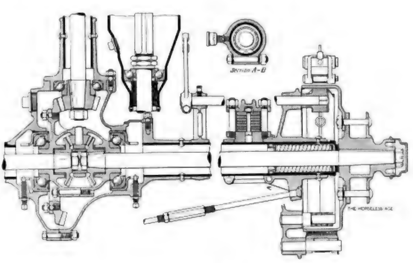
The frame is a typical pressed steel construction. It is 33 inches wide over all. The largest section is 4x1½ inches, made of three-sixteenth inch stock.

BRAKES AND STEERING.

Both sets of brakes are at the rear wheels. The outer contact surface is 12 inches in diameter, with 2½ inches face. The inner brakes are cam expanded. Both sets are lined with Thermoid brake lining. The contracting brakes are equalized by a long pressed steel evener, while the expanding brakes use a short evener.

Steering is by a hardened worm and sector. The sector is cut with a radius slightly out of centre with its bearings, so it is about .007 inch closer in mesh at its middle than at the ends when new. This is to compensate for the wear. The car is said to turn in a 30 foot circle.

The wheel base is 106 inches; the stand-



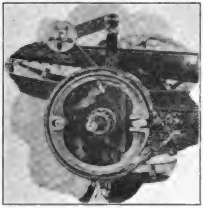
Cadillac Thirty Rear Axle.

ard tread is 56 inches, with an option of 61 inches. Standard tire equipment is 32x 3½ inches, but 33x4 inches will be furnished at an extra price. Touring, roadster and demi-tonneau bodies will be furnished.

The 1909 Acme Models.

The Acme Motor Car Company, of Reading, Pa., has made only few changes in its models for 1909. The bore is increased from 4½ inches to 5 inches, and the braking is done on both jack or driving shaft and on the rear wheels instead of on the rear wheels only. There are, in addition, many refinements of both chassis and body and the 1909 cars will be much lighter in weight.

The cylinders are cast separately with water jackets integral, and they are mounted vertically under the hood. The engine base is fastened to a substantial sub-frame by means of three large arms on each side. The seven crank shaft bearings are fastened to the upper half of the crank case, and can be examined by the removal of the lower half. The bearings are of Parsons white bronze, machined and scraped to fit both the crank case in which they rest and the crank shaft which revolves within them. The tops of the cylinders are provided with relief cocks actuated by a lever on the dash, by means of which the compression is relieved in the cylinders for starting. The cylinders have valves on opposite sides. They have been increased in size and are now 3 inches in diameter. The heads and stems of these valves are nickel steel. The valves are mechanically operated by means of cams which move against hardened steel rollers. These rollers are mounted in a new and improved plunger that does away with all nuts, screws and cotters, and gives a large bearing surface. The cam shafts are supported by four large bearings, two at each end, one between the second and third cylinders, and one between the fourth and fifth cylinders, obviating the tendency of the cam shaft to spring. The cam shafts are driven by steel gears. The magneto gear is driven by a cam shaft gear on one side, while the pump gear is driven by the cam shaft gear on the opposite side. All these gears are enclosed by an aluminum housing bolted to the crank case. The crank case forms the rear end of the housing, the cover being then bolted to the crank case, forming a separate housing for these gears. The pistons have four rings, three at the top of the piston and one at the bottom. The pistons themselves have a convex top to keep the oil and carbon from collecting on the top of it. The piston pins are of large dimensions, and made of hardened steel, bored hollow, ground to size and lapped. The piston pin oscillates in a hardened and ground steel bushing, pressed in the connecting rod. The connecting rod is a drop forging.



Acme Rear Wheel Brake.

The crank pin bearings are also of Parsons white bronze, of a generous size, and made in halves, and shimmed, to allow for take-up. The crank shaft is nickel steel single piece forging with the flywheel bolted to an integral flange. The end thrust caused by the pull-out of the clutch is taken up by a large ball thrust. The engine is of high compression and is claimed to develop its greatest power at about 1,400 revolutions per minute. It is said to have been tested under load at from 80 to 2,150 r. p. m.

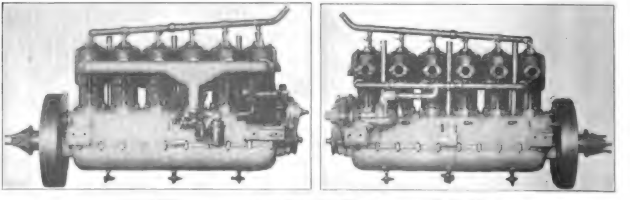
The clutch is an aluminum leather faced cone with cork inserts and held in by a spring, whose thrust is taken up a ball bearing at the end. It is mounted in a steel centre which has its bearing on the end of the crank shaft. This bearing is of bronze, with a grease pocket to supply lubrication. A grease cup in an accessible position for filling supplies the pocket.

The exhaust and intake manifolds have scraped fits to the cylinders. The exhaust manifold is of cast iron and is so shaped that it forms an expansion chamber. The intake manifold is of such shape as to allow of an equal flow of gas to each cylinder.

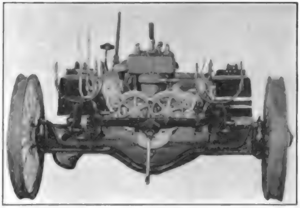
The carburetor is of Acme construction, altered to meet the requirements of the larger engine. The gasoline is fed to the carburetor by gravity, and must first pass through a screen before entering the float chamber; this screen can be removed for cleaning by loosening one nut. The carburetor this year has a universal connection at the top which permits of a lower gasoline level. The float is of hard rubber, which is kept in place by a needle valve in its centre, the valve having a bearing in both top and bottom of the float chamber. After leaving the float chamber the gasoline passes into a spray nozzle, which is of the mushroom type. It is explained that the multiplicity of the openings causes the gasoline to be broken up into such minute particles as to be almost gaseous before coming in contact with the primary air current. For ordinary speeds the air is drawn through small openings at the bottom of the mixing chamber, but as the throttle is opened additional air is admitted.

The main system of ignition consists of a high tension jump spark magneto, which is bolted to the forward end of the crank case. The secondary system comprises a timer and distributor mounted between the third and fourth cylinders, and driven by means of bevels from the cam shafts, the coil being carried on the dash, and a storage battery furnishing the current. The spark plugs are placed over the intake valves, and a separate set of spark plugs for the secondary system are mounted over the exhaust valves. These systems may be used independently, but a single spark lever on the steering column controls both.

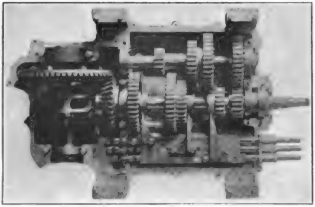
A horizontal tubular copper finned radiator is used. The water is circulated by means of a gear driven centrifugal pump located on the left hand side of the motor and bolted to the case. The pump, which is



Intake Side. Acme Motor, 1909 Model. Exhaust Side.



Front View of Acme Chassis.



Acme Transmission.

of aluminum with a bronze bushing, has the outer end of its shaft supported by a ball bearing. This shaft is connected by means of a Cardan joint to the gear.

The change gear is of the four speed selective type. The direct drive is on the third speed. The gears are of wide face and made of chrome nickel steel. All gears are bolted to their respective shafts. D. W. F. ball bearings are used throughout. The transmission case is so arranged as to be easily accessible, all bearings being held into position independent of the top half or cover of the case. The countershaft bearings are mounted in eccentric cups, by means of which the slightest wear in the gears can be taken up, it is claimed. The differential is of the bevel gear type, and adjustable to bring the bevels into proper mesh. The transmission case is fastened to the sub-frame by means of four large arms, two on either side. It has an inspection cover on the top, drain cocks in the bottom and the gear shift pawls within the case, so as to protect them from dirt or dust.

The jack shafts are in one piece, supported on their outer ends by means of a large D. W. F. bearing. Each jack shaft is so constructed that by loosening two binding nuts the entire shaft is loosened and can be withdrawn without dismounting or disturbing the transmission case. The sprockets are bolted to a flange forged integral with the jack shaft. The radius rod is supported at its forward end by means of a ball and socket universal joint.

Lubrication is by means of a force feed oiler of the cylindrical type without springs. The oiler is driven from the cam shaft and is located under the footboards, easily accessible for filling. Sight feed glasses are provided on the dash. The engine is supplied by three pipes and is oiled by the splash system. The expansion tubes on the exhaust side of the motor equalize the pressures in the crank case. The chain is oiled by means of drips from the force feed oiler.

Steering is by means of a quadruple screw and nut. The nut itself is composed of two parts, the male and female parts, which when screwed together are claimed to take up any play. The steering shaft is mounted on ball bearings at both ends. The shaft and steering arm is a one piece forging of nickel steel. The case itself is a steel casting, provided with aluminum covers for inspection or adjustment. The spark and throttle control are contained in the steering column and are operated by means of levers above the hand wheel.

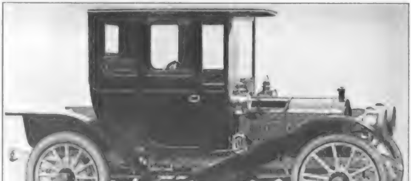
The front axle is of drop forged nickel steel, with spring seats integral. The bearings for the pins are of steel, hardened and ground. The knuckles are a one piece hand forging from the nickel steel billet, and are of the inverted Elliott type. The knuckles are provided with large oil cups. The rear axle is an "I-beam" nickel steel drop forging, with seats integral.

The radius rods support the internal expanding brakes and the ratchet sprag. The internal expanding brakes are bronze to steel, the drums themselves forming the sprockets. The sprag is controlled from the seat by means of a small lever placed convenient to the right hand of the driver. The foot brakes are placed on the jack shaft. They are external constricting brakes of asbestos on steel. The brakes are adjusted by means of thumbscrews placed conveniently under the footboard. The clutch control is entirely new and is controlled by means of a cam, which is claimed to allow one to hold the clutch out of engagement without any appreciable pressure of the foot.

Packard Inside Operated Coupe.

The Packard Motor Car Company have added to their line an inside operated coupé, an adaptation of the standard Packard "Thirty" runabout. This special body is interchangeable with the regular runabout body without alteration of levers or other mechanical parts. The owner of a Packard runabout may thus use it as an open car during the pleasant summer months and then readily convert it, by the exchange of bodies, into an inside operated, enclosed car for comfortable driving in the winter.

The body is built in the limousine department of the Packard shops and is upholstered and trimmed in the same style as the company's limousine. The regular Packard runabout body being interchangeable on the 1909 "Thirty" and "Eighteen" chasses, the coupé body also may be used either on the "Thirty" or on the smaller runabout.



The Packard Inside Operated Coupe.

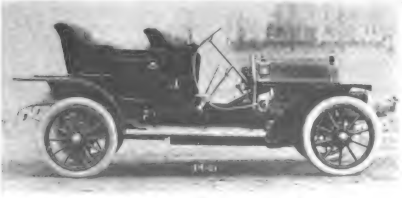
The Paterson Motor Buggy.

The W. A. Paterson Company, Flint, Mich., are producing a high wheeled type of car fitted with a 14 horse power, double opposed, air cooled motor. The cylinder dimensions are 4¼ inch bore by 4 inch stroke. The crank shaft is made from a drop forging and is supported in bronze bearings which are said to be extra large and long. A planetary two forward speed change gear is used, which together with the differential and bevel gear set is enclosed in a single casing, into which the tubular housings of the countershaft fit. All gears run in oil. The drive from the countershaft to the rear wheels is by side chains. Ignition is by battery and coil, a double coil being fitted to the dash. A pressure lubricator with sight feeds is provided. The steering device is of the irreversible gear type, and spark and throttle levers are mounted on the steering wheel. The frame is of pressed steel construction and is supported on semi-elliptic springs in front and full elliptic springs in the rear. Thirty-six inch artillery wheels with 1⅝ inch solid rubber tires are used. The wheel base is 80 inches. Internal expanding brakes act on drums secured to the rear wheel hubs. The body is of the regular runabout type, with a large carrying space in the rear boot. The company refers to this model as its "Model 14."

PATERSON MODEL 14.

Chalmers-Detroit "Forty" With Close Coupled Body.

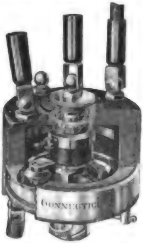
This new body design has been brought out to meet the demand for a car with more carrying capacity than a runabout but lighter than a touring car. The rear seat is brought well forward, making it easy riding; it has a full height back, so that it is more comfortable than toy tonneau models. All the mechanical specifications are the same as in the touring cor.



CHALMERS-DETROIT FORTY, WITH CLOSE COUPLED BODY.

The Connecticut Distributor.

The Connecticut distributor is composed of two principal parts, the primary and secondary, which are held together by two threaded studs with lock nuts, and are therefore easily separated for cleaning purposes without removing the instrument. The primary section is made of aluminum, and forms the base, containing the ball bearing shaft and the timing or contact making device, which is essentially the same as in the well known 1909 type Connecticut timer.



CONNECTICUT DISTRIBUTOR.

The timer and distributor sections are separated by a hard fibre disk to prevent grease working from the timer into the distributor section. The upper or secondary section is composed of hard rubber, accurately machined and polished, and is of heavy construction to prevent warping or distortion when used in places of high temperature, and is claimed to be absolutely water and dust proof. Both primary and secondary connections are furnished with quick detachable terminals to fit any size wire desired. Mounted upon the shaft extending from the lower or primary section into the secondary section is a key fastened hard rubber cap, from which extends the distributor arm, which is insulated from the shaft, but in contact with the stud projecting from the top of this cap and forming the end of the shaft and reaching into the upper ball bearing, which is adjustable from the outside of the top of the distributor by means of an aluminum knurled knob, which may be locked after adjustment by means of a set screw. The distributor arm is formed of a closely wound piano wire spring, and is flexible and adjustable as to its length by a lock nut. Upon the inside of the rubber case and in line with the distributor arm are mounted the slightly projecting steel contact blocks spaced in synchronism with the contact maker in the lower part and fastened by means of studs and the ball terminal nuts. Connection for the primary current is made underneath by means of a quick detachable terminal, and the advance stud is on the opposite side.

The Kidder Shock Absorber.

Wellington P. Kidder, of 18 Robeson street, Jamaica Plain, Boston, Mass., who in the early years of the light steam automobile brought out a steam runabout with direct spur gear drive, has lately been giving attention to the problem of shock absorbers, and has developed the device here illustrated. Mr. Kidder reasons that such mechanism to be satisfactory must possess the following elements: First, it must not materially interfere with the freedom of the springs in their easy, normal play. Second, either way from normal, the perfect device must gradually develop an increasing resist-

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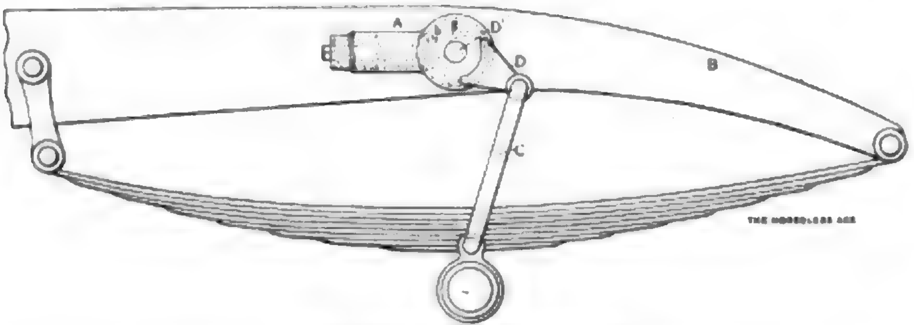
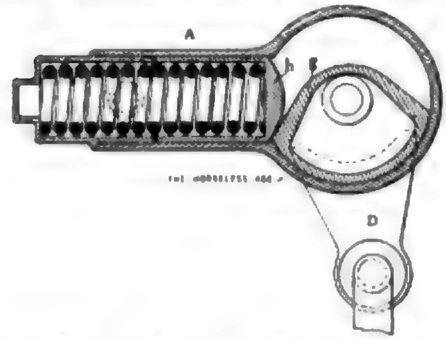


Fig. 1.—Kidder Shock Absorber.

ance to such maximum as will, at the extreme, take upon itself all excess of load without sudden arrest. Third, on return to normal it must exert a drag to check the rebound and vibration. Fourth, with no sudden arrest at any point, it must insure spring protection against breakage under any stress that the axle or wheels may withstand. Fifth, it must not require frequent adjustment; must be strong, light, durable, well protected from dust and self lubricating for long periods.



Sectional View of Kidder Shock Absorber.

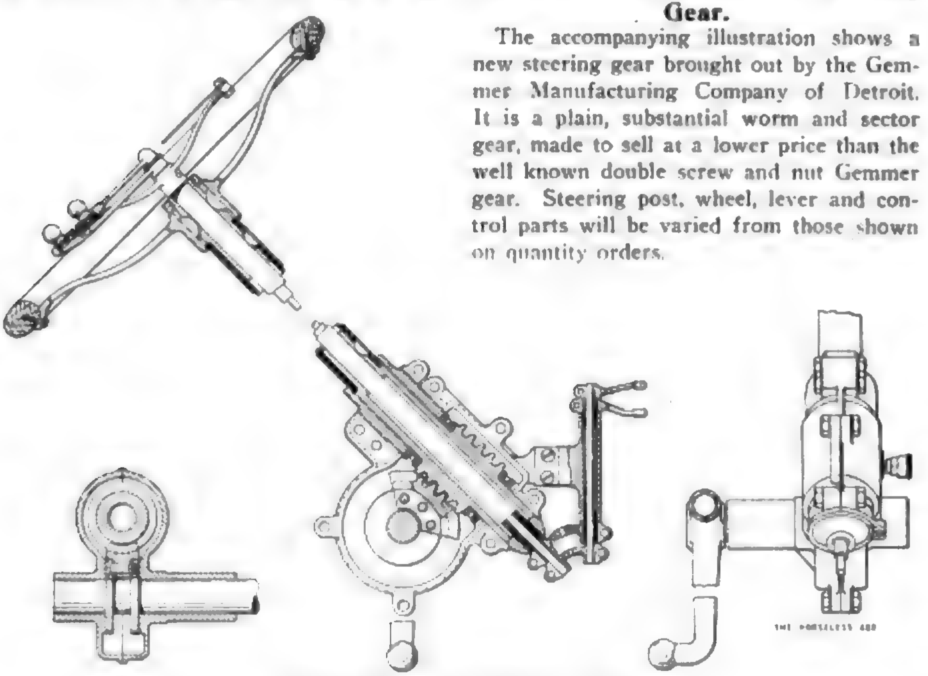
The Kidder shock absorber is shown in the normal position in Fig. 1. The casing A is bolted to the frame B of the vehicle. The connecting rod or link C is pivoted to the crank D at its upper end and to the axle at its lower end. Fig. 2 shows the extreme position of the same device at the upward limit of spring deflection. Approaching either of the extreme positions, the link C thrusts or draws nearly across the centre D' of the crank, losing its effective leverage, while at the same time the increasing resistance to rotation, on account of the incline *g* of the crank forcing back the spring pressed plunger *h*, constitutes a strong check to any further motion. The excess of load is taken mainly by the crank, the spring pressed plunger serving to gradually arrest rotation before the dead centre is reached. It is claimed that in all positions the pressure of the plunger exerts a sufficient drag to check vibration.

A patent on this shock absorber was issued December 1, and the device will soon be placed on the market.

Gemmer Worm and Sector Steering Gear.

The accompanying illustration shows a new steering gear brought out by the Gemmer Manufacturing Company of Detroit. It is a plain, substantial worm and sector gear, made to sell at a lower price than the well known double screw and nut Gemmer gear. Steering post, wheel, lever and control parts will be varied from those shown on quantity orders.

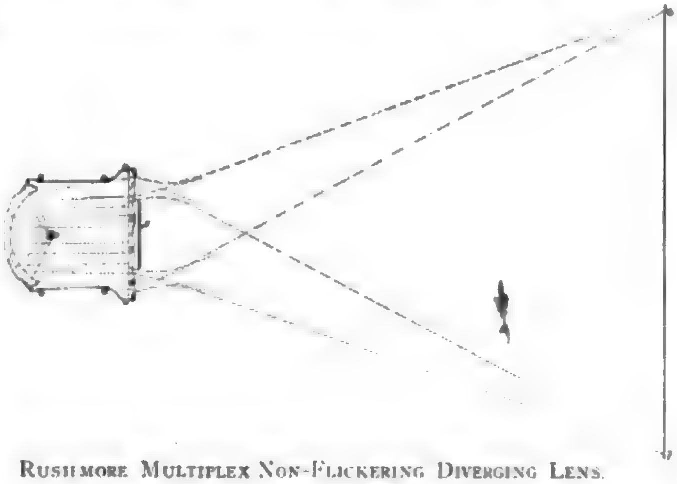
The principal novelty about the gear is the method of attaching the sector. It is held firmly between two flanges, turned integral with its shaft, by three screws, which are locked in place by peining the metal over slightly to keep them from turning. This fastening is adopted so that it will be easy to replace the sector should it become worn. The worm and sector are of steel and the case is of malleable iron. The worm is furnished with or without ball thrusts, as desired.



Gemmer Model K Steering Gear.

The "Multiplex" Non-Flickering Diverging Lens.

This new lens consists of a number of lens strips of glass in place of the usual plain glass strips in the front door of the searchlight. In the cut herewith 1, 2, 3 and 4 show a number of the lens strips in section. These consist of the plate glass, the front surface of which is ground convex, thus acting as a diverging lens in a horizontal plane only. 5 is supposed to show a shield held momentarily in front of the strips 2 and 3, so that the light from the lens mirror can escape only through the strips 1 and 4.



Rushmore Multiplex Non-Flickering Diverging Lens.

It will be seen that the rays from strips 1 and 4 are spread out to cover the space 6-7. If strip 4 should also be covered by the screen the rays from strip 1 would still cover the same space 6-7, but with only one-half the illumination.

It will be seen that uncovering more of the strips merely increases the intensity of the illumination. As a matter of fact, the field 6-7 is wider when all the strips are uncovered than with only one strip, by just the diameter of the lamp door; but this is so small a proportion of the width of the field at a distance down the road that it is practically true to say that there is no difference whether one or all of the strips are exposed.

When a searchlight beam "dances" from the flickering of the gas flame there is no great diminution of lighting power. The driver is simply confused by his inability to concentrate his gaze upon a single object ahead. When the flame flickers the light may momentarily be cut off from strips 1 and 2, but it will reappear through strips 3 and 4, and through those strips be projected to cover exactly the same field, and it is claimed that, no matter how badly the flame may flicker in a strong wind, the illumination ahead is practically constant, and the only wavering that can be observed, even at highest speeds, is at the top and bottom edges of the rectangular beam, and this is of no consequence, as the driver's attention is directed to the roadway covered by the body of the beam.

The plano-convex lens strips are manufactured by the Rushmore Dynamo Works, Plainfield, N. J.

The 1909 Model Auto-Meter.

The Warner Instrument Company, of Beloit, Wis., have brought out for the 1909 season an instrument of flat cylindrical form, resembling the majority of other speed indicators in general appearance, except for the absence of the scale in the form of a circular arc. In the face of the instrument there are three slots, behind which appear figures indicating respectively the speed in miles per hour, the trip mileage and the total mileage. The speed indicating mechanism is identical with that used in last year's instrument, but an entirely different odometer is used. The season odometer has a range of 100,000 miles, and can thus be operated continuously for a number of years. Until now it has been customary to supply season odometers of a maximum range of 10,000 miles, but the manufacturers of this instrument claim that this mileage is exceeded in a year by quite a number of motorists. The trip odometer records up to 1,000 miles, and can be reset by a single turn of the reset device on the face of the instrument. An interesting feature of the new instrument is the illuminated dial. The case of the instrument is made of heavily drawn brass, while the dial is of metal, silvered, with the figures edged upon it in black. Above the dial, inside of the bevel glass cover, is a small incandescent light, which illuminates the dial and permits of reading it on the darkest night.

The drive of the autometer has also been improved. The shaft of the instrument is now run at one-half the speed of former models, whereby the wear and tear is reduced. The need of abrupt bends in the shaft has also been done away with.

WARNER AUTO-METER.

The Gabriel Whistle.

The Gabriel Horn Company of Cleveland, Ohio, has brought out a new signaling device under the above name. It consists of a 2x16 inch brass tube, divided into two chambers, producing separate notes that blend together to form a whistle tone, which is claimed to be rather shrill and of great carrying power, and to be audible at a distance of a mile or more under favorable weather conditions. When the car is running at from 8 to 15 miles per hour the whistle is said to produce a pleasing and effective signal that can be heard four or five blocks. The whistle is intended for use with motors of not over 4 inches bore. It is unsuited for motors of greater bore, for the reason that the passage through the whistle is of insufficient size to dispose of all the gases without creating considerable back pressure. With the whistle is furnished the regular 1909 pattern of control valve.

GABRIEL HORN.

How Para Rubber Is Harvested.

For many years the collection of the rubber from the forests lining the banks of the Amazon has been effected by any individual who by hook or by crook succeeded in hiring or purchasing one of the small river steamboats used for the purpose. A sufficient supply of labor, imported from the Latin countries of Europe, is easily obtained, and rates of pay, which fall far short of a living wage, are immediately arranged, whereupon the expedition starts up river. The trees are tapped one by one, and all the rubber drawn off, thereby either entirely ruining the trees or preventing any further yield for at least twenty years. During the expedition the underfed laborers contract fever and many die off; others desert, and either die of starvation in the bush or are eaten by beasts of prey The ranks may be filled, or not, as opportunity arises, from those freshly imported from Europe and proceeding up river in search of employment. It will be seen, therefore, that with reasonable "luck" the proprietor of the expedition has very little or no wage bill to meet, so that one expedition, when rubber is dear, yields a small fortune, and these men are well able to wait, years if necessary, until the condition of the rubber market makes it worth their while to undertake a fresh journey. The Brazilian Government, regarding rubber as a valuable asset, imposes an export tax of approximately 20 per cent. of its market value.

The producers in Brazil have regarded the falling market with no friendly eye, and for twelve monthes past have preferred more and more to store the rubber in hand rather than to export it. This move not suiting the Government, which found its revenue decreasing, led to the imposition of a rubber storage tax, so that those merchants who preferred to hoard their stocks to exporting them have now a storage tax to face. In short, the Para rubber trade may be summed up as being in the hands of men who are now very rich, and who, having only their immediate needs to consider, have steadily drawn off all the rubber from the trees tapped, thereby preventing further yield. The supply area is enormously less today than formerly. The rubber is subject to a large Government tax, and, unless some radical improvements are made, both regarding this tax and the methods of collection, it seems likely that, for some years to come, the Para rubber industry will become a negligible factor in the rubber markets of the world.—*Commercial Motor.*

Dual Ignition Systems Patents.

Announcement is being made by Elmer Apperson, of the Apperson Brothers Automobile Company, Kokomo, Ind., that they own two controlling patents on dual ignition systems and will enforce their rights and prosecute all infringers. About two years ago Mr. Apperson bought the United States patent No. 617,806, which was granted to F. E. Canda, of New York, January 17, 1899, for "electric igniters for explosion engines," and he has himself been granted patent No. 905,625 in December 1, 1908, for "improvements in explosion engines." It is claimed that these two patents cover broadly the use of dual systems of engine ignition involving the use of two spark plugs or points per cylinder with a magneto and battery with spark coil separately connected to each, with means for separately or jointly switching both sets into action. The patents as they appear are broad enough to cover all dual ignition systems now in use, but their validity may, of course, be questioned.

Autogenous Welding by the Oxy-Acetylene Flame—Correction.

Owing to an unfortunate mistake in transcribing the article by Mr. Cave which appeared in our Engineering Number, the meaning of one of the statements made by him was reversed. At the top of the second column, referring to the medium pressure torch, the article reads * * * "and which has most of the disadvantages of the other two systems." This should have read * * * "and which has most of the advantages and eliminates most of the disadvantages of the other two systems."

On the second page of the article, second column, the ratios of acetylene to oxygen are given as 1.70 and 1.30 for the low pressure and high pressure torches, respectively. These are the ratios of oxygen to acetylene.

COMMUNICATIONS

Long and Short Stroke Motors.

Editor Horseless Age:

While there is so much discussion as to the relative merits of the long and short stroke motor it is interesting to make a comparison of the different articles written on the subject and to note the grounds upon which the various claims are based.

In the beginning I will say that during the fifteen years I have devoted to the study of this subject of gas engines I have superintended the construction and testing of over 5,000 engines, of a great variety of sizes and types.

When the A. L. A. M. adopted their horse power formula evidently but little thought was given to the matter. At any rate, just now it is somewhat difficult to get anyone to admit that he really believed at any time that the stroke had nothing to do with the horse power of a motor. Yet it is only a few years since any attorney, involved in the trial of a case wherein the horse power of an engine was in question, had but little difficulty in getting gas engine experts to testify under oath that the stroke had nothing to do with the horse power of the engine, and that a motor with the bore equal to the stroke would produce just as much horse power as another motor with the same bore and with 1, 2 or more inches longer stroke.

I take it for granted that the recent trend of automobile manufacturers toward longer stroke motors, and the comparative tests of the past year, have put to rest for all time the contention that a motor with a stroke equal to the bore would produce as much actual horse power as one of the same bore with a longer stroke, and that I need not spend time on this particular point.

With this point settled, the remaining questions are: First, to what extent does the horse power increase with the stroke; and second, is the longer stroke motor more desirable for motor car construction and service?

In a recent article by G. H. Baillie reference is made to a formula showing that by increasing the stroke 50 per cent. the horse power is increased 17 per cent. Nothing could be more misleading than a statement of this kind without a detailed statement of the facts on which the claim is based. This statement neglects the fact that speed must be taken into consideration in the comparison. For instance, take a 6x6 four cylinder motor and make a test of it, as compared with a 6x9. At first thought we would figure that the 6x9 would develop just 50 per cent. more power than the 6x6, whereas at one speed it will develop over 50 per cent. more power than the 6x6, and at another speed it will develop less than 50 per cent. more. Piston speed must be taken into consideration in figuring the actual horse power delivered.

Other designers may take issue with me at once when I make a statement that a 6x9 motor will develop over 50 per cent. more power than a 6x6, both running at a speed of 400 r. p. m.; but that such is the case can easily be demonstrated. On the other hand, the 6x9 will by no means develop 50 per cent. more power than the 6x6 when running at a speed of 800 r. p. m. The question then comes up, how are we going to rate the motor for automobile construction, and where are we going to draw the line, and what formula can be presented upon which the accurate horse power rating can be based, covering engines of all classes and of different construction? I am free to confess that I know of none that will cover the situation with absolute accuracy. If we had a fixed speed from which to figure then the matter would be simple, but considering the fact that these motors must be run from a minimum to the maximum speed of which they are capable, it is impossible to increase the stroke to the greatest point of efficiency for one speed and secure the same results at all speeds.

DESIRABILITY OF LONG STROKE.

In general automobile work better results can be secured from a motor with a longer stroke than the bore. However, the stroke cannot be increased advantageously to the same extent where the motor is to be used for some other purpose where it operates at nearly constant speed. This assertion is based on the following facts:

First, by increasing the stroke the power gained is procured without any proportionate increase in the weight of the motor, and it will not be denied that every increase in power without increase of weight is a step toward high grade motor car construction.

Second, in expanding the gases further the exhaust is discharged under less pressure, lessening the noise and decreasing the amount of heat carried off through the exhaust, as well as the back pressure.

Third, the greatest efficiency and economy are obtained when the piston is running at a reasonably high speed. As most cars are now built the speed limit is from 40 to 60 miles per hour for ordinary use. These same cars probably run 80 per cent. of the time between 20 and 40 miles per hour. Therefore the motor runs generally at an extremely low piston speed, which, as every engineer knows, means loss of power and efficiency. By increasing the stroke a higher average piston speed will be secured.

Fourth, the full power of a motor is most needed for hill climbing when the motor is running at slow speed, and right here is where the long stroke shows its advantages over the short stroke. Let us not forget the fact that an internal combustion engine is a heat engine pure and simple. The slower the movement of the piston the greater the loss of heat through the cylinder walls and the less the power from a given size cylinder and from a given amount of fuel.

From this it should be quite clear that all the advantages are with the long stroke motor, not only from a standpoint of power but from a standpoint of fuel consumption, and that the slower the motor must run the more pronounced are these advantages.

Fifth, the initial impulse is less in the long stroke motor than in the short stroke of the same horse power, because of the smaller area of the piston. In other words, the initial impulse of a 4x4 is approximately the same as a 4 inch bore and 5 inch stroke; hence if you build a motor of the same horse power as the 4x5, and make the bore equal to the stroke, you must necessarily have a greater pressure on the piston head at the time of ignition. This means that for the same power the short stroke motor cannot operate as smoothly as the long stroke motor.

Someone may say that if it is a good thing to build the motor 4x5 instead of 4x4 why not go still further and make it 4x6 or 4x7? Right here is where the distinction must be made between a motor running at a given speed and one running at all speeds, as is required in motor car construction. In increasing the stroke of the motor for general car use I do not contend that it can be carried to the extent that all other points of car construction are of secondary consideration to the question of power and economy, but I do claim that the designer who is unable to retain all the flexibility of the very best cars, and at the same time use a motor wherein the stroke is one-quarter greater than the bore, is not doing justice to at least some parts of the machine.

E. A. Myers.

[We agree with our correspondent that within the limits of dimensions current in automobile work a cylinder with a stroke longer than the bore is more economical of fuel than a cylinder with a stroke equal to the bore, but we must take exception to some of his other statements. He is wrong when he says that an increase in the length of stroke does not entail a proportionate increase in weight. The connecting rod length is proportional to the length of stroke and the height of the compression space also, consequently the height of the whole engine is very nearly proportional to the stroke, and as all diameters remain the same, the weight of the cylinder will be practically proportional to the stroke. The diameter of the crank chamber is proportional to the stroke, and the weight of the whole crank chamber increases at least as fast as the stroke. The crank shaft of the long stroke motor weighs more than the crank shaft of the short stroke motor for the reason that its arms are longer, and the shaft itself must be made of greater diameter, owing to the fact that the piston works on it with the same force through a greater lever arm. Finally the flywheel must be larger and heavier, because the energy liberated by each charge is greater, the charge itself being greater. Taking all these things together, we do not believe we are far wrong in saying that the weight of a motor is practically proportional to the length of the stroke.

Our correspondent also asserts that in a long stroke motor the gases are expanded more than in a short stroke motor. This contention, too, is fallacious. In both the long and the short stroke motor you have originally a charge equal in volume to the piston displacement, and this charge is compressed in a certain ratio (which may be the same for both types), and is then expanded to its original volume previous to compression, so that the ratio of expansion is exactly the same in both.—Ed.]

Yielding Drive.

Editor Horseless Age:

The concluding statement of the lucid article in the Engineering Number of The Horseless Age by P. Maisonneuve, that a yielding member inserted into the transmission "will absorb both speed fluctuations and sudden shocks, and it will tend to preserve all transmission parts," should give promise of great improvement in transmission design. This authoritative indorsement of a yielding drive is quite opportune when the prevailing tendency of manufacturers is in quite the opposite direction—from spring torsion rod to rigidly supported propeller shaft housing.

The major part of the wear and breakage of transmission parts is due to the sudden shocks which they receive rather than to continuous use, and a brief review of these shocks may lead to a just estimation of the ills that can be remedied by a yielding drive.

In the motor itself we have a constant shock producing factor. It is most noticeable in single cylinders, less in two cylinders and still less in four or more cylinders. The engine delivers intermittent explosive blows on the pistons, which are transmitted through the gear and driving wheels to their points of contact with the roadbed.

Speed changing, unless the speeds of the engine and car are in unison, produces shocks proportionate to the difference between the two speeds.

Sudden application of brakes gives a shock proportional to the power of the brakes and the vehicle speed.

Sudden application of the clutch, sometimes due to a faulty clutch, sometimes to faulty operating, produces a severe and damaging shock. This sudden application of driving power is not only damaging to the car but is very disagreeable to the occupants.

Road shocks transmitted with multiplied force from the driving wheels, through the transmission to the engine and the frame, are the worst of all, and will cause some part in the transmission to break sooner or later, though it may be of the best material and design.

These shocks tend to rotate the driving wheels either forward or backward when they are locked to the ground, thus making strains in the line of their circumference. The tires are the only yielding link in the transmission chain. The compressed air with which they are filled is highly elastic, but it is so arranged that it cannot absorb the circumferential strains. The function of compressed air in the tires is to soften the impact of wheels upon obstacles and roadbed by resisting radial pressures. Incidentally we have noted the principal cause of relatively rapid rear tire destruction, viz., circumferential strains.

Long life of a motor vehicle subjected to these severe strains cannot be reasonably expected. The desirability of a yielding element in the transmission (which has been found in practice to do all that has been claimed for it) is self evident.

At present the means of attaining a yielding drive are limited to some form of spider with coil springs between the driving and driven members (such as is illustrated in the article referred to), the spiral spring shaft and the multiple spring rods shaft. The latter have been described in The Horseless Age.

J. O. Hobbs.

Book on Workshop Operations for Amateurs.

Editor Horseless Age:

I have a copy of your "Operation, Care and Repair of Automobiles," and it is decidedly the best thing of its kind I have seen. It has been of great assistance to me. Will you kindly advise me if you have in your list a book written on the same intelligent lines for an amateur, covering the ordinary workshop operations of an amateur's shop? Your book is written so as to be of service to a person of ordinary intelligence, but without technical training. Is there another, describing such operations as soldering metals, brazing, care and use of hand tools, etc.? If so, please advise me its price.

I have books on "workshop practice," but they are either too technical for amateur use, or so simple as to consist mainly of definitions. One doesn't care so much for the information that "soldering is a method of joining metals, etc.," as for information as to how to tin an iron, what flux to use, etc.

Geo. B. Elliott.

[Most books for amateurs cover only the construction of some particular piece of apparatus, and we know of no such book as you require. Perhaps some reader can recommend one on the basis of actual personal experience.—Ed.]

Turbines as Automobile Motors.

Editor Horseless Age:

I was much interested in the article entitled "Turbines as Automobile Motors," by P. Maisonneuve, on page 861 of the December 16 issue of The Horseless Age. However, the fallacy of some of his statements and theories greatly depreciated its value. He states: "Going further into the matter, it will be found that high speed rotary motors will do away with the necessity for change speed gears, for in practice the fluid will act continuously, and deliver almost the same power at all speeds of the turbine (above a certain minimum speed, of course)."

The statement above quoted is evidently wrong, as is shown by a study of the general equations for power of a turbine.

First considering an impulse turbine:

Let W = weight of steam or gas passing bucket,
V = the entering absolute velocity,
V_1 = the absolute exit velocity,
C = constant to convert energy to power.

Then $\frac{W V^2}{2G}$ = energy of entering jet and $\frac{W V_1^2}{2G}$ = energy of exit jet. The work done upon the buckets is therefore $\frac{W (V^2 - V_1^2)}{2G}$. Hence, Power = Work × C = $\frac{W (V^2 - V_1^2)}{2G} \times C$. In this equation W and $(V^2 - V_1^2)$ are the variables and decrease rapidly as the velocity of the turbine wheels decreases; hence the power of the turbine decreases directly as the product of $W \times (V^2 - V_1^2)$ decreases.

Now consider an impulse and reaction turbine:

Let W = weight of steam or gas passing bucket,
V_1 = velocity at entrance of first moving blade,
V_2 = velocity at exit from blades,
v_1 = relative velocity at entrance to moving blades,
v_2 = relative velocity at exit from moving blades.

Then the work done in the first stationary blades is $E_s = \frac{W V_1^2}{2G}$, or that required to increase the velocity from zero to V_1, at which it enters the moving blades. At the entrance and exit to the moving blades the relative velocities are respectively v_1 and v_2, hence the work done in the moving blades = $E_m = \frac{(W\ v_1^2 - v_2^2)}{2G}$, part of which produces pressure against the blades, and part is lost as exit energy, due to the velocity V_2.

Hence the net work done upon the turbine,

$$E_n = K_s + K_m - \frac{W V_2^2}{2G}$$

and the net power,

$$E_n \times C = \left(K_s + K_m - \frac{W V_2^2}{2G} \right) \times C,$$

the value of which depends directly upon the value of W and V_1 and V_2, which decrease rapidly with a decrease in the velocity of the turbine.

It is well known that a turbine, no matter what fluid is used, is essentially a constant speed machine, and for each speed of turbine wheel there should be used buckets designed for that particular speed. Gas turbines cannot have even the fair degree of flexibility that reciprocating engines have.

by Google

because the weight of charge depends almost entirely upon the speed; they would, therefore, require a very extensive change speed gear instead of none at all.

It would seem that P. Maisonneuve was building air castles when he suggested the use of pure oxygen as part of the combustible mixture instead of air. No doubt part of his reasoning is correct, but the cost of pure oxygen will for a long time prohibit its use in turbine mixtures. At present the cost of oxygen in tanks is between 6 to 8 cents and more per cubic foot. When generated in a generator it costs 2 to 3 cents per cubic foot, and then the generator is cumbersome and not suitable for application to automobiles.

P. Maisonneuve is evidently very enthusiastic about the future of the gas turbine; he, however, apparently is not familiar with its shortcomings and the practical difficulties yet to be solved. It is interesting to note that a few years ago a well known engineering journal published the opinions of many prominent engineers regarding the future of the gas turbine. Among these engineers were such men as Güldner, Dugald Clerk, Professor Lucke, Professor Carpenter, and others of equal standing in the profession, and nearly all agreed that the practical gas turbine is a very remote possibility.

Robert E. Newcomb.

Cylinders Will Not Hold Compression.

Editor Horseless Age:

I have a light four cylinder runabout which has been used two years and which is in good shape in every particular with the exception of the compression. I have had new cylinder rings put in, and they are bright all around, showing they touch the cylinder, but I think the rings are too short. If I could get good compression in this car it would be as good for practical purposes as it ever was. If you can offer any suggestion I would appreciate it. Do not want to buy new cylinders.

H. G. Stevens.

[You ought to determine first of all just where the leakage occurs, whether it is past the pistons, valves or spark plugs. If the leakage is found to be past the cylinders the rings are likely to be at fault. If they are not wide enough to fill up the whole width of the grooves the charge will inevitably leak past the rings on the under side. The remedy then would be to have new rings made and carefully fitted, in a shop where they are familiar with such work.—Ed.]

Formula for Steering Arm Angles.

Editor Horseless Age:

The following formula for the angle of steering forks will probably answer the request of your correspondent of December 16, 1908:

$$\text{Sin}\ \theta = 0.8883 - \log \left(\frac{B}{A}\right).$$

θ = combined angle of both steering forks.

A = distance between steering forks.

B = distance between front and rear axles.

Taking an example where B = 120 inches, A = 48 inches:

$120 \div 48 = 2.50,$

$\log 2.50 = 0.39794$

$.883 - .39794 = .48506 = \sin\theta\ 29°,$

consequently the angle is 14½° for each steering fork.

This formula was derived from the table compiled by A. E. Dey and published some years ago in The Horseless Age.

William L. Breath.

More About Generators versus Gas Tanks.

Editor Horseless Age:

Personally I would not be caused the inconvenience of a generator of any make in any event. In fact, I could not be induced to ever use one again since the advent of the gas tank. Let the chauffeurs attend to generators if they care to, but none in mine. As regards reducing valves I have seldom, no, never, found a tank on which the valve would fit and not leak more or less, generally more than required to run the lamps, even after having the union joint ground in. Therefore, I felt obliged to discard these valves, although they were a convenience otherwise.

R. M. H.

Chauffeurs' Tips.

Editor Horseless Age:

At dinner a number of us who hire automobiles were discussing what fee should be given to the chauffeur. The rates of hire varied from $15 to $35 a day. The "Trinkgeld" given varied from 50 cents to $2 per day, and it was decided to ask you what was the correct amount.

An Old Subscriber.

[We regret to inform you that we can give you no authoritative answer to the above. You are not obliged to give a tip. If a hirer of an automobile tips the chauffeur he does so of his own free will, and there is nothing else to determine the amount but his own generosity. We do not believe that a convention has yet been established as to what proportion the tip should bear to the hire, and we do not consider it within our province to lay down any rule regarding this matter.—Ed.]

Anti-Chain Ordinances.

Editor Horseless Age:

The Evanston (Ill.) City Council are preparing to pass an ordinance prohibiting the use of chains or anti-skidding devices on autos, and I would like a reference if you can furnish same as to where such laws are already in force, and if in any place where they were adopted they have been declared null by a higher court?

E. Kappelman.

[The first ordinance of this nature in the country was adopted by the New York Department of Parks on December 16, 1907. It prohibited the use of tire chains on all of the boulevards and drives under the jurisdiction of the department. A test case under this ordinance was instituted on March 25, 1908, when Edward Anderson, driver of a taxicab, was arrested for driving in Central Park with tire chains fitted to his wheels. The case was tried before Justice Davis, of the Supreme Court of New York, who in his decision declared the ordinance void and in violation of the constitution of the State of New York and of the United States, on the ground that it was a direct violation of the motor vehicle law of the State of New York. An abstract of the decision appeared in The Horseless Age of September 23, 1908. An anti-chain ordinance is at present also being enforced by the Boston Park Board.—Ed.]

Air Pump Capacity.

Editor Horseless Age:

Please give formula for finding out how much an air pump will pump. Bore, 1½ inches; stroke, 1½ inches; revolutions per minute, 200.

Experiment.

[At this low speed the pump barrel will fill with air completely to atmospheric pressure at each stroke. Supposing that there is practically no clearance in the cylinder when the piston is at the outer end of its stroke, the pump will evidently deliver 200 cylinder volumes of air per minute. The pump cylinder has a volume of 2.73 cubic inches, and the volume of air moved per minute is therefore 546 cu. ins. and per hour 32,760 cu. ins. = 19 cubic feet (approximate). As the pressure and volume of the air are inversely proportional, if you compress to 2 atmospheres (30 pounds) gauge or 3 atmospheres absolute, you would get about 6 cubic feet; to 3 atmospheres (45 pounds) gauge, 4½ cubic feet, and to 4 atmospheres (60 pounds) gauge, a little less than 4 cubic feet per hour. This neglects the effects of leakage and of clearance in the pump chamber, which would probably reduce the figures by 20 to 25 per cent.—Ed.]

Wants Valve Setting Directions.

Editor Horseless Age:

Could you tell me where I could get a book describing the valve setting of the 1905 35 horse power Panhard; also one on the Eisemann magneto? If so I would like to hear from you.

P. Movehill.

[Probably the only sources from which the desired information can be conveniently obtained are the selling branches for Panhard cars and Eisemann magnetos in this country. Write to Panhard & Levassor Auto Company, Broadway and Sixty-second street, New York, and to Lavalette & Co., 112 West Forty-second street, New York.—Ed.]

Unconsidered Weights on Motor Cars.

Editor Horseless Age:

In view of the very important bearing that weight in a motor car has upon wear and tear of tires, and noticing at the works what a tremendous amount of care, time and trouble is taken is getting a few pounds weight off the chassis here and there, and then seeing the very little trouble that is taken by owners to keep the weight down as exemplified by going to body builders who may make excellent bodies to look at and sit in, but which are absolutely tire killers from the terrible weight that their unscientific construction necessitates. In addition to this I thought it would be interesting to see the weight of accessories that the average user puts upon the car, and I find it comes out as per attached list, and the actual accessories on a car over and above the chassis and body actually come to 2 cwt., 93 pounds. No doubt some of them could be left behind, but for a long tour they all seem desirable. It is a point well worth keeping in mind that in addition to the weight of the chassis and carriage body there are nearly 3 cwt. of accessories to be carried on the tires.

S. F. Edge.

Accessories on Average Forty Horse Power Car.

	Pounds.	Ounces.
Head lamp brackets	8	..
Pair of head lamps	24	..
Generator for above	9	..
Pair of special dashboard lamps	8	..
Special dustproof tail lamp	2½	..
"Ever Ready" electric torch	1	..
Three refills for above	2	13
Wagner electric horn complete, with eight volt accumulator	17½	..
Elliot speedometer and odometer, with trip recorder	8½	..
Eight day clock in case for fitting to dashboard or interior of carriage	1	12
Two waterproof wrappers for outer covers	5½	..
Nesthill air compressor	6	..
Extra accumulator, 60 amperes	26	..
Voltmeter for testing accumulator	..	5
Six special sparking plugs at 4½ ozs.	1	11
Extra strong lifting jack	8	..
Set of tube spanners	2	..
Large leather roll of tools	17½	..
Spare outer cover for front wheel, 880x120, grooved	22	..
Spare inner tube for front wheel, 880x120	5	..
Spare outer cover for back wheel, 805x135, studded	37½	..
Two spare inner tubes for back wheel, two 805x135	12	..
Three waterproof bags	½	..
Tire repair outfit	5	..
Distributor coil (including trembler blade with screw)	3½	..
Trembler blade for coil	..	½
Platinum tipped screw	..	½
Valve (interchangeable for inlet or exhaust) complete, with spring, collar and key	1	4
Solid boxwood case for same	..	14
Valve spring lifter	..	10
Rubber diaphragm for hydraulic air regulator	..	½
Mica commutator cam, six point	..	10
Solid boxwood case for same		
Commutator brush with solid end and spring back	..	½
Carburetor float	..	10
Solid boxwood case for same		
Pump driving chain and connecting links	1	8
Six swabs	..	14
Two driving pins for water circulating pump	..	1
Gasoline funnel with gauze	..	8
Springs for governors, valves, etc.	..	24
Tire levers for 90, 120 and 135 mm. tires	..	20
Four pounds grease in 2 pound tins	5	..
One pound pump grease	1½	..
One gallon tin of engine oil	10½	..
One gallon tin of gear oil	10	..
One tin of acetyloid (about 4 pounds)	4	..
One half gallon tin of clutch oil	5	..
Two 60 ampere accumulators	26	..
Set of spares	9	..
Total	2 cwt.	93 lbs.

Queries.

Editor Horseless Age:

1. Why do the English Daimler Manufacturing Company, in their modification of the Knight engine, use such a large crank case? It apparently hangs 6 inches below the throws of the crank in their lowest position.

2. Will you kindly give me the names of manufacturers of traction engines and other forms of machinery driven by explosive engine power?

489 Colo.

[Presumably the designer considered it desirable to have a quite large oil supply in the crank chamber, as the engine necessarily consumes much more oil than the ordinary Otto or Daimler type, and the oil level in the crank case must not be too high, or the exhaust will be smoky. This is only a conjecture. An inquiry addressed to Knight & Kilbourne, Chicago, has brought no reply.

The agricultural motor tractor described in one of our recent issues is manufactured by the Transit Thresher Company, Minneapolis, Minn. Gasoline tractors are also manufactured by the Hart-Parr Company, Charles City, Ia.; the Abenaque Machine Works, Westminster Station, Vt., and the Flinchbaugh Manufacturing Company, York, Pa.—Ed.]

Novel Show Window Exhibit.

Dealers may be interested in a new show window display scheme of the Chalmers-Detroit Motor Company. The representatives of this company in the various cities are showing in their windows a Chalmers-Detroit four throw, two ball bearing crank shaft on which is fitted a radiator fan. At a distance of about a yard from this fan is mounted an electric fan, operated at low speed, and the blast from this fan impinging upon the blades of the fan on the crank shaft keeps the later in rotation, thus showing that there is very little frictional resistance to the motion of the shaft.

Registrations of Motor Vehicles in California.

Between November 1 and December 1 of 1908 the number of motor vehicles registered in the office of the Secretary of State at Sacramento, Cal., was 410, which exceeds the number for October by 75, and the number for November, 1907, by 154. It is probable that when the list of registrations for the whole year 1908 is complete the value of motor vehicles registered in California during the twelve months will be $12,000,000.

Last Pope Dividend to Be Paid.

An order transferring the cash assets of the Pope Manufacturing Company to New Jersey, for payment of the final dividend of 25 per cent. and 6 per cent. interest, to the creditors was passed by Judge Milton A. Shumway on December 24. The sum of $163,000 was ordered transferred. The Connecticut receivers have about $177,000 on deposit and the balance of $14,000 will be retained for the payment of the receivers' fees, etc.

Auto School for Des Moines.

I. R. Campbell will open the Campbell Automobile School in Des Moines, Ia., at 309 East Walnut street, on January 18. Mr. Campbell is president of the Campbell Automobile Company, operating garages in Des Moines, Fort Dodge and Albia. The course will include class instruction, adjustment and repairs, and road work, and both private owners and chauffeurs will be taken as pupils. The classes will be conducted by Mr. Campbell and by Norlan Snow, secretary and treasurer of the garage company.

Bid for Corbin Motor Vehicle Corporation.

An offer for the purchase of the Corbin Motor Vehicle Corporation has been made by Howard S. Hart, who was until recently president of the corporation. No decision in the matter has as yet been made. In the event of the business being sold to Mr. Hart the manufacture of automobiles will be continued.

The Quaker City Endurance Run.

In the winter endurance contest of the Quaker City Motor Club, from Philadelphia to Wilkes-Barre and back, on January 1 and 2, there will probably be thirty-two starters, including twenty-four touring cars and eight runabouts. The average speed to be maintained was fixed at 20 miles per hour. There has been some complaint about this high average speed, on the ground that the roads are in much worse condition now than when the "pathfinder" cars went over it last fall, but the committee decided not to change the rule. Preparations for receiving the contestants have been made at the various cities along the route.

A delegation of members of the Cleveland, Cincinnati and Toledo automobile clubs went to Columbus, Ohio, on Tuesday of this week to confer with respect to desired changes in the Ohio automobile law. The Cleveland Club was represented by W. F. Bennell, C. B. Haskins, H. L. Vail, Homer Johnson and C. J. Forbes, Jr.

Two suits for $5,000 damages each have been brought against Chambers & Shea, automobile dealers at Danville, Ill., by Johnson Miles and Madeline Rivan, who were thrown out of their buggy and seriously injured on September 13 last, when their horse was scared by an automobile belonging to defendants, it is alleged.

Commercial Applications.

Municipal Auto Troubles.

Police Chief Kern, of Los Angeles, Cal., declares that the new automobile patrol wagon, delivered six weeks ago, does not come up to expectations. He states that it is too short in the body, being unable to accommodate the full length of a stretcher; that the motor does not work right, and that it cannot climb the steepest hills which are scattered throughout the city. The members of the city council are at war among themselves concerning the purchase of an automobile for their and the mayor's use. The majority of the body proposes to buy a seven passenger, $4,000 machine, while the minority contends that, in view of the city's financial condition, the purchase of a machine would be ill advised at present. The minority is discouraged concerning motor cars by the trouble the supervisors of Los Angeles County are having with a motor car bought just a year ago for their use. The county paid $4,100 for the machine, but the car is in such a deplorable condition now that the supervisors propose to trade it for a second hand machine, paying $1,600 "to boot." Though the county machine is little better than junk now, it cost over $1,000 for repairs during the year it was in commission. The driver, so the supervisors say, neglected the machine. The cylinders "blew out," a wheel was smashed in a midnight raid on a "blind pig," and the days of the auto were full of trouble. Including the purchase price the machine has cost the county over $500 a month in the year it has been in use. The car first achieved notoriety when the supervisors attempted to collect mileage fees at the rate of 15 cents per mile for their inspection trips made in the county's automobile and propelled by gasoline bought with the county's money. The same gentlemen—or rather three of the five—attempted to sell $3,500,000 worth of good roads bonds at a private sale for a premium of a little more than $8,000. The citizens, through the courts, stopped the steal and a few weeks ago the bonds were sold at a premium of $139,000 at a public sale.

Hard Service on an Automobile Stage Line in California.

Excellent work is said to have been done for two season by two two-cylinder touring cars on the automobile stage line between St. Helena and Ætna Springs, Napa County, Cal. The cars were in use during the two seasons and carried heavy loads of passengers and baggage on nearly every day except Sundays, when they did not run. They are said to have behaved well on the steep grades and to have covered a total number of 21,000 miles apiece. Len D. Owen, the owner of the stage line, and Randolph Preston, a driver, brought the two cars into San Francisco just before Christmas. Next season Mr. Owen will place two four cylinder touring cars of 50 horse power and carrying seven passengers on the line from St. Helena to Ætna Springs, both of which are popular summer desorts.

New Undertaking Firm May Adopt Motor Car.

The Cassel Company, of Milwaukee, recently incorporated with a capital stock of $11,000 to do an undertaking and livery business, may establish a motor car service for funerals instead of horses. Peter Cassel is the first undertaker in Wisconsin to use the motor car to lead funeral processions. Mr. Cassel has not definitely decided to break away from custom altogether, but says he will eventually do so. The great saving in the cost of maintenance strikes him as being the best argument in favor of motor propelled vehicles over horse drawn vehicles.

Commercial Notes.

J. N. McFate has established an automobile service between Douglas and Portland, Ariz. He formerly operated a similar service between Hachita and Sylvanite.

The residents of West Dallas, Tex., desire improved means of transit between that suburb and the city of Dallas, and are considering the possibilities of an automobile service.

An automobile service has been established between Millton and Carrollton, Ky. A seven passenger touring car is used and two trips are cade per day. The distance is 12 miles and the roads are generally level.

The first taxicabs in St. Louis were placed in service on December 19 by the Mississippi Valley Automobile Company. The chasses were built at Clyde, Ohio, the taximeters were imported from Paris and the cab bodies were built in St. Louis.

Frank Wood, a farmer of Grover, Marinette County, Wis., has purchased a motor truck for general farm use, the first in Wisconsin, as far as known. Besides using the car for hauling produce and delivering garden truck, Mr. Wood proposes to use it to run his churns, treadmills and power machinery in winter and when travel is impossible on country roads. He has sold all but one of his horses.

The Ohio River Passenger Railway Company has purchased a twenty passenger motor bus to transfer passengers from Wilkinsburg to Beaver, Pa. The car met with a number of untoward incidents on the first day of its service, among which was a collision with a Beaver Valley Traction Company's car. H. E. Rothrock, president of the Auto Transit Company, has charge of the service.

Milwaukee's health commissioner, Dr. G. A. Bading, is the latest member of the official family to apply for a motor car, and indications are that the city's list of municipal cars will be increased within a few weeks. An ordinance has already been introduced appropriating money for a car. The machine is to be used chiefly for the fumigating squad, which has to cover much ground each day.

Atlantic City, N. J., has joined the cities boasting of a taxicab service, a single cab having recently been placed in service there. The company operating it has ordered a dozen cabs, however.

The General Motors Company Launched.

The formation of the General Motors Company as a New Jersey corporation, and offers of an exchange of stock made to stockholders of the Olds Motor Works, of Lansing, Mich., have started anew the rumors of the consolidation of automobile manufacturing interests. Considerable secrecy is maintained in regard to the new company, which is said to be capitalized at $12,500,000, divided into $7,000,000 preferred stock and $5,500,000 common stock, each share having a par value of $1. At present the new company is said to embrace the Buick Motor Company, of Flint, Mich., and the Olds Motor Works, of Lansing, Mich. Reports from Lansing, Mich., state that the stockholders of the Olds Motor Works have been approached with a proposition to exchange their shares for shares of the General Motors Company, the basis for the exchange being $400 in preferred stock and $100 in common stock of the General Motors Company for each $1,000 of the Olds Motor Works stock. There is said to be considerable opposition on the part of some Olds stockholders, although it is said that holders of three-fourths of the stock have assented. Attorney C. R. Hatheway, of the law firm of Ward, Hayden & Satterlee, is said to be engineering the deal, but refused to make any statement at present. The General Motors Company has an office in the Terminal Building, Forty-first street and Park avenue, New York city, but the manager was said to be "extremely busy" and could not be seen. The plan is said to be to continue the different works as at present under their proper names, assigning to each the manufacture of certain types of vehicles. The General Motors Company will act as a holding concern, and appoint the directors of the subsidiary companies.

Obituary.

Arthur W. Tobin, president of the Continental Motor Manufacturing Company, of Muskegon, Mich., died at the Augustana Hospital, Chicago, on December 13. Mr. Tobin went to Chicago early in December to attend a social event, and while there determined to submit to an operation to remove a growth of bone in his nose which prevented him from breathing from the one nostril. After the operation he appeared to be improving, but it was thought that he caught cold in the wound and blood poisoning set in, taking effect throughout his body. He was removed to the Augustana Hospital, where he died at 2 o'clock on the morning of December 13.

List of Exhibitors at the Madison Square Garden Show.

Main Floor.

Knox Automobile Company.
Matheson Motor Car Company.
Elmore Manufacturing Company.
Cadillac Motor Car Company.
Pope Motor Car Company.
Royal Motor Car Company.
Autocar Company.
Everitt-Metzger-Flanders Company.
Corbin Motor Vehicle Corporation.
Studebaker Automobile Company.
Lozier Motor Company.
Electric Vehicle Company.
F. B. Stearns Company.
Packard Motor Car Company.
George N. Pierce Company.
E. R. Thomas Motor Company.
Chalmers-Detroit Motor Company.
H. H. Franklin Manufacturing Company.
Locomobile Company of America.
Pope Manufacturing Company.
Winton Motor Carriage Company.
Stevens-Duryea Company.
Peerless Motor Car Company.

Elevated Platform.

Selden Motor Vehicle Company.
Haynes Automobile Company.
Simplex Automobile Company.
Hewitt Motor Company.
Walter Automobile Company.
Woods Motor Vehicle Company.
The White Company.
Apperson Brothers Automobile Company.

Exhibition Hall, Madison Avenue Front.

The Waverly Company.
The Electric Vehicle Company.
The Rauch & Lang Carriage Company.
S. R. Bailey & Co., Inc.
The Anderson Carriage Company.
Babcock Electric Carriage Company.
Studebaker Automobile Company.
Baker Motor Vehicle Company.

Basement, Commercial Vehicle Department.

Knox Automobile Company.
General Vehicle Company.
Champion Wagon Company.
H. H. Franklin Manufacturing Company.
Studebaker Automobile Company.
E. R. Thomas Motor Company.
Alden Sampson, 2d.
Hewitt Motor Company.

Elevated Platform, Accessories.

The B. F. Goodrich Company.
The Diamond Rubber Company.
C. F. Splitdorf.
The Goodyear Tire and Rubber Company.
Shelby Steel Tube Company.
The Brown-Lipe Gear Company.
G & J Tire Company.
Briscoe Manufacturing Company.
Gilbert Manufacturing Company.
Automobile Improvement Company.
American Electric Novelty and Manufacturing Company.
Vacuum Oil Company.
Herz & Co.
S. F. Bowser & Co., Inc.
Gray & Davis.
The Veeder Manufacturing Company.
R. E. Dietz Company.
Atwater Kent Manufacturing Works.
Baldwin Chain Manufacturing Company.
N. Y. & N. J. Lubricant Company.
Warner Instrument Company.
Light Manufacturing and Foundry Company.
Empire Automobile Tire Company.
The Autocoil Company.
The Swinehart Clincher Tire and Rubber Company.
Remy Electric Company.
Dow Tire Company.
Jones Speedometer.
Connecticut Telephone and Electric Company.
Morgan & Wright.
Continental Caoutchouc Company.
Spicer Universal Joint Manufacturing Company.
J. H. Sager Company.
The R. E. Hardy Company.
Ajax-Grieb Rubber Company.
Weed Chain Tire Grip Company.
Consolidated Rubber Tire Company.
F. H. Wheeler.
Witherbee Igniter Company.
The Republic Rubber Company.
The Duff Manufacturing Company.
The Chandler Company, Inc.
Michelin Tire Company.
Leather Tire Goods Company.
Adam Cook's Sons.
Avery Portable Lighting Company.
Fox Metallic Tire Belt Company.
The Globe Machine and Stamp Company.
Janney-Steinmetz & Co.
Firestone Tire and Rubber Company.
Oliver Manufacturing Company.
The Timken Roller Bearing Axle Company.
Hartford Suspension Company.
Pennsylvania Rubber Company.
Manufacturers' Foundry Company.
Motsinger Device Manufacturing Company.
Atwood Castle Company.
Byrne-Kingston & Co.
The William Cramp & Sons Ship and Engine Building Company.
A. W. Harris Oil Company.
Brennan Manufacturing Company.
The Warner Gear Company.
Phineas Jones & Co.
The Standard Welding Company.
The American Ball Bearing Company.
The Badger Brass Manufacturing Company.
The Fisk Rubber Company.
Diamond Chain and Manufacturing Company.
Pittsfield Spark Coil Company.
Rose Manufacturing Company.
Whitney Manufacturing Company.
The Hartford Rubber Works Company.
A. R. Mosler & Co.
Gabriel Horn Manufacturing Company.
Joseph Dixon Crucible Company.
Heinze Electric Company.
C. T. Ham Manufacturing Company.
Valentine & Co.
Hyatt Roller Bearing Company.

Balcony.

McCord Manufacturing Company.
George A. Haws.
C. A. Shaler Company.
William C. Robinson & Sons Company.
Cook's Standard Tool Company.
A. C. Smith Company.
Eastern Carbon Works.
Allen Auto Specialty Company.
Jeffrey-Dewitt Company.
Morrison-Ricker Manufacturing Company.
New York Sporting Goods Company.
Metal Stamping Company.
Hydraulic Oil Storage Company.
Hopewell Brothers.
J. S. Bretz Company.
Pierson Motor Supply Company.
Havoline Oil Company.
Apple Electric Company.
Isaac G. Johnson & Co.
The Auto Pump Company.
The Rushmore Dynamo Works.
English & Mersick Company.
E. M. Benford.
K.-W. Ignition Company.
Austro-American Separator Company.
William R. Winn.
New York Coil Company.
Voorhees Rubber Manufacturing Company.
American Thermos Bottle Company of New York.
L. J. Mutty Company.
The A.-Z. Company.
High Frequency Ignition Coil Company.
H. H. Franklin Manufacturing Company.
Keystone Lubricating Company.
Leon Mann Company.
P. Reilly & Son.
Philadelphia Timer and Machine Company.
Jarman & Baker.
R. I. V. Company.
Atlas Rubber Company.
Champion Ignition Company.
Burnet Compound Spring, Inc.
Buda Foundry and Manufacturing Company.
Chas. E. Miller.
Trenton Rubber Manufacturing Company.
O. W. Young.
Anderson Forge and Machine Company.
M. H. Cormack & Co.
Geiszler Brothers.
William P. Miller Sons.

Concert Hall.

The Sprague Umbrella Company.
L. C. Chase & Co.
Noera Manufacturing Company.
Columbia Lubricants Company of New York.
The Hess-Bright Manufacturing Company.
National Carbon Company.
The Lunkenheimer Company.
National Battery Company.
The Hoffecker Company.
Westchester Appliance Company.
Standard Roller Bearing Company.
The Randall-Faichney Company.
The Edmund & Jones Manufacturing Company.
The Pantasote Company.
Electric Storage Battery Company.
Manhattan Screw and Stamping Works.
Springfield Metal Body Company.
Gemmer Manufacturing Company.
C. Cowles & Co.
Coes Wrench Company.
Never Miss Spark Plug Company.
Stewart & Clark Manufacturing Company.
C. A. Mezger, Inc.
American & British Manufacturing Company.
Rands Manufacturing Company.

Second Tier Boxes.

Bosch Magneto Company.
Columbia Nut and Bolt Company, Inc.
H. A. Allers & Co.
Traver Blowout Patch Company.
Paul S. Reeves & Son.
The Seamless Rubber Company.
Sampson Leather Tire Company.
Davis-Bournonville Company.
The Perfection Wrench Company.
Erie Foundry Company.
Ernst Flentje.
The Sireno Company.
Duffy Grease Company.
Caloris Manufacturing Company.
Union Battery Company.
Chicago Wind Shield Company.

Third Tier Boxes.

Vesta Accumulator Company.
The Mica Core Manufacturing Company
Nadall Manufacturing Company.
Elite Manufacturing Company.
Auto-Tire Inflater Company.
American Electric Fuse Company.
John Lucas & Co.
H. & C. Bottle Manufacturing Company.
A. O. Brictson.
The Standard Leather Washer Manufacturing Company.
The "Lux" Auto Lamp Manufacturing Company.
Quincy, Manchester, Sargent Company.
Marko Storage Battery Company.

Basement Accessories.

Patterson, Gottfried & Hunter.
Healy Leather Tire Company.
C. J. Downing.
Kitsee Storage Battery Company.
The Class Journal Company (*Motor Age*).
The Class Journal Company (Automobile and Auto Trade Directory).
Horseless Age.
Albert Champion Company.
E. T. Burrows Company.
Stromberg Motor Devices Company.
Julius King Optical Company.
Livingston Radiator Company.
The White & Bagley Company.
The Vehicle Apron and Hood Company.
Hill Dryer Company.
American Thermo-Ware Company.
Chilton Printing Company.
Auto Supply Manufacturing Company.
Lavalette & Co.
Perfection Spring Company.
Automobile Topics.
Publication Automobilia, Ltd.
The New Departure Manufacturing Company

Stanley & Patterson.
Vanguard Manufacturing Company.
Merchant & Evans Company.
Motz Clincher Tire and Rubber Company.
The Post & Lester Company.
Motor.

BASEMENT, MOTORCYCLE DEPARTMENT.

Merkel Light Motor Company.
The Consolidated Manufacturing Company.
Excelsior Supply Company.
N. S. U. Motor Company
Motorcycle Publishing Company.
American Motor Company.
Hendee Manufacturing Company.
F. A. Baker & Co.
The Pierce Cycle Company.
Bicycling World Company.
Ovington Motor Company.
Reading Standard Company.
Aurora Automatic Machine Company.
The Hornecker Motor Manufacturing Company.
Harley-Davidson Motor Company.
The Auto-Bi Company.
Thiem Manufacturing Company.
The Motor Car Equipment Company.
Walton Motor Company, Inc.
H. & F. Mesinger Manufacturing Company.
G. H. Curtiss Manufacturing Company.
Eclipse Machine Company.
The New Era Gas Engine Company.
Reliance Motor Cycle Company.
Crouch Motor Company.
The Persons Manufacturing Company.

BASEMENT, ACCESSORIES.

G. L. Economizer Company.
Comptoir 'd'Innovations Pour Auto.
Nathan Novelty Manufacturing Company.
Noonan Tool and Machine Works.
Pratt & Whitney Company.
Philadelphia Storage Battery Company.
The Troy Car Sun Shade Company.
The Garvin Machine Company.
Faultless Auto Tube Company.

Motor and Accessories Manufacturers Will Show Only at New York, Chicago and Boston.

The Motor and Accessories Manufacturers' Association has decided to sanction no shows this year except those held at New York, Chicago and Boston. The decision and the reasons therefor are discussed in a communication of Secretary Peter S. Steenstrup, of the association, in the Detroit *Free Press*, from which we extract the following:

"Our association last year, and for several previous years, through its board of directors, granted sanctions to every local show of any consequence. The numbers of the local shows had last year grown to such an extent that many of our members insisted on some change in policy which would enable them to spend more time on their regular business. Many complained that they were often compelled to exhibit against their better judgment because some ill advised competitors, unable to reckon results by their costs, made it necesary for them to do so.

"Last year there were from one to three automobile shows a month from January to April, and for our members to exhibit at these shows, as many of them were compelled to do, meant that their best men must spend the greater part of the selling season at these shows looking after their customers and keeping in touch with the factory. These conditions were not conducive of the best results for the industry at large.

"The board of directors, fully realizing the seriousness of the situation, but mindful of the possible criticisms which might result should they at once cut off all sanctions for local shows, concluded that they would not decide this matter upon their own judgment alone, and they therefore asked the members to vote as to just what shows they wished the directors to sanction and which shows they wished the directors not to sanction.

"The members voted overwhelmingly in favor of sanctioning the shows at New York, Boston and Chicago, and voted just as overwhelmingly against sanctioning any other shows, including that in Detroit. The importance of a town as an exhibiting point was measured by the volume of buyers which the show could attract, and not by the number of cars made in that town. The matter of sanction for Detroit was therefore disposed of by the members themselves and not by the officers of the association. * * * and it was therefore not a question of dilatory tactics on the part of any officers of the association. The local association was advised some time ago that, the members having decided that they did not wish to sanction anw show in Detroit, it left the officers powerless to exercise any discretion in the matter."

Alleged Defective Forgings Suit Settled.

In a suit which has been pending between the Anderson Forge and Machine Company and the Northway Motor Company, both of Detroit, since the beginning of this month, a verdict for $2,700 was given in favor of the Anderson Company by Judge Murphy on December 24. The Anderson Company had contracted to furnish the Northway Company with certain forgings for automobile parts, which the Northway Company intended to use in its motors and gears. It was alleged that the motor crank shafts and the gears made from the forgings furnished by the Anderson Company did not stand up in service, and the Northway Company refused to pay for the forgings. The Anderson Company thereupon brought suit, and tried to establish that the forgings were made from a poor grade of steel. Metallurgists from the University of Michigan and others were called in to testify as experts. The costs of the proceedings will amount to many times the verdict. The arguments occupied a day, and Judge Murphy was two hours in delivering his verdict.

Splitdorf Celebrates Anniversary.

The Splitdorf laboratory was established in Philadelphia in 1858 by Henry Splitdorf as a laboratory for those desiring to experiment in the field of electricity, the possibilities of which were then being only partially understood by scientists. During the Civil War the enterprise prospered, being the only plant in the country engaged in the manufacture of electrical detonators for shells and projectiles. In 1867, on the occasion of the birth of the present owner, the laboratories moved to New York, being located at Centre street, from which place they were moved in 1888, when Mr. Charles Splitdorf assumed control.

Last year the Splitdorf laboratories were moved to Walton avenue, being the first of the many automobile accessory firms to seek factory quarters in the vicinity of Mount Vernon. Splitdorf coils and magnetos were introduced during the last year in France, where they have been exhibited for some years. It is understood that the Pipe, Darracq, Cottin-Desgouttes and Lorraine-Dietrich firms have made Splitdorf coils and magnetos a part of their standard equipment for 1909. To fill this demand a French factory will be established in Paris under the management of Theodore Miller.

To celebrate the fiftieth anniversary of the founding of the business Mr. Splitdorf gave a theatre party to his road representatives and factory managers, "The Traveling Salesman" being selected as being the most appropriate play for these knights of the road.

Club Notes.

The Milwaukee A. C., at a meeting held on December 21, discussed plans for the new proposed clubhouse, and appointed finance and auditing, legislation, racing and membership committees.

Invitations have been issued by the Automobile Club of America to the trade and visiting automobilists for a smoker, which will be held at the clubhouse, Fifty-fourth street, west of Broadway, on Saturday evening, January 2. At the conclusion of the entertainment refreshments will be served.

The Denver Motor Club recently elected the following officers for the coming year: Ralph W. Smith, president; William D. Nash, vice president; Frank England, secretary; C. P. Allen, treasurer; S. D. Hopkins, George Tritch, J. Nicoll Vroom, E. F. Dean, Ralph L. Taylor and W. H. Sharpley, board of governors.

The Denver Motor Club have secured both a downtown clubhouse and a country clubhouse for the coming year. The downtown clubhouse, at 1407 Cleveland place, was taken possession of the day before Christmas. It is centrally located, only a short distance from Denver's automobile row. The members of the Denver Motor Club will also have the privileges of the clubhouse at Overland Park, 7 miles south of Denver.

The Green County A. C. of Monroe, Wis., a new branch of the Wisconsin State A. A. and the A. A. A., has selected a committee on legislation to assist the State body in its fight before the Wisconsin Legislature, which meets in January. It is composed of Charles S. Dodge, chairman; J. C. Murdock and Dr. M. J. Morgan. The racing committee is: W. J. Knight, mayor of Monroe, chairman; R. Schiesser and C. W. Emerick; touring committee, F. E. Millman, chairman; E. South and A. Trickel.

MINOR MENTION

The Bosch Magneto Company, of New York, last week moved into its new building at 223 and 225 West Forty-sixth street.

It is reported from England that the Ford Motor Company is planning to establish a factory in England, and that a suitable site is already being considered.

The Lexington Motor Company, Lexington, Ky., have acquired the Sharkey property on West Main street, having taken it in exchange for the Mammoth Skating Rink.

The Webb City Automobile Company, of Webb City, Mo., will hold a stockholders' meeting on February 1, 1909, for the purpose of increasing the capital stock from $4,000 to $10,000.

The name of the firm introducing the angular drilling apparatus described in our last issue was erroneously given as Radial Angular Drill Company; it is Radical Angular Drill Company.

The General Manufacturing Company, of Elkhart, Ind., inform us that they will not add to their line of parts two sizes of planetary transmissions, as was erroneously stated in our last issue.

The Rapid Motor Vehicle Company, of Pontiac, held a stockholders' meeting on December 16 and re-elected the old officers and directors. It is stated that a dividend was declared on the stock of the company.

The Sterling Motor Company, of Binghamton, N. Y., was adjudged bankrupt on December 18. An application for bankruptcy proceedings was made by three creditors, and a statement of assets and liabilities will be made shortly.

The annual automobile show at Kansas City will be held this year during the week of March 8, under the auspices of the Kansas City Automobile Dealers' Association, in Convention Hall. W. S. Hathaway is chairman of the committee on arrangements, and Fletcher Cowherd, Jr., secretary and treasurer.

At the new San Francisco branch of the Fisk Rubber Company compressed air tanks have been placed under the sidewalk in front of the building from which air can be drawn for the inflation of tires. Every user of Fisk tires in San Francisco is to be provided with a key to open the iron door over the connection to the storage tank.

The Fiat Automobile Company are negotiating with the city authorities of Detroit, Mich., with respect to the location of a branch in that city. In their communication they express the view that the tariff on automobiles will not be reduced, and state that they plan to establish a branch factory in this country, asking what inducements Detroit has to offer. They offer to guarantee the employment of 500 men at the start and of 2,000 men within a year. The letter has been turned over to Secretary Sawyer, of the Board of Commerce.

Motorists of Marshalltown, Ia., are fostering a plan to mark out an automobile route from Chicago to Omaha, placing large road signs at all points where this seems necessary.

According to a report from Harrisburg, Pa., 12,000 applications for license tags had been made up to December 26. Last year close on to 20,000 licenses were issued, and it is thought that this year the number will reach 26,000.

The Buick Motor Company, of Flint, Mich., have completed a motor truck on a special order from the J. B. Armstrong Manufacturing Company, also of Flint. The truck made its first appearance on the street on December 14.

The Harris Tire and Rubber Company, of Philadelphia, who manufacture the Harris vertical fibre tread tire, have opened an office in Pittsburg at Thirty-third street and Grant boulevard, in charge of E. C. McGraw and W. L. Burgess.

We have an inquiry from a garage firm as to who manufactures a whistle called the Canary whistle, which is operated by means of the exhaust from the engine. Any information on this point will be gladly received and forwarded to the inquirer.

The manufacturers' committee in charge of the Briarcliff race held a meeting at the A. C. A. on Monday and elected the following officers: Percy Owen, president; C. F. Wyckoff, vice president; J. S. Josephs, H. A. Lozier and Sydney B. Bowman, finance committee.

The H. H. Franklin Manufacturing Company, of Syracuse, N. Y., are erecting an inspection shed, 85x40 feet, across a small stream known as Harbor Brook, from their main plant. A bridge is being built across the stream to connect the new building with the main factory.

A movement was recently started in Atlanta, Ga., to organize a series of automobile races there similar to those conducted at Savannah. The matter was brought up for discussion at the Atlanta Chamber of Commerce last week, but the proposal met a very chilly reception.

The St. Joe Motor Car Company, of Elkhart, Ind., are making arrangements with the Commercial Club, of Hutchinson, Kan., to transfer the business of the company to that place and change its name to the Sun Flower Motor Car Company. The capital stock of the company is to be increased from $50,000 to $100,000.

The Citizens Motor Car Company, successors to the A. & C. Auto Company, have recently been incorporated at Oklahoma City, with a capital stock of $25,000, and are building a 100x200 concrete brick and terra cotta garage in the residence section of that city. Weston Atwood is president; Guy E. Blackwelder, vice president; Ray Colcord, treasurer, and C. A. Newman, secretary and general manager. The company will handle the Franklin air cooled line, electrics, and a line of water cooled cars not yet selected. They will specialize on electrics, their care and garaging. Until the new building is completed the company will be located at 614 and 616 West Grand avenue, in the downtown district.

The National Tube Company, Hudson Terminal Building, New York, have brought out the "Kewanee" pipe union, which is octagonal, brass against iron, with a spherical seat.

The Newark dealers will hold their second annual show in the Essex Troop Armory February 20-27. According to George Paddock, president of the New Jersey Automobile Trade Association, a larger exhibit than last year is already assured. The show will be managed by H. A. Bonnell, secretary of the Associated Automobile Clubs of New Jersey.

Thos. B. Jeffery & Co. inform us that they have built 13,800 Rambler cars during the past seven years, as follows: 400 in 1902, 1,500 in 1903, 2,100 in 1904, 2,300 in 1905, 2,500 in 1906 and 5,000 in 1907 and 1908. They state that the total parts sales during the past twelve months amounted to $213,438.86, which is an average of $15.24 for each car sold by them to date.

The annual handbook of the American Motor Car Manufacturers' Association, containing the specifications of 1909 models of the members of the association, has just come from the press. The book is entitled "Leading American Cars," and gives brief specifications of all the models listed by the different manufacturers, but does not contain any illustrations of the cars.

The Boston Automobile Dealers' Association is considering the advisability of erecting a large building in the Back Bay district, which may be used for salesrooms, and have a number of individual repair departments and storage rooms for automobiles. No definite plan has as yet been agreed upon, however. A large number of dealers are said to be in favor of the scheme, and several sites have been recommended.

A movement is on foot in the Western agricultural States to have instruction in the operation of gasoline engines given at the State agricultural colleges. The agricultural school at Ames, Ia., has just decided to introduce during the winter term a course of instruction on this subject, while the State agricultural colleges of several other Western States, including Nebraska and North Dakota, already furnish such instruction.

The two days' Women's Motoring Club's New York to Philadelphia and return run, which was to have been held on Tuesday and Wednesday of this week, was postponed to Monday and Tuesday, January 11 and 12, owing to the present bad state of the roads, it is said. Another cause for the postponement may possibly be read between the lines of the official announcement, which runs: "The new dates for the run come most opportunely between the Palace and Garden Shows, and a larger entry is expected then."

The Gramm-Logan Motor Car Company, of Bowling Green, Ohio, have completed their first two motor trucks, which will be exhibited at the Grand Central Palace Show.

Thomas B. Jeffery, of Kenosha, Wis., has donated $500 to the Kenosha fire department pension fund as an appreciation of services during the recent fire in his home.

The Southern Motor Works, Jackson, Tenn., is reported to have placed contracts for parts for fifty cars. The firm will exhibit its first machines at the Chicago Automobile Show in February.

H. G. Moore, formerly secretary of the McDuffy Automobile Company, of Chicago, has taken charge of the Chicago selling branch of the Velie Motor Vehicle Company, of Moline, Ill., located at 1615-1617 Michigan avenue.

The International Engineering Company, 1779 Broadway, New York, has been appointed the sole United States representative of the Etablissements Lemoine and the Société Française des Roulements à Billes. The International Engineering Company will import and supply Lemoine forgings and springs and R. B. F. ball bearings.

Kardell Brothers, implement and farm wagon dealers at St. Louis, have entered the automobile field, having taken the agency for the Reo for Missouri and Illinois. One of the members of the firm stated that the demand for automobiles among customers had become so pronounced that they decided to take on the additional line.

Garage Notes.

The Lucia Cycle Co., of Oconto, Wis., are about to erect a $5,000 garage and salesrooms. The building will be ready for occupancy about April 1, 1909.

The Pence Automobile Co., of Minneapolis, Minn., has filed an amendment to its articles of incorporation, increasing its capital stock from $25,000 to $250,000.

The Bland-Mueller Auto Co., Milwaukee, has been appointed State distributor for Wisconsin of the "Volta-Magneto" by the Witherbee Igniter Co., of New York. Mark W. Heath, of Chicago, has joined the Bland-Mueller Co.

D. F. Poyer, of Menominee, Mich., has awarded contracts for the erection of a $7,000 garage to supply Marinette, Wis., and Menominee, Mich., the twin cities. It will be two stories high, of brick, in classic style, entirely fireproof.

The Stevens-Duryea will be represented for the first time in Wisconsin after January 1, when the Akin Motor Car Co., Wisconsin distributors, open their new garage. The company have temporary headquarters in the Bland-Mueller garage, Fourth and Prairie streets, Milwaukee.

The Maxwell-Briscoe Co. branch at Atlanta is reported to have outgrown its present quarters at 34 Auburn avenue, and the company has placed a contract for the erection of a new garage, 50x175 and two stories high, at 38 and 40 Auburn avenue. The new garage will be occupied the middle of January.

The Anderson Vehicle Co., of Fond du Lac., Wis., will erect a $20,000 garage this winter. It will be the largest in Wisconsin outside of Milwaukee, and will be known as the "Travelers' Home Garage." The motor car end of the company's business has surpassed the vehicle end, and the new building will be devoted almost exclusively to motor vehicles. There will be two elevators and a crane.

Nels Gervais will engage in the auto business in Minneapolis.

The Connolly Carriage Works, of Dubuque, Ia., are planning to erect a garage and repair shop on Iowa street.

The Overland Motor Co., Kansas City, Mo., have changed their name to the Western Motor Sales Co. They have the Brush and Overland agencies for Kansas, Oklahoma and Missouri.

The Penn Motor Car Co., of Philadelphia, have purchased the Media Garage, corner Front and Orange streets, Media, Pa., which they propose to conduct as their Delaware County branch. The Mitchell car will be handled by the company.

The Hokanson Automobile Co., of Madison, Wis., Western Wisconsin distributors for the Buick, Ford and White steam cars, announced that the formal opening of their new garage at Madison would take place on Saturday evening, December 26. The main floor affords 10,164 square feet of clear space. It is entirely fireproof, and there is not a single post in it. A new line of 1909 models will be exhibited for the first time.

New Incorporations.

Bell Munson Auto Co., Atchison, Kan.—Capital, $10,000.

Story Puncture Proof Tire Co., Philadelphia, Pa.—Capital, $150,000.

James Motor Express Co., Chicago, Ill.—Capital increased from $16,000 to $34,000.

Gate City Motor Car Co., Des Moines, Ia.—Name changed to Ayer Manufacturing Co.

West Medford Automobile Co., West Medford, Mass.—Capital, $20,000. Treasurer, Charles E. Hall.

Auto Light and Equipment Co., Boston, Mass.—Capital, $100,000. To carry on general automobile business.

Baker Vehicle Co., New York, N. Y.—Capital, $1,000. Incorporators, Nathaniel Platt, Fred R. White and R. C. Norton.

P. & H. Taxi Co., New York, N. Y.—Capital, $5,000. Incorporators, Elek J. Ludvigh, Arthur Present and Edwin C. Hyman.

Taxi Associates, South Berwick, Me.—Capital, $200,000. President, E. Burleigh Davidson. To carry on general automobile business.

Cory Motor Car Co., Oklahama City, Okla.—Capital, $25,000. Directors, G. P. Cory, C. D. Crouch, W. E. Crouch and W. L. Peck.

White Plains Auto Exchange, White Plains, N. Y.—Capital, $1,000. Incorporators, Louis W. Haight, Edson Card and Cora R. Card.

Royal Gray Motor Car Co., Asbury Park, N. J. —Capital, $50,000. Incorporators, Louis P. Groce, Mary F. Groce and William M. Skinner.

Motor Transfer Co., Fort Wayne, Ind.—Capital, $10,000. Incorporators, Arthur C. Majors, Hugh J. Keenan and J. Ross McCulloch.

Auto Windshield Co., Cambridge, Mass.—Capital, $2,000. President, Frank Thorsen; treasurer, Herbert H. White. Automobile supplies.

Tourist Auto Car Co., Niagara Falls, N. Y.—Capital, $10,000. Incorporators, James R. Brydges, E. Margaret Wheeler and Severin C. Fagard.

Memphis Tax-Cab Co., Memphis, Tenn.—Capital, $25,000. Incorporators, Frank Farrell, R. H. Allen, W. D. Watson, N. J. Sawrie and S. G. Childress.

Empire Auto Specialty Co., Berea, Ohio.—Capital, $10,000. Incorporators, T. G. Gunther, C. Rush, L. C. Loomis, F. E. Pfeiffer and W. K. Caldwell.

Brownsville Motor Car and Machinery Co., Brownsville, Tex.—Capital, $5,000. Incorporators, W. H. Mason, Jr.; A. G. Mason, L. H. Mallam and C. Everson.

Merchants' Automobile Co., Cincinnati, Ohio.—Capital, $10,000. Incorporators, Edward Stang, William E. Day, Thomas J. Leonard, Gerritt J. Fredrike, Jr., and Louis Capelle.

Jewel Motor Car Co., Massillon, Columbus, Ohio—Capital, $250,000. Incorporators, H. A. Coxton, O. K. Bernhart, F. F. Taggart, W. E. Hemperly and I. M. Taggart.

Speedwell Motor Car Co., Chicago, Ill.—Capital, $30,000. Incorporators, Robert Patterson, Thomas F. Smith and Edmund D. Gibbs. General manufacture and merchandise business.

American Motor Cycle Co., Chicago, Ill.—Capital, $15,000. Incorporators, William H. Hess, O. W. Frischkorn and A. J. Musselman. To manufacture and deal in motorcycles and automobiles.

Motor Appliances Co., Security Building, Chicago, Ill.—Capital, $2,500. Incorporators, J. W. Lindgren, E. H. Tillson and A. L. Ringo. To manufacture automobiles, motors and accessories.

Motor Appliances Co., Chicago, Ill.—Capital, $2,500. Incorporators, J. William Lindgren, E. H. Tillson and Al Ringo. To manufacture and deal in automobiles, machinery and other merchandise.

Model Automobile and Garage Co., Belleville, Ill.—Capital, $2,000. Incorporators, I. H. Wangelin, Joseph Schwarz and E. L. Schwarz. To manufacture automobiles and accessories, and maintain a garage.

Worthing-Clark Automobile Co., Fond du Lac, Wis.—Capital, $20,000. Incorporators, George W. Worthing, E. W. Clark, Anton Hoenigsberg, John W. Immel and G. H. Stanchfield. The company will erect a garage on East First street.

Trade Personals.

Richard C. Peete, of the Western branch of the Jones Speedometer Co., of Chicago, visited San Francisco recently.

R. K. Swett, formerly with the Pope-Hartford Co., has joined the ranks of the H. H. Franklin Manufacturing Co. as a salesman.

W. E. Knight, who has for some time been with the New York Leather Belting Co., has joined the selling force of the H. H. Franklin Manufacturing Co.

C. H. Martin, who has recently returned from Porto Rico, where he established an automobile line, has assumed charge of the used vehicle department of the White Co.

W. O. Campbell, agent of the Overland car at Waterloo, Ia., recently visited San Francisco, and proceeded thence in his automobile to Los Angeles, where he will remain for the winter.

David S. Ludlam, assistant cashier of the Philadelphia National Bank, has resigned that position to become president and general manager of the Autocar Co., Ardmore, Pa.

F. T. Pendleton, of Boston, representing the Cartercar Co., Pontiac, Mich., is making a trip through the West, establishing new agencies. He was last reported from Des Moines, Ia.

W. H. Kirkpatrick, manager of the sales department of the Peerless Motor Car Co., of Cleveland, Ohio, has been visiting San Francisco, the guest of Max Rosenfeld, manager of the Auto Livery Co.

Archie McLachlan, who has had charge of the Chicago branch of the Royal Motor Car Co. for the past six months, has returned to Cleveland to become sales manager of the Royal Tourist Motor Co.

S. G. Chapman has been appointed selling agent of the Oakland cars in California, Washington, Oregon, Idaho, Montana, Nevada, British Columbia and the Hawaiian Islands. He returned recently from Los Angeles to San Francisco.

Charles H. Burman, for the past four years Pacific Coast representative for the Peerless Motor Car Co., has been transferred to the engineering department of the company, and will hereafter be located at the main office of the company in Cleveland.

Arthur Holmes, assistant mechanical engineer of the H. H. Franklin Manufacturing Company, has just returned to Syracuse after a three months' trip to the Pacific Coast for the purpose of studying automobile conditions west of the Rockies and of conferring with Franklin dealers.

H. K. Sheridan, who has driven the White steamer to victory in a number of important reliability runs, has accepted an offer to become superintendent of the New York branch, and he will hereafter be in charge of the garage and repair shop. Mr. Sheridan has for several years held a position at the White factory in Cleveland.

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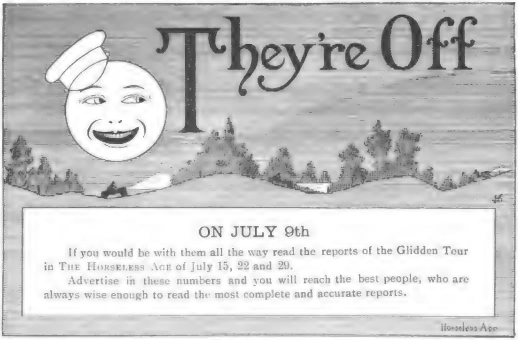

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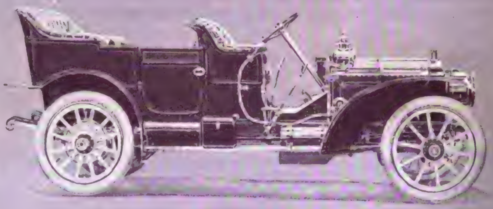

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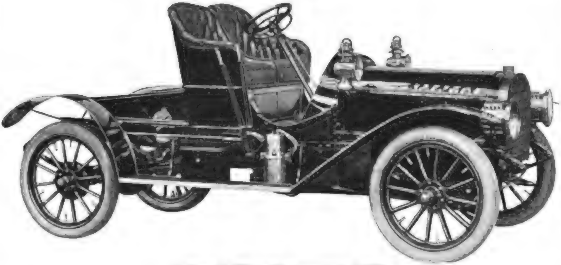

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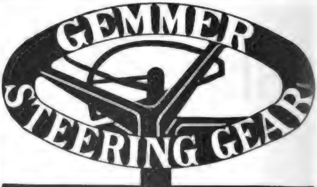

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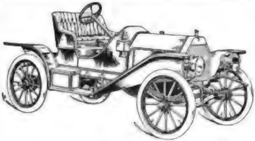

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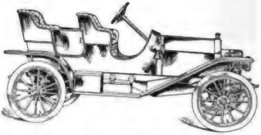

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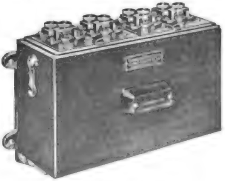

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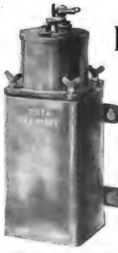

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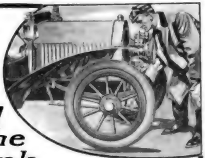

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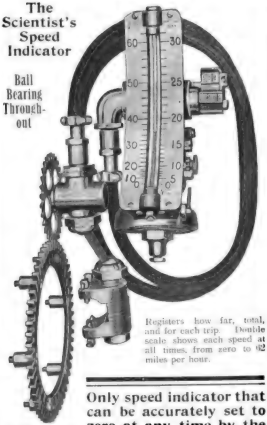

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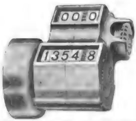

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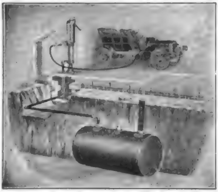

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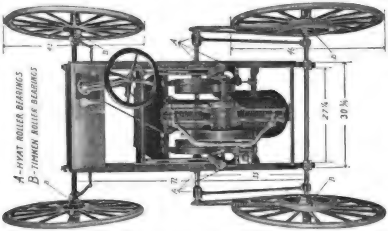

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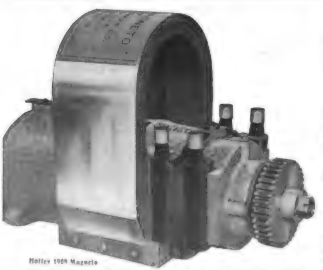

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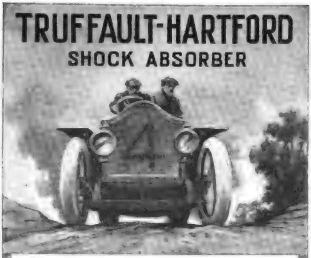

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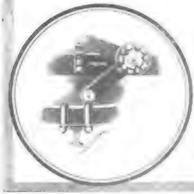

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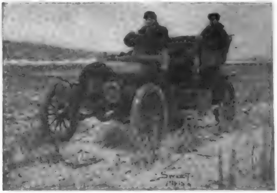

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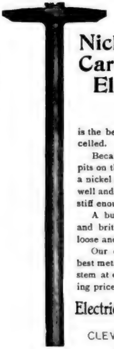

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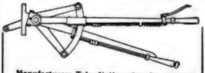

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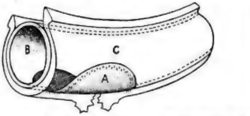

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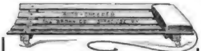

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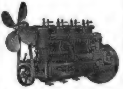

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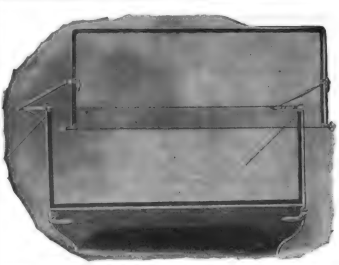

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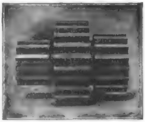

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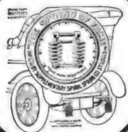

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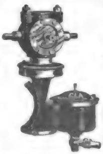
RIDE IN COMFORT

Without the nerve-racking jolting common to cars not equipped with a Supplementary Spiral Spring. The roughest road has no terror for it. Prevents breaking of springs. Tires will last longer. Engine runs smoother. Top will not rattle nor get loose. Relieves the strain on the body, which causes the doors to stick or jam. Saving in repair bills; quickly repays its cost. Full guaranteed Trial free. Interesting illustrated booklet on request.

Supplementary Spiral Spring Co.
ST. LOUIS
Motor Mart Building, New York

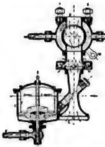


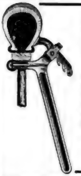
Positive Automatic Carburettor

G. & A.

SOLD BY
Pneu L'Electric Co.
1610 Broadway, New York City
Licensed American and Foreign Patents.

This Carburettor will work under all climatic atmospheres and is positive automatic without any springs, and needs no adjustment.

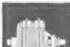




Springfield Tire Detacher

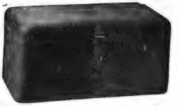
This tool will easily remove any clincher tire from 2½ to 5 inches. Total length, 14 inches. Weight, 1½ lbs. Aluminum finished. Price, $1.00, express prepaid.

The Shawver Co.
SPRINGFIELD, OHIO



The Ball Transmission
FOR
Automobiles & Motor-Boats
NEW YORK GEAR WORKS.
56 GREENPOINT AVE., BROOKLYN, N. Y.

LIKE GOLD DOLLARS
SPLITDORF IGNITION
has qualities of its own. Everywhere conceded to be the best
C. F. SPLITDORF
Walton Ave. and 138th St., NEW YORK

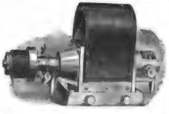


METAL TOOL and BATTERY BOXES
Send for circular giving sizes.
HAYES MFG. CO.
458 Mabury Grand Ave. DETROIT, MICH.

"The oil with a reputation behind it."
TRADE MARK
VALVOLINE
MOTOR CYLINDER OILS

The only strictly high grade and *perfect* motor lubricants—*ask the man who uses them.*

Valvoline Oil Co.
11 Broadway, NEW YORK
BRANCHES:
PHILADELPHIA BOSTON CINCINNATI
CHICAGO ST. LOUIS SAN FRANCISCO
LIVERPOOL PARIS HAMBURG
WORKS:
Edgewater, N. J.; Butler, Pa.; Struthers, Pa.



1908 M. & S. Magneto

It is designed to take the place of the batteries on your automobile. With the simple instructions given you can put this system on your machine in a few moments and do the work yourself. Cheaper and more efficient than batteries. Will last the life of your car. Send for our finely illustrated catalogue which gives full particulars.

MAVITY-SLEEPER CO.
FOWLER, INDIANA

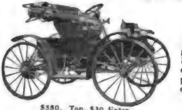
At present can furnish attachments for the Ford and Maxwell runabouts. Others later.

Burrowes Spare Wheel

Best emergency wheel made. Carried equipped with inflated tire on step or back of car, ready for instant use. Applied without removing deflated tire. Clamps securely to rim of auto wheel. Creeping impossible. Makes no difference in running or steering of car. All standard sizes for clincher or quick detachable tires.

E. T. Burrowes & Co.
Portland, Maine

P. M. C. $550 RUNABOUT



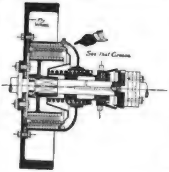
$550. Top, $30 Extra

SOLID TIRES

Low first cost. Little expense to maintain. 12 H. P. opposed air-cooled motor. Planetary gear. Positive chain drive. Brakes on rear hubs. Standard construction. Complication eliminated. Great hill climber. Ideal for pleasure or business. Information upon request. Immediate delivery.

NO TIRE TROUBLES

C. S. PEETS MFG. CO., 60 West 43d Street, New York

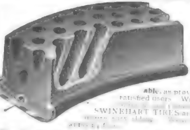


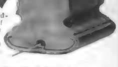
Hele-Shaw Clutch

Greatest Frictional Area
Lowest Spring Pressure

Gentlest, Most Fool-Proof, Durable, Efficient Clutch on the market. Can be installed into your car. 12,000 in use in England and Europe. The coming Clutch in America.
Write for particulars.

Merchant & Evans Company
Philadelphia Baltimore New York Kansas City Chicago Denver





Swinehart TIRES

are absolutely dependable, as proven by our thousands of satisfied users. Write for a copy of their [illegible]
SWINEHART TIRES are resilient enough to [illegible]

The Swinehart Clincher Tire & Rubber Co., AKRON, O.
New York, 875 7th Ave.
[illegible], 1231 Michigan Ave.

CORBIN

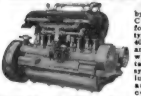
STOP
[illegible] Attach our [illegible] CLIMBING PUMP on [illegible] White Steamer
[illegible] *Easily Attached*
EDW. S. CLARK 241 Freeport St. Boston, Mass.

For WORN OUT BORES

of useless engines, get the WILLE PATENT RENEWAL PISTON. Will not lose compression or wear the cylinder after it is inserted. Protects new cylinders from being destroyed.

P. A. WILLE, Sole Mfrs.
19 Herkimer Place, Brooklyn, N. Y.

"CONTINENTAL MOTORS ARE STANDARD"



They are made by MOTOR SPECIALISTS in four cylinder types, from 24 to 40 horse power, and are equipped with self-contained oiling system, insuring lubrication, and are ready for coupling any standard type of magneto. Increased facilities enable us to guarantee quality and deliveries. Also clutches and transmissions. Send for Catalogue,

CONTINENTAL MOTOR MFG. CO., Muskegon, Mich.
K. Franklin Peterson, Western Representative,
166 East Lake Street, Chicago.
Thos. J. Wetzel, Eastern Representative,
29 West 42d Street, New York City.

Oildag

A new lubricant made from deflocculated Acheson - Graphite. FOR **Gas Engines**

Cuts oil consumption in two.
Gives increase of available power by reducing the friction and increasing the compression.
Eliminates smutting of spark plugs and makes pitting of valves and valve seats an unknown trouble.

ACHESON OILDAG COMPANY
NIAGARA FALLS, N. Y.

2nd Hand
AUTOMOBILES
GUARANTEED

We will buy, sell or trade any high-grade car, second hand or new

NYBERG AUTOMOBILE WORKS
2431 Michigan Ave., CHICAGO, Ill.

Bodies

of all descriptions designed and built for manufacturers and assemblers. In the white or painted and upholstered. We can give you unequaled values. Let us know your wants.

THE BARNDT-JOHNSTON AUTO SUPPLY COMPANY
408-426 Donaldson St., Columbus, O.

MOSLER "Spit Fire" PLUG

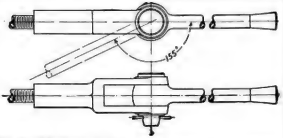
IT SPITS FIRE.
NOT THE UNRELIABLE LITTLE SPARK LIKE OTHER PLUGS.
IT NEVER QUITS.
MOSLER "SPIT FIRE" IS THE PLUG THAT ALWAYS HAS AND ALWAYS WILL SATISFY EVERYBODY.

ENERGETIC IGNITION GREATER POWER

A. R. MOSLER & CO.,
163 West 29th Street
NEW YORK, N. Y.

A.L.A.M.

Standard Rod and Yoke Ends



All sizes now in stock, both plain and adjustable patterns, either blanks or milled.

Write for new circular with full particulars.

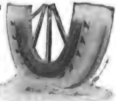
THE BILLINGS & SPENCER CO., HARTFORD, CONN.

NO

PUNCTURES
BLOW-OUTS
PINCHED TUBES
LEAKY VALVES
RIM CUTTING
SKIDDING

IT BENDS

Write for Circular D



MOST RESILIENT AND THERE WITH THE WEAR
We furnish tool for applying tires.

The Motz Clincher Tire & Rubber Co.
AKRON, OHIO

THE FRENCH MFG. CO.
128 ROBBINS ST
WATERBURY, CONN
Manufacturers of

SEAMLESS TUBING

Brass, Copper, Bronze and White Metal

Thin Gauges

Small Sizes

SPECIALTIES:
Irregular Shapes, Solid Drawn Work and Hydro-Carbon Lighting Tubing

GEARS

Can furnish accurate Gears of any kind, and in any quantity, promptly.

The New Process Raw Hide Co.
SYRACUSE, N. Y.

U. S. or CANADIAN PATENTS $25

We pay all expenses and disbursements except Government fees.

Write to us for preliminary opinions on all legal matters. No charge unless retained.

Associates throughout Continental Europe, Great Britain, the Colonies, South America and Canada enable us to investigate and prosecute foreign interests with dispatch.

Our Pamphlet for the asking.

THE INDUSTRIAL LAW LEAGUE, Inc.
170 Broadway, NEW YORK CITY, N. Y.

MOUND

TOOLS FOR THE AUTOMOBILE

This cut shows our new set of twenty tools for auto repair work. Made of the best steel, combining the highest grade of tool smithing. The set is in an oak case, easy to get at, all highly polished.

No. 1. Twenty tools in a set, ... $4.50
No. 22. Set of Six Mound Hollow Ground Scraping Tools in Oak Case, ... 3.00
No. 25. Set of Three Carbon Scrapers, . . 2.50

Ask your dealer or send to us. Be sure and write for Circular.

MOUND TOOL & SCRAPER CO. TOOLSMITHS 298 Howard St., St. Louis, Mo.

HERE IS PROOF THAT THE ENTIRE COUNTRY IS AWAKING TO THE STRUCTURAL, OPERATIVE and ECONOMICAL ADVANTAGES of THE

3 Cylinder Elmore
$1,750.00

Elmore Valveless **2-Cycle**

4 Cylinder Elmore
$2,500.00

OVER ANY OTHER CAR

Elmore Town Car, $2,250.00 ***Elmore Taxicab, $2,250.00***

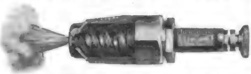
In spite of the fact that ours is the only factory in America to increase its output over 1907, almost every Elmore agent is confronted with a shortage of cars.

Not only would most of the agents gladly pay a premium for more cars, but we have been compelled for two months to refuse requests for new agencies and requests from our larger dealers for an increased allotment of cars.

Surely this condition should prove beyond question the fact that the entire country is awaking to the structural, operative and economical advantages of the valveless, two-cycle Elmore over any other car. The time is past for an argumentative discussion of these advantages. They have of themselves pushed the Elmore into a position which makes it the most talked of car in the automobile world today.

ELMORE MFG. CO., 1004 Amanda St., **CLYDE, OHIO**

THE ONLY SPARK PLUG THAT



is really soot, oil and carbon proof is the "CLEVELAND." The action of the *spiral core* protects the insulation — also causes the plug to "*shoot a flame,*" giving you *maximum energy* at every stroke.

Write TODAY for interesting printed matter that fully describes our other specialties, and ask for our Special Introductory Offer that gives you Cable Terminals and Battery Connections FREE with Cleveland Spark Plug orders.

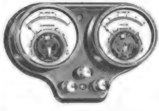
THE CLEVELAND SPARK PLUG CO., *Ignition Specialists,* **950 Power Ave., CLEVELAND**

Oil and Gasoline Storage Tanks

Shop Specialties and Automobile Springs

Write for Catalogue E7.

THE CLEVELAND WIRE SPRING CO.
CLEVELAND, OHIO.



Our Bulletin A. C. contains a fund of information regarding Ignition Troubles. Send for copy.

Hoyt Electrical Instrument Works
PENACOOK, N. H.

RAJAH

SPARK PLUGS

IGNITION
ABSOLUTELY SURE
RAJAH AUTO SUPPLY CO.
BLOOMFIELD, NEW JERSEY
(WATSESSING STATION, D., L. & W. R. R.)

The Rumor Season

is here again, just as it always comes with the regularity of the malaria germ, or the hay-fever, or the June-bug; only it becomes more virulent as it gets older.

The Whooper Company—so Dame Rumor says—will have a world-beater in the shape of a motor that has *more cycles* to it than you have fingers and toes, to sell at —— $. Just wait and see.

The Spouter Company has something up its sleeve that will be a combination of features as variegated as the ingredients in a mince pie to sell at —— $. They will show you later.

The Holler Company has a new startler of the wait-till-we-show-you-and-get-left kind, a conglomeration of metals so diversified as to make the most enterprising experimenter in and mixer of metals quit his job in disgust, and it will sell at —— $. A lick and a promise.

And so it goes on—if you have been in the business long enough you will know the story.

Not so facetious, but similar in trend are the reflections as one scans the horizon of trade promises. I have been asked what we are going to do, and when I started to write this ad it was to give the answer:

We have found that with Maxwell principles of automobile construction, and with honest manufacture and decent selling methods, old terra firma is a good enough place to do business on, and we are going to stay on earth, saving ourselves the trouble to come down again after the soaring flights of fancy in which some of our friends now indulge.

We are in the automobile business for the profits that are in it, and we are satisfied with the results. It pays to build the only good, moderate priced automobile. Our dealers are satisfied, for they, too, find legitimate effort rewarded with a legitimate profit. Maxwell owners are satisfied, because they know that they possess a car that will give satisfactory service at minimum expense, every day in the year, and that looks as stylish and imposing—without extra charge for the style and imposition—as the highest-priced cars made anywhere. Being built upon well-tried design and honestly made, they are free from the find-me-out-later-on handicap of some other manufacturers.

We will sell Maxwell cars, some ten thousand of them, at legitimate prices—prices high enough to give to our dealers and to ourselves a legitimate profit, and low enough to give every purchaser the full value of his money.

The only change we will make will be in the distribution of profits resulting from the sale of Maxwell cars. Here the new management will favor the individual dealer, giving the hustler the hustler's reward. If you are a hustler we want you and you will want us. So let's get together as soon as possible. Write to me now, telling me something of your territory and its sales possibilities, and I will communicate with you and tell you of the new Maxwell selling plan, the plan for business-getters.

Benj Briscoe
President

MAXWELL-BRISCOE MOTOR CO., P. O. Box 107, Tarrytown, N. Y.

Members A. M. C. M. A.

Factories: TARRYTOWN, N. Y. NEWCASTLE, IND. PAWTUCKET, R. I.

MICHELIN

FRANCE. ENGLAND. ITALY. AMERICA.

Whenever Michelin tires are compared with any other makes for good wearing service, reliability, durability and *economy,* the lead of Michelin's is always emphasized, and here are some *reasons why.*

In 1895 Michelin made the first successful automobile tires ever constructed. Our entire time and attention ever since have been devoted to building tires and tubes only, and not divided among various lines of rubber products.

Michelin tire quality proves that concentration counts, by winning every important contest in Europe and America in which they participate. Michelins get harder usage in these events than you can ever give them, and they invariably withstand it successfully.

Don't you think we know something about tires when you consider that to September last we had made 1,180,830, or tires enough to equip 26,837 automobiles each and every year since 1895.

In spite of the fact that Michelin tires cost a trifle more than others, more than half the cars in Europe are equipped with them, because the car owners can get no other tires to give the Michelin's economy and satisfaction of service.

MICHELIN TIRE CO.

MILLTOWN, N. J.

NEW YORK, 1763 Broadway
CHICAGO, 1344 Michigan Avenue
DETROIT, 247 Jefferson Avenue
BOSTON, 895 Boylston Street
BUFFALO, 908 Main Street
SAN FRANCISCO, 308 Van Ness Avenue
DENVER, 15 East Colfax Ave.

Soda and Potash Kettles

For quickly, thoroughly and economically cleansing all oil, grease and chips from newly made machine parts, preparatory to being case hardened, plated or assembled; also handy for cleansing parts of machinery of all descriptions in repair shops or garages.

More economical and safer to use than gasolene for cleansing. Heated by Bunsen gas burner or blue flame kerosene burner. No expensive steam traps, special piping or drainage. One size only. Ten gallons capacity. Low cost as compared with steam kettles. In stock ready for prompt shipment.

Send for Descriptive Circular "K" today.

The Gray & Prior Machine Co.

42 SUFFIELD STREET, HARTFORD, CONN.

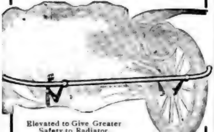
Sager Equalizing Springs

WIN ON MERIT. OVER 25,000 IN USE

COMMENDED BY
LEADING MANUFACTURERS

"We are entirely satisfied with them."
Elmore Mfg. Co.
"The 'Sager device' presents advantages not found in other so-called 'shock absorbers'."
Olds Motor Works
"They add greatly to comfort and reliability."
Crawford Automobile Co.
"We find them indispensable."
Logan Construction Co.
"Our customers are more than satisfied with them."
Dorris Motor Car Co.
"Have given us very excellent satisfaction."
Thomas B. Jeffery & Co. (Rambler)
"The success of your shock absorbers has interested us considerably."
The Dayton Motor Car Co. (Stoddard-Dayton)
"Used your springs with splendid success."
The Autocar Co.
"We claim 1908 will be a Sager year."
Meteor Automobile Works
"A great benefit and we cannot speak too highly of them." **The Forest City Motor Car Co. (Jewel)**
"Give perfect satisfaction."
Evansville Automobile Co. (Gearless Automobile)
"We found your springs to be satisfactory."
Pope Mfg. Co.

Protection Bumper



Elevated to Give Greater
Safety to Radiator,
Lamps and Tires.

Will save its cost many times in a season.

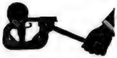
Write for full particulars.

J. H. SAGER CO.
Rochester, N. Y.

New York Agents, Manufacturers' Distributing Co., 1900 Broadway.

Chicago Agents, Western Distributing Co., 1424-1426 Michigan Ave.

"L & M"
Shoe Loosener



Loosens Rusted or Frozen Tires from Clincher or Detachable Rims.

PATENT APPLIED FOR

PRICE $3.00 DELIVERED

Either side of shoe loosened with equal ease; fits in tool box.

— MANUFACTURED BY —

Long & Mann Company
519 Graves St., Rochester, N. Y.

Also "L & M" Adjusters and Lifters, "Minute" Adjusters and "Perfect" Auto Washers (The Sponge Savers).

REMOVES CARBON FROM
AUTO CYLINDERS

The Anti-Selenite Company's Carbon Cleansing Compound absolutely and positively removes carbon from gas engine cylinders without pitting or other injury. Endorsed by everyone.

Buffalo, N. Y., April 15, 1908.
The Anti-Selenite Co., St. Louis, Mo.

Our Mechanical Department advises that after testing sample of Carbon Cleansing Compound recently sent us, they find that same works very satisfactorily. We will thank you to quote us price on this material, and remain.

Yours very truly,
E. R. THOMAS MOTOR CAR CO.,
J. B. MacDonald, Pur. Agt.

Anti-Selenite Co., St. Louis, Mo.

If your dealer doesn't keep it, write
H. G. STRIPE, General Eastern Agent,
220 Broadway, New York

NON-SULPHATING
Storage Battery Igniter

IGNITER
GEISZLER BROS.

Size 66.
Volt, 60 Ampere Hour, - - $15.00

GUARANTEED for one year
Send for Catalog H.

GEISZLER BROS., 514 & 516 West 57th St.
New York City
(Formerly of 316 West 42d St.)

TAXICAB NUMBER
Issue of May 13, 1908

Full discussion of the new phase of automobile development at home and abroad, engineering articles, foreign experience, domestic possibilities, treated by experts.

Price, 10 Cents
THE HORSELESS AGE, 9-11 MURRAY ST., NEW YORK

VALENTINE & COMPANY
Manufacturers of HIGH-GRADE VARNISHES and COLORS for MOTOR CARS Send for Color Sample Book.

Trade VALENTINE VARNISHES Mark

NEW YORK CHICAGO BOSTON PARIS AMSTERDAM

THE PRICE IS LOW

but "Operation, Care and Repair of Automobiles" is high class. Compiled by Albert L. Clough, it is a complete, up-to-date handbook for owner, chauffeur or garage keeper.

Price $1.00. By Mail, $1.10.

THE HORSELESS AGE, **9-11 Murray Street, New York**

CARRY A DETECTIVE
In Your Pocket

The Robert Pocket Meter will tell you quickly and correctly the exact cause of your battery trouble . . . It will locate the dead battery, one of which may weaken your entire set. The cost is small . . . Benefit great!

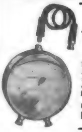
Send for our latest catalog

ROBERT INSTRUMENT COMPANY
55 Shelby Ave., Detroit, MICH.

HEALY RAPID REMOVABLE RIM

Entirely eliminates tire troubles—complete change of tire made in three minutes—simple in operation, yet guaranteed to stand hardest driving on racing or touring car. Costs $60 equipped, with extra Rim and Wrench. **Get our Special Guarantee**

HEALY LEATHER TIRE COMPANY
88-90 Gold St., New York
1906 Broadway, N. Y. 1231 Michigan Avenue, Chicago
WRITE FOR BOOKLET



How Are
Your Batteries?

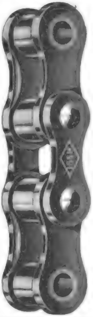
Test with our combination **Pocket Volt-Ammeter.** 0-30 Amperes, 0-6 Volts, $5.00. Ammeter only $3.50. Price includes a leather case. Send for Circular B.

Connecticut Tel. & Elec. Co. Inc., Meriden, Conn., U. S. A.

You Will Remember the Quality of a

Diamond Chain

Long After You Forget the Price



The price, by the way, is no more than for others, but when you consider that our NICKEL STEEL rivets are the only really serviceable chain rivets made, and that chain life is entirely dependent upon the wear-resisting quality of the rivets, the final cost of a Diamond Chain is much the lowest.

Our rivets have that characteristic nickel steel toughness which allows them to bend before breaking, yet the glass-smooth surface is hardened so thoroughly and carefully by our special process that there is no danger of wear from grit which may work onto the bearing surface.

Only DIAMOND CHAINS HAVE NICKEL STEEL RIVETS, AND NICKEL STEEL RIVETS ARE THE ONLY ONES WHICH POSITIVELY WILL NOT CRACK, BREAK OR WEAR SERIOUSLY.

Write for Catalog.

DIAMOND CHAIN & MFG. CO.
245 W. Georgia Street
INDIANAPOLIS, IND.

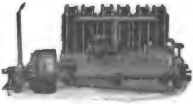
No. 28

F. A. Brownell Motor Company

POWERFUL **RELIABLE**

Motor of Acknowledged Superiority

4, 6 and 8 Cylinders



15 to 160 H. P.

6-Cylinder, 75-80 H. P. Motor

Embodies the most scientific and approved principles of internal combustion engine construction.

Motors for Automobile, Marine, Tractor, Suburban Car and other purposes.

A Postal—A Catalogue

F. A. Brownell Motor Co.

634-666 Lexington Ave., Rochester, N. Y.

AJAX
WRAPPED TREAD TIRES

Tire pools
are formed
from time to time
for the dual purpose
of maintaining high prices
and thwarting attempts
of buyers to
obtain
better quality.

"You pay
our price
and accept
what we choose to give you"
is the pleasant ultimatum.

AJAX tires
were first made to break
the pool—the "trust"—
and we did it
by offering to guarantee
every AJAX tire
for 5,000 miles of
service.
That Guarantee proved
such a good
selling argument
we have
continued the practice
ever since.

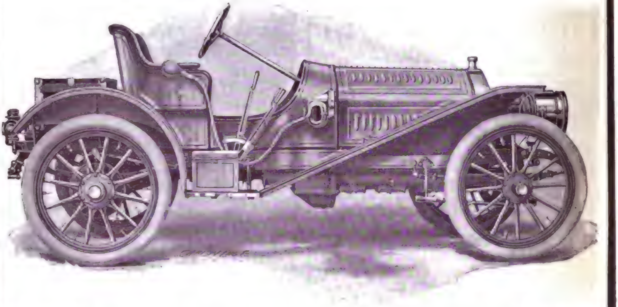
Write for copy of Guarantee, stating what size tire you are using.
Address Dept. E.

AJAX-GRIEB RUBBER COMPANY
GENERAL OFFICES: N. E. Cor. 57th Street and Broadway, New York
Factories: Trenton, N. J.

BRANCHES:

New York, 1776 Broadway
Boston, 810-a Boylston St
Chicago, 1418 Michigan Ave.
Detroit, 748 Woodward Ave.
Denver, 1529 Cleveland Place
Seattle, 1102 Broadway
San Francisco, 400 Golden Gate Ave.
Los Angeles, 1040 S. Main St.

Agents in all large cities.



Mora Tourer

MECHANICALLY FINEST LIGHT SIX BUILT IN AMERICA

Mora Racytype

Is such because it is designed on the most up-to-the-minute mechanical lines, built of first-class material, with the best machinery obtainable, by skilled workmen, with extreme care.

Its distinctive mechanical features are

An all ball (imported annular) bearing engine.
A selective type ball-bearing nickel steel transmission.
A mud-proof, aluminum pan construction, unit power plant.
A full floating type rear axle, 36-inch wheels.
A platform spring construction.
A double independent ignition system.
A pressed steel frame of unquestionable strength.

No other manufacturers in America combine in their car all of the points of mechanical superiority enumerated above.

That's why the Mora is the finest of any built in America.

The price is right too: **Tourer Six, $3,600; Racytype Six, $3,500.**

Two distinct models—neither a made-over makeshift of the other.

ASK FOR DETAILS

Mora
MECHANICALLY RIGHT

Mora Motor Car Company
29 Mora Place
NEWARK, NEW YORK
New York Branch, Broadway and 52d Street

JUN 28 1

...THE...
Horseless Age

VOLUME 22 NEW YORK, DECEMBER 30, 1908 NUMBER 27

INVESTIGATE

and you will not only find the Horseless Age carefully read by the leading technical men in the automobile and parts factories, but you will find it

BOUND AND PRESERVED

in the factory libraries, advertisements and all, and frequently referred to and studied.

"When I want amusement I take up the________. When I want instruction I read the Horseless Age," said an old subscriber recently.

Bound volumes of the Horseless Age will also be found in the **libraries of many cities, towns, colleges and private persons.**

Advertisements of staple parts and accessories, therefore, have more than temporary value in the Horseless Age.

When a manufacturer is designing a new machine, or planning improvements his engineers are reading advertisements that appeared in the Special Numbers of former years as well as in the regular issues of the Horseless Age.

In the Horseless Age your advertisement is good not for a day only but for a decade.

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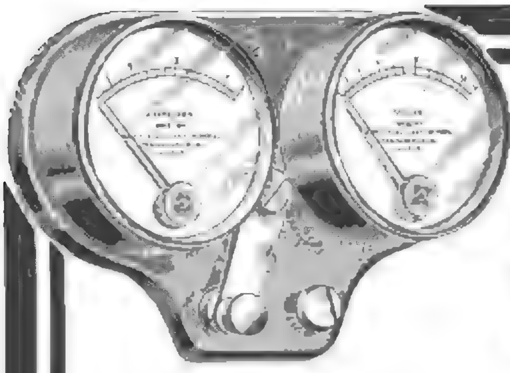


CUT YOUR BATTERY BILLS IN HALF

BY USING

The Hoyt Voltammeter

as well as doubling the efficiency of your ignition system. Hoyt System of testing Ignition Circuits is the only means of keeping a check on ignition troubles.

THE

Hoyt Triune Voltammeter

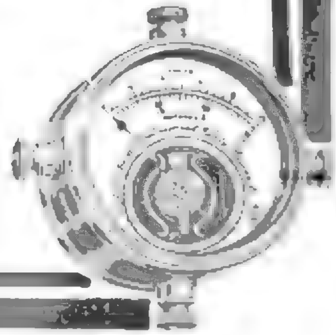
HAS NO EQUAL
THREE SEALS

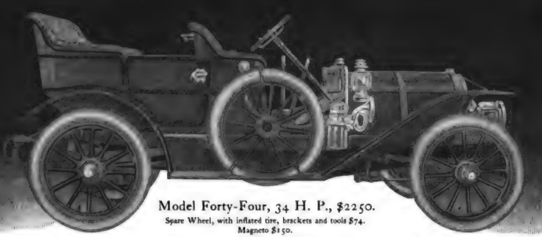
0 to 10 Volts, for testing Storage Batteries.
0 to 30 Amperes, for testing Dry Cells.
0 to 1½ Amperes, for testing Coils.
Has silk covered cables in plush lined morocco case, **$12.00**
Thirty days' trial; fully guaranteed.
Thirty years' practical experience to back up our output.

We make Electrical Instruments for every purpose.

Write for Bulletin A. C. describing our complete line.

Hoyt Electrical Instrument Works
PENACOOK, N. H., U. S. A.



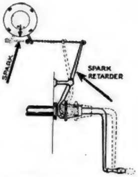


Model Forty-Four, 34 H. P., $2250.
Spare Wheel, with inflated tire, brackets and tools $74.
Magneto $150.

THE SAFETY SPARK RETARDER

There is absolutely no danger in cranking a Rambler when properly adjusted. The starting crank then cannot engage until the spark has been automatically retarded.

Every one who has had the unpleasant experience of a premature spark in starting an automobile will appreciate the Rambler safety starting device. This prevents an explosion ahead of center, even though the operator forgets to retard the spark.



You cannot engage the lug on the shaft with a tooth on the starting crank until the spark-retarder lever has moved from the position of the dotted line to the position shown, thus retarding the spark.

Rambler

The Car with the Offset Crank Shaft

Seven passenger model, forty-five horse power with offset crank shaft, $2500. Other models, $1150 to $2500. Write for catalog describing in detail Rambler offset crank shaft, Spare Wheel, straight line drive and other exclusive features of the new Rambler models.

THE CAR OF STEADY SERVICE

Thomas B. Jeffery & Company, Main Office and Factory, Kenosha, Wis.

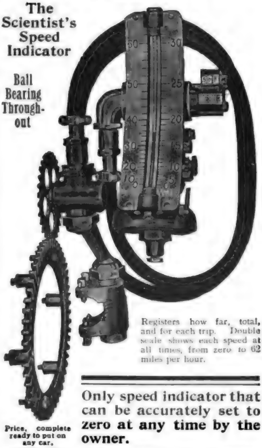
Branches and Distributing Agencies:
Chicago, Milwaukee, Boston, New York, San Francisco. Representatives in all leading cities.

**"It's nice to know how far you go;
And this will show the speed,—also."**

Veeder
Tachodometer

**The
Scientist's
Speed
Indicator**

**Ball
Bearing
Through-
out**



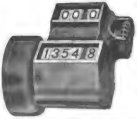
Registers how far, total, and for each trip. Double scale shows each speed at all times, from zero to 62 miles per hour.

Only speed indicator that can be accurately set to zero at any time by the owner.

**Price, complete ready to put on any car,
$50.00**

No Springs or variable elements; no delicate mechanism.

Only One Moving Part



Thousands of Veeder Odometers in use to one of any other make.

—THE—

Veeder Mfg. Co.

**SARGEANT STREET,
HARTFORD, CONN.**

FORM D or DASHBOARD ODOMETER. Complete with flexible shaft and attaching fixtures, ready to put on any car, **$20.00**

Represented in Great Britain by Messrs. Markt & Co., Ltd., 6 City Road, Finsbury Square, London, E. C., England.

THE WISE MEN OF THE EAST
THE WISE MEN OF THE WEST
USE THE

Reliance

SPARK PLUGS

"THEY SPARK IN WATER"

**YOU TRAVEL FAR
YOU TRAVEL GOOD**

JEFFERY-DEWITT CO.
217 E-HIGH ST. NEWARK, N.J.

SEE OUR EXHIBIT AT BOTH NEW YORK SHOWS

THE A B C

of the Combination Nickel Steel Head—Carbon Steel Stem, Electric Welded Valve

A.—Before Welding. B.—After Welding. C.—Finished.

These valves, after several years' use by the most prominent manufacturers in the United States, have proven to be the best on the market to-day.

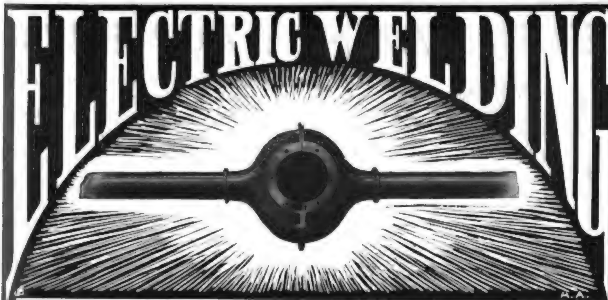
Nickel steel is the best material for the head and carbon steel the best for the stem, for obvious reasons.

The valves receive special heat treatment and are guaranteed never to break in the weld. We can furnish them ready for seating in your engine, with stems and seats ground, keyways and slots cut, etc., at lower prices than your present cost on valves.

We want to quote on your '09 requirements—May we?

THE ELECTRIC WELDING PRODUCTS CO.

Formerly THE CLEVELAND CAP SCREW CO.
CLEVELAND, OHIO



A Real Accomplishment by Electric Welding

The following figures are the result of a test given a piece of 3½ per cent. Nickel Steel, ½ inch diameter,

Electrically Welded, Annealed and Tested by Our Process:

Tensile Strength Per Square Inch, 145,504 lbs.
Elastic Limit Per Square Inch, - 139,459 lbs.

After being tested to the above figures, the rod broke in the main body,

But Did Not Break in the Weld

—a strong testimony for the art of Electric Welding in the hands of the masters of the process.

See our Exhibit at spaces No. 124 at Grand Central Palace Show
and No. 163 at the Madison Square Garden Show

Western Representative
L. F. McCLERNAN
1061 Monadnock Block
CHICAGO

THE STANDARD WELDING CO.

CLEVELAND

Eastern Representative
L. D. ROCKWELL
United States Express Building
NEW YORK

by Google

EISEMANN MAGNETO

THE **Eisemann Magnetos** have reached the highest degree of perfection, outclassing all competitors.

You can run your motor at slower and at higher speed on the **Eisemann Magneto** than any other, and with an absolute certainty of a full development of the possibilities of your motor. The **Eisemann** requires practically no attention and is always ready to give you the very best results.

See us at the Shows
NEW YORK and CHICAGO

An examination of the records will show that the **Eisemann** was equipped upon the winners of the principal motor racing events of the last three years.

You cannot make a mistake if you equip with **Eisemann.** Various models for any and all kinds and sizes of motors. Give us the specifications of your motor and we will advise you just what you need.

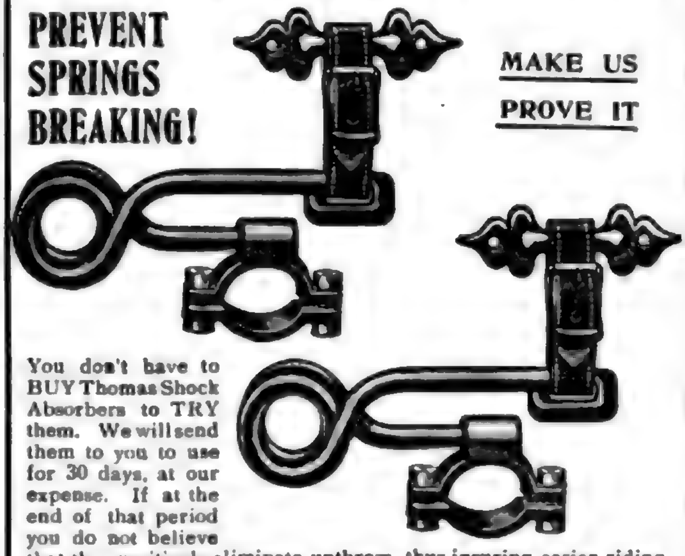
LAVALETTE & COMPANY

112 West 42d Street NEW YORK CITY

THOMAS SHOCK ABSORBERS

PREVENT SPRINGS BREAKING!

MAKE US PROVE IT



You don't have to BUY Thomas Shock Absorbers to TRY them. We will send them to you to use for 30 days, at our expense. If at the end of that period you do not believe that they positively eliminate upthrow, thus insuring easier riding —more speed—less wear on tires—NO BROKEN SPRINGS and fewer repairs—just send them back. Could anything be fairer? Can we make our guarantee stronger? Remember you have nothing to lose—everything to gain. Send for full particulars—they are worth real money to you.

BUFFALO SPECIALTY CO., 390 ELLICOTT ST., BUFFALO, N. Y.

JOT IT DOWN

to call at our Exhibit at either of the New York Automobile Shows.

You will find an interesting display of our product, including several new and distinctive features.

SPACE 155 *A. M. C. M. A. SHOW*

Standard Roller Bearing Co.
PHILADELPHIA, PA.

14 entries. Only one perfect score—the Franklin.

Against thirteen competitors, the 1909 Model D Franklin touring car won the only perfect score in the Worcester, Mass., reliability contest, December 12. Eight of the contestants went through the road run without penalization. But the Franklin was the only one to withstand the rigid examination after the run by a technical committee from the faculty of the Worcester Polytechnic Institute.

All except the Franklin suffered penalization due to broken, strained, bent or loosened parts, leaks, etc.

It was necessary for the committee to go over the Franklin six times in order to satisfy the other competitors.

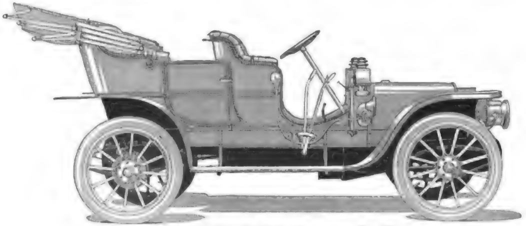
Was this luck? No!

This is the fifth severe contest in which a 1909 Franklin stock model has carried off the honors. Franklins won perfect scores in the Glidden Tour. The only Franklin entered in the Bretton Woods endurance run won a perfect score. Another Franklin won a perfect score in the 1,000-mile Chicago reliability contest, and also had the lowest gasoline consumption in its class. Still another Franklin won a perfect score in the Cleveland sealed bonnet run, and had the lowest gasoline consumption of all contestants.

These five consecutive perfect scores in five consecutive contests, each with a stock model and, except in the Glidden Tour, only one in each contest, are most significant. How significant is of interest to every buyer of an automobile. No other automobile has such a record.

Most any automobile can make a hard road run without stops, but to go through without troubles of any kind and without any derangement or strains resulting is what tells the story.

The light-weight air-cooled Franklin does not strain or rack itself. It stands up. It rides comfortably.



MODEL D. $2,800. F. O. B. Syracuse. Top Extra.

A high-grade powerful automobile. Refined, reliable and safe. Abler for touring on American roads than any automobile but a Franklin. Beautiful to look at, comfortable to ride in and doing its work at the lowest operating cost.

H. H. FRANKLIN MANUFACTURING COMPANY, Syracuse, N. Y.

ORDER YOUR STOCK NOW!

HESS-BRIGHTS

ARE ALWAYS GOOD STOCK

Hess-Bright Ball Bearings are the one detail your designers do not often change. Your stockman knows that an overstock is not dead stock, but is as good next season as this—he considers it good business to be forehanded.

The Hess-Bright Manufacturing Company

2114 Fairmount Avenue, PHILADELPHIA

A. O. SMITH CO.

MAKERS OF

Pressed Steel Frames

(*Capacity 100,000 per Annum*)

Heavy and Difficult Stamping
Front and Rear Axles, Steering Columns
Transmissions, Selective and
Progressive, Multiple Disc Clutches

SEE OUR EXHIBITS:

Grand Central Palace, Space 134
Madison Square Garden, Space 205
Coliseum, Chicago, Space 6

A. O. SMITH COMPANY
245 Clinton Street
Milwaukee, Wis.

2
SEPARATE
SPARK
GAPS

PITTSFIELD

IGNITION SYSTEM

New Pittsfield Magneto Plug

Two spark gaps in same plane, which is at right angles to axis of plug.

Both sparks of equal efficiency, firing straight out into mixture.

No gland or packing nut used.

Long, accurately fitted taper of bushing and plug makes it **absolutely gas tight.**

Insulation is the very best mica washers subjected to enormous pressure, making them **practically a solid block of mica.**

Clean and sootless during its whole life.

Unqualifiedly the best magneto plug on the market.

Unapproachable in its record for efficiency and durability.

Made for **service** and not merely for show.

2
SEPARATE
SPARK
GAPS

New Pittsfield Switch

This latest product of the Pittsfield Spark Coil Co., overcomes **all** the defects of other switches, and has **none** of its own.

Unbounded satisfaction is assured, as quick, positive changes are made which cannot jar away from contacts.

Batteries perfectly safe from all danger of short circuiting through this switch, as there is no chance for the closing of the battery circuit when plug is removed.

Wiping action of contact surfaces makes **dirty contacts impossible.**

Can be easily substituted for other and inferior switches.

Two styles—two batteries and magneto and battery.

Practically as safe as an unpickable lock.

Its own plug **must** be used. **Thieves are completely baffled.**

Pittsfield Spark Coil

Pittsfield Spark Coils represent all that is best in design, material and construction. The boxes are of finest solid mahogany, beautifully finished. The windings are of magnet wire of the highest grade obtainable. Specially prepared insulation, so perfect that short circuiting is impossible.

Absolutely moisture proof.

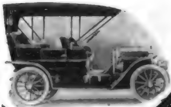
Patent vibrator, acknowledged to be the fastest made.

Dependable in its action, making a perfect electrical connection at every impulse.

Breadth of adjustment far superior to any other.

Condensers carefully made in proportion with working parts of coil, resulting in consumption of but one-half ampere of battery current on short circuit and one-tenth ampere when engine is running.

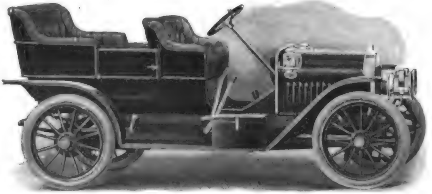
PITTSFIELD SPARK COIL CO., Dalton, Mass.



1909

REGAL

The Car That Has Made Good



$1,250.00

Compare It With a Regal

Regal Model A, 5 passenger Touring Car, and Model B, 3 or 4 passenger Runabout, 30 H. P., 4 cylinder, sliding gear transmission, shaft drive, equipped with Remy High Tension Magneto, are exclusive in design and construction.

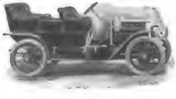
The Regal is not an experiment, as it has been on the market for the past two years. It has proven itself to be the most durable car in every respect.

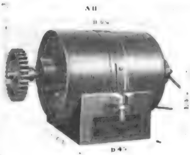
HIGHEST QUALITY *Our New 1909 Models A and B are ready for shipment.* **POWER**

Write us today for literature.

Regal Motor Car Co.

DETROIT, MICH.





Heinze Magneto.

HEINZE Low Tension Magneto operating through vibrating coil to plug gives the most complete dual ignition system. No possibility of getting stalled if you use the Heinze system.

Send for 1909 catalogue on our complete line of Coils, Magnetos, Spark Plugs, and other automobile ignition appliances.

Heinze Electric Co.
LOWELL, MASS.

Magneto Disassembled.

WARNING!

After January 1st, 1909,

A RED SEAL

will be attached to the outside of

ALL IGNITION COIL UNITS

made under our patents and sold by our licensees.

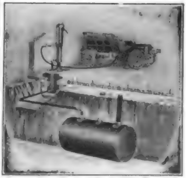
THE UNLICENSED MANUFACTURERS, USERS OR VENDORS WILL BE PROSECUTED

THE UNIT COIL CO.

Address license application to the Secretary, 15 Exchange Place, Jersey City, N. J.

SEAL
(COPY)

LICENSED BY THE UNIT COIL CO.
PAT'D
FEB. 4 1908
APR. 7 1908
UNIT NUMBER
A 17249



Cut 41--Long Distance Outfit. The Standard Garage Equipment for Gasolene Storage

Better Gasolene for Less Money

If you could run your car farther with less gasolene, and pay less for what gasolene you do use, wouldn't you do it?

This may sound impossible, but it is easily done. Just get

BOWSER GASOLENE TANK

The BOWSER enables you to safely store gasolene in large quantities so you can pay wholesale prices.

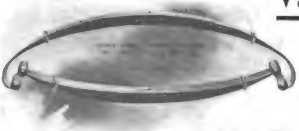
Then the BOWSER keeps the gasolene for you just as strong and powerful as when it left the refinery, giving you more power per gallon than gasolene stored any other way.

Aren't these points worth looking into?

Send a postal for Catalog H. It is full of automobile pointers.

S. F. BOWSER & CO., Inc.
Fort Wayne, Indiana

255 Atlantic Avenue, BOSTON. 50 Church St., NEW YORK. Fisher Building, CHICAGO. 612 Howard St., SAN FRANCISCO. 66-68 Frazer Avenue, TORONTO.



Vanadium Steel Springs

Are the Springs For Hard Service

Information of value to every owner, dealer and manufacturer of automobiles may be had free on request.

Let Us Solve Your Spring Problems for You

The Cleveland-Canton Spring Co.
CANTON, OHIO

466,800 H. P. is being Transmitted by clutches equipped with

Three-Plate Disc Clutch with Cork Inserts.
The Autocar Company.

CORK INSERTS

(Patented.)

Leather-Faced Cone with Cork Inserts.
The Geo. N. Pierce Co.

In Cars made by these well known builders

De Luxe Motor Car Co.
Knox Automobile Co.
Chase Motor Truck Co.
Reliance Motor Truck Co.
Alden Sampson Mfg. Co.
Stilson Motor Car Co.
Kirkham Motor Mfg. Co.
Premier Motor Mfg. Co.
Continental Motor Mfg. Co.
Klink Motor Car Mfg. Co.
Northway Motor & Mfg. Co.
New York Car & Truck Co.
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Adams Co.
Moline Automobile Co.
Pennsylvania Auto Motor Co.
Dayton Motor Car Co.
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Mora Motor Car Co.
Atlas Motor Car Co.
Midland Motor Co.
Meteor Motor Car Co.
Marion Motor Car Co.
Napier Motor Car Co.
Roberts Motor Car Co.
Mack Bros. Motor Car Co.
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Coppock Motor Car Co.
F. B. Stearns Co.
Matheson Motor Car Co.
Auto Parts Mfg. Co
Abendroth & Root Mfg. Co.
American Machine Mfg. Co.
Forest City Motor Car Co.
Studebaker Automobile Co.
H. E. Wilcox Motor Car Co.
Simplex Motor Car Co.

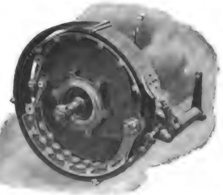
OIL-COOLED CORK INSERT BRAKES

Extracts from an editorial in *The Automobile*, Oct. 22d, 1908, entitled "A departure in Brake Practice":

"One of the last things that the average driver is anxious to have come in contact with the brakes of his car is oil, so that at first sight the proposal to employ brakes running in oil appears somewhat far-fetched, in view of the fact that even a small amount of lubricant is destructive of the frictional properties of two rubbing surfaces. This is true of metal, wood, or fiber surfaces, regardless of their character, but it is one of the peculiar properties of Cork that its coefficient of friction with a metal surface is but very slightly influenced by the presence of oil in any quantity, and it is this that has made possible what may be best termed an OIL-COOLED BRAKE."

"The protecting influence of the oil, and the possibilities that it throws open in the way of improved brake service, as compared with the present day practice of employing frictional materials that must of necessity be renewed periodically, are limitless. It would be futile to attempt to pit either the water or the air cooled brake against one constantly immersed in oil, as in view of the peculiar property of Cork in not losing its frictional properties under the influence of a lubricant, the advantages of a generous supply of oil for cooling are obtained, without the attendant disadvantages of lubrication, which are naturally not to be desired where the object in view is the maximum friction."

In perfect condition after Run of 12,189.6 miles on Premier Century Car



Extract from the Official Report of Messrs. Becroft and Nadall on the Premier Cork Insert Oil-Cooled Brake, after making a run of 12,189.6 miles:

"The external fibre lined brakes did not appear to have been used, and were in perfect condition.

"The internal brakes, bronze expanders, 14¾ inches in diameter and three inches wide, provided with Cork Inserts, **did not show any indication of wear or scratching; these brakes run in oil, and all of the Cork Inserts were in condition, and the wear on the bronze shoe was not noticeable**, except at the margin in two places, where there had been a little dragging. The committee was particularly impressed by the dimensions and observations of these brakes."

If you have Clutch or Brake troubles, write the

National Brake & Clutch Co., 16 State Street
Boston

OPENS NEW YEAR'S EVE

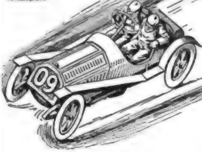
Finest Decorations by S. R. BALL CO. ever offered at any Motor Car Exhibition

DEC. 31 to JAN. 7

Leading American Cars—All the Foreign Cars direct from the Paris Salon
All Accessory Makers

ONLY EXHIBIT OF FOREIGN CARS IN AMERICA

9TH INTERNATIONAL AUTOMOBILE SHOW



GASOLINE—ELECTRIC—STEAM

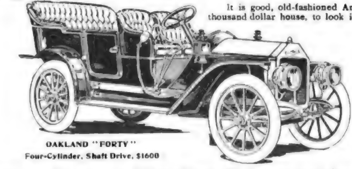
Management of American Motor Car Manufacturers' Association

GRAND CENTRAL PALACE

43d St. and Lexington Ave., New York Admission, 50c.; Tuesday, $1.00

Oakland

The Oakland Is the Answer to the Man Who Says "Show Me"



OAKLAND "FORTY"
Four-Cylinder, Shaft Drive, $1600

It is good, old-fashioned American habit, whether buying a cigar or a ten thousand dollar house, to look into things a little before spending your money and see that you are paying not one cent more than is necessary.

You select an automobile for what it IS and for what it will DO.

Why Should You Pay From 50 to 100 Per Cent. More for a Car That Will Do No More Than the Oakland "Forty"?

It has a forty horse power motor with cylinder cast in pairs, giving more power than you will ever want for ordinary driving, with enough reserve to overcome any hill you will meet, and to keep you ahead of any car but the extreme high-power racing types.

It has 112-inch wheel base, seats five people without touching elbows, and in every little appointment is luxurious and easy-riding. Compare it with any high-priced car, and you will wonder how the other fellows ever get people to pay the long price for cars no better appointed than the Oakland.

Light weight, 2,000 lbs., means low cost of maintenance. Big 34-inch wheels, 4-inch tires, steel I-beam axles—nothing cheap about the Oakland—simplicity of construction and scientific manufacturing system alone can account for the phenomenally low price.

This is the car you want to buy, and if you are a dealer it is the car you will want to sell if we have open territory in your locality.

Write us to-day for a fuller description. You owe it to your pocketbook to find out more about the Oakland.

OAKLAND MOTOR CAR CO.
202 Oakland Ave., Pontiac, Mich.
Members American Motor Car Manufacturers' Association.
Will exhibit in New York only at Grand Central Palace Auto Show, opening December 31

THE OAKLAND TWENTY

is designed for the man who wants car of moderate power, made with all the mechanical excellence of a big high-priced car. Its two-cylinder vertical motor runs as smoothly and quietly as a four-cylinder engine—better than many of the light, trappy "fours" of questionable cheapness

SPECIFY
"Hartford" Universal Joints

Type J.

You will get something that is as good as you could wish for and at a surprisingly low price considering the quality of material and machine work. There is no secret about it, simply due to the fact that they are

MADE BY SPECIALISTS

All of our machinery and tool equipment has been specially designed for this work. We manufacture in large quantities and buy raw material in car lots. That's why a few manufacturers who formerly made their own joints now find it profitable to have us make them. Our prices and examination of our samples would be a pleasant surprise to you. "Hartford" Universal Joints have come to stay, because they are made right and of the best material to be had. We believe there are plenty of manufacturers who appreciate "good stuff" and are willing to pay a fair price for it.

Type C

For the season of '09 we are making a large number of our Type J Joint, furnishing them as a complete drive-shaft, with joint on each end.

The Type C, as shown, is the latest thing on the market and the price is surprisingly low. No castings in it, all drop forgings.

Better get in touch with us. It will cost only a red stamp to find out what we can do for you.

The Hartford Auto Parts Co.

443 Asylum Street, HARTFORD, CONN.

J. S. BRETZ CO., Times Building, New York, Selling Agents.

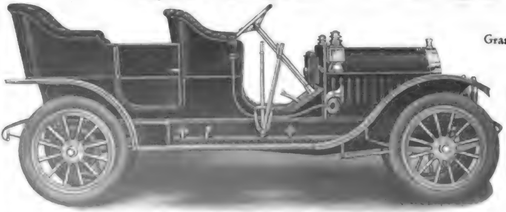
The Atlas MOTOR CARS

Three-cylinder Touring Car is equipped with the Atlas Two-cycle, Simple, Flexible, Efficient, Indestructible Engine. The Three-cylinder, Two-cycle Atlas Engine has the light multiple impulses of the six-cylinder, four-cycle type without any of its complications or rapid deterioration. The numerous poppet valves, valve shafts, adjustable bearings, cams, springs and dozens of other small breakable wearable parts are completely eliminated in the Atlas.

The Engine Is Practically Indestructible

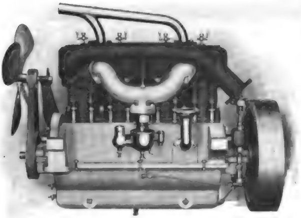
The 1909 Touring Car has pressed steel frame, 110-inch wheel base, geared pump, geared oiler, and geared fan, Atwater Kent ignition, ¾ elliptic rear springs, 34x4-inch tires, aluminum body, handsome lines, extreme ease of riding, full equipment of lamps and generator or tank. Price, $2,000. The 1909 line:

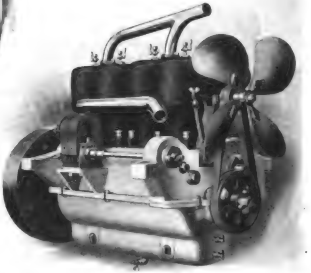
2 Cylinder Runabouts
3 Cylinder Runabouts
3 Cylinder Touring Cars
Town Cars
Taxicabs
Delivery Wagons



Will exhibit
at
Grand Central Palace
December 31st
to
January 7th
Space 9, Section N

Atlas Motor Car Co.
102 Birnie Avenue
SPRINGFIELD, MASS.
New York Office,
1876 Broadway
Send for catalogue and two cycle catechism.





Northway Motors

ARE THE MOST

POWERFUL and SILENT

MOTORS BUILT OF

Best Material and Workmanship.

Large factory capacity insures early deliveries.

Furnished complete as illustrated,
including integral oiling system.
Write for bulletin today.

THREE SIZES:
4 x4, 20 H. P
4 x4½, 25 H. P.
4½x4½, 32 H. P.

NORTHWAY MOTOR & MFG. CO.
Detroit, Mich.

Ninth National Automobile Show

Madison Square Garden

January 16 to 23, 1909, New York City

Under the Auspices of the

Association of Licensed Automobile Manufacturers

Exhibiting standard Gasoline Cars licensed under the Selden patent.

LICENSED GASOLINE CARS

Apperson
Autocar
Buick
Cadillac
Chalmers-Detroit
Corbin
Columbia
Elmore
E-M-F
Franklin
Haynes
Hewitt
Knox
Locomobile
Lozier
Matheson
Packard
Peerless
Pierce Arrow
Pope-Hartford
Pope-Toledo
Royal Tourist
Sampson
Selden
Simplex
Stearns
Stevens-Duryea
Studebaker
Thomas
Walter
Waltham
Winton

ELECTRIC

Anderson
Babcock
Bailey
Baker
Champion
Columbia
General Vehicle Co.
Rauch & Lang
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Waverly
Woods

STEAM

White

Complete exhibit by the Motor & Accessory Manufacturers. The only complete Motorcycle exhibit in New York, by the Motorcycle Manufacturers' Association, Commercial Vehicles, Town Cars and Taxicabs.

STEWART SPEEDOMETERS EXCLUSIVELY

Many of the largest accessory dealers in the United States and Europe are stocking Stewart Speedometers exclusively

THE FAMOUS STEWART SWIVEL JOINT
(Patented)

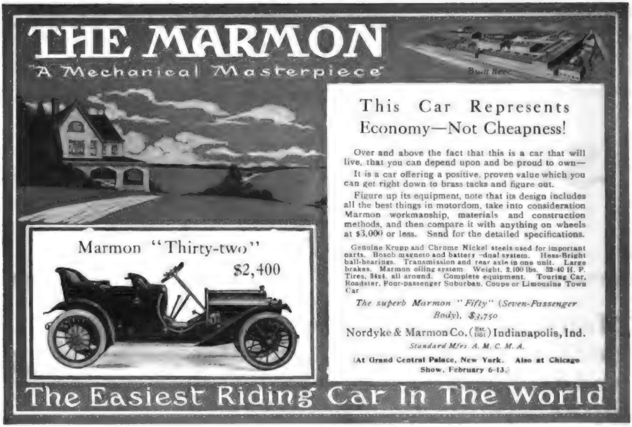
WHY? *Because they have come to realize that with* **STEWART SPEEDOMETERS**, *guaranteed for five years, they are relieved of many annoyances incident to handling other makes.*

GET OUR LITERATURE

MODEL 11—Four-inch 60-mile dial, enclosed season odometer and automatic resetting trip register. New construction. Price . . **$25**

Stewart & Clark Mfg. Company

508 Diversey Boulevard, Chicago, U. S. A.



THE MARMON

"A Mechanical Masterpiece"

This Car Represents Economy—Not Cheapness!

Over and above the fact that this is a car that will live, that you can depend upon and be proud to own—

It is a car offering a positive, proven value which you can get right down to brass tacks and figure out.

Figure up its equipment, note that its design includes all the best things in motordom, take into consideration Marmon workmanship, materials and construction methods, and then compare it with anything on wheels at $3,000 or less. Send for the detailed specifications.

Genuine Krupp and Chrome Nickel steels used for important parts. Bosch magneto and battery—dual system. Hess-Bright ball-bearings. Transmission and rear axle in one unit. Large brakes. Marmon oiling system Weight, 2,100 lbs. 32-40 H. P. Tires, 34x4, all around. Complete equipment. Touring Car, Roadster, Four-passenger Suburban, Coupe or Limousine Town Car

The superb Marmon "Fifty" (Seven-Passenger Body), $3,750

Nordyke & Marmon Co. (Est. 1851) Indianapolis, Ind.

Standard Mfrs. A. M. C. M. A.

(At Grand Central Palace, New York. Also at Chicago Show, February 6-13.)

Marmon "Thirty-two"

$2,400

The Easiest Riding Car In The World

Mr. Motorist:

You cannot afford to take the word of some other fellow in the important question of tires. The "show me" spirit of "the Man from Missouri" pervades the trade world of to-day. How many times have you heard and appreciated the truth of the old statement—"The Proof of the Pudding is in the Eating"?

AJAX TIRES

are the gratifying result of modern machinery combined with high-class materials and intelligent workmanship. A 5,000 mile written guarantee reflects the confidence of the Ajax-Grieb Rubber Company in their product. Write for a copy.

AJAX-GRIEB RUBBER CO.

General Offices: 1776 Broadway, New York City. Factories: Trenton, N. J.

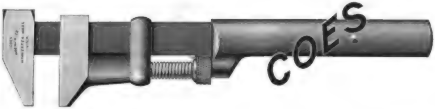
BRANCHES:

New York City,	N. E. Cor. 57th St. and Broadway	San Francisco,	438 Market Street
Boston,	15 Park Square	Los Angeles,	1038 South Main Street
Kansas City, Mo.,	1422 Grand Avenue	Philadelphia,	316 North Broad Street
Denver, Col.,	1529 Cleveland Place	Detroit,	743 Woodward Avenue
Seattle,	1102 Broadway	Chicago,	1418 Michigan Avenue

Milwaukee Agents, . . . Goodyear Rubber Company

Exhibited at the Grand Central Palace and Madison Square Garden Shows

IN A TIGHT PLACE



And there are many of them around an automobile.

You need a wrench that will grip and hold until the nut gives, and not slip and bark your fingers. Coes has the right grip, it holds to the nut with the tenacity of a bulldog.

If the nut don't turn it won't be the fault of the wrench.

In crannies and corners, in the most out of the way places, Coes won't strip a thread or break a jaw.

16 inspections prove it capable of standing the severest strains, as well as hard abuse.

70 years we have led in manufacturing wrenches.

Try one and be convinced it is 30 per cent. stronger than any so-called "just-as-goods."

Made of the highest grade steel specially hardened by our own secret process.

You can't destroy it, or wear it out.

5 styles, 50 sizes.

Get our Wrench Book.

COES WRENCH COMPANY, Worcester, Mass.

AGENTS—J. C. McCARTY & CO., 21 Murray Street, New York
JOHN H. GRAHAM & CO., 113 Chambers Street, New York

See our new Auto Models at all the Eastern Shows

"Non-Swell"

Silent Running

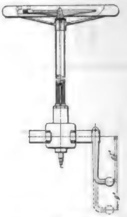
Filled Gears

INFORMATION
ON REQUEST.

Universal Joints

Self Lubricating and Dust Proof

No. 1 . . . 18 H. P.
No. 1½ . . 25 H. P.
No. 2 . . . 35 H. P.



"Little Giant"
Steering Gear

**Buggyabout
Steering Gear**

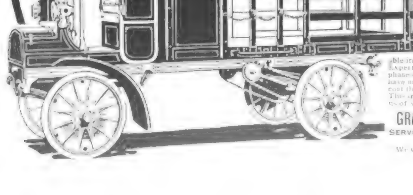
Widmer Machine Company

145-149 FORT STREET
DETROIT, MICHIGAN

GRABOWSKY

WE GUARANTEE SERVICE

POWER WAGONS



Here at last is a commercial car that is ***original*** in every sense of the word—original in design, in construction, and in sales methods.

ORIGINAL DESIGN. Look for these points, that make a commercial car an economical investment instead of an expense. You will find them only in a Grabowsky Power Wagon.

A quick detachable power plant, including engine, transmission and control, that can be detached and replaced in fifteen minutes.

Independent unit construction throughout.

Thermo-siphon cooling system, with emergency condensing chamber that positively prevents superheating.

Double ignition system controlled by one master plug.

Original oiling system that will not splash or foul plugs

ORIGINAL CONSTRUCTION.

Perfect balance throughout

Quick detachable, interchangeable body.

Hardened steel bushings on all wearing parts, that indefinitely prolong the life and service of the car

Compensating steering gear that can always be kept tight

Adjustable glass front and driver's cab on every car.

ORIGINAL SALES METHOD.

We do not wish to sell a single Grabowsky Power Wagon until we know the conditions under which it is to be operated, and know that it will prove a profitable investment for its owner. To this end we maintain an Expert Service Bureau, composed of men who know every phase of the commercial car and its successful operation. We have more authentic information on operating and maintenance cost than any other body of men connected with the industry. This information is at your command, if you will write advising us of your present equipment and service desired

GRABOWSKY POWER WAGON COMPANY

SERVICE BUREAU: 88 CHAMPLAIN ST., DETROIT, MICH.
STANDARD MFRS. A. M. C. M. A.

We will exhibit in New York only at Grand Central Palace Auto Show, opening December 31st

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Premier

The direct comparison between American and foreign cars under the same roof at the Grand Central Palace emphasizes the fact that Europe has lost her supremacy.

The Premier stock chassis is generally conceded to represent the highest achievement in motor car engineering.

"The Quality Car"

Send for Catalogue P

Premier Motor Mfg. Co.
Indianapolis
Ind.

R. M. Owen & Co.
Distributors
East, North and Northwest

100% Minimum Increase
In Power 100%

is applied individually to the driving wheels by the use ofthe HEDGELAND EQUALIZER, over what can be applied by the use of the differential. We drive both wheels positively. This helps on bad roads. Of vital interest to commercial car builders, standard equipment on several of the '09 leading cars. Interchanges with differential on twenty-two makes of cars. Write for the list.

HEDGELAND MFG. CO.

CANTON, OHIO

Briscoe Manufacturing Co.

MANUFACTURERS OF THE CELEBRATED

Briscoe Radiators, Hoods, Fenders, Tanks, Etc., Etc.

The largest and oldest manufacturers of automobile components in the world.

We make all types of Radiators, Honeycomb, Vertical and Horizontal tube, with continuous or individual fins, also for Thermo-Syphon and Pump systems.

We repair all makes of radiators at either plant.

Write either plant for catalog and quotations.

DETROIT, MICH. NEWARK, N. J.

Raybestos

Friction Facing for

Automobile Brakes and Clutches is

Oil Proof Water Proof
Heat Proof (Almost) Wear Proof

Raybestos is a composite asbestos and copper wire material made up in one integral part which permits of its being stamped out in circular form without disintegration occurring.

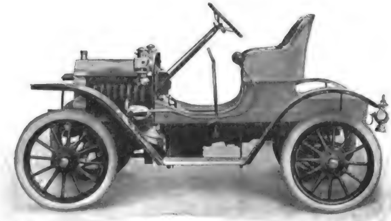
It is the one brake lining that produces friction greater than metal to metal and assures a quick and easy stop on the steepest grade.

Specify Raybestos!

Royal Equipment Co., 163 Housatonic Ave. Bridgeport, Conn.

CHASE
AUTO TOP FABRICS,
HIGH GRADE RUBBER,
and
CHASE LEATHER.
in single & double texture.
MACKINTOSH CLOTHS
All popular materials
Unequaled quality
Coating and proofing.
Write for samples.
L. C. CHASE & CO.
BOSTON. NEW YORK. CHICAGO.
SAN FRANCISCO.

Brush Runabout



On Pneumatic Tires, $550
On Solid Tires - 500

The excellence of a car lies in HOW WELL IT RUNS.

How well it runs is determined by ITS DESIGN AND THE WAY IT IS MADE.

The Brush is WELL DESIGNED. Brush did it. That Brush in designing this car was two years ahead of the times is now shown by the fact that most of the biggest and most reliable French makers are this year showing models that look like plagiarisms of the Brush Runabout. See the pictures and descriptions of the Paris Show.

The Brush is WELL MADE. Visitors to our factory invariably exclaim, "I had no idea you were putting such material and work into such a low priced car." Other manufacturers tell us we are foolish to establish such fine limits or sizes, use such large bearings, and be so particular on materials.

Because of these things the Brush Runabout runs well.

That it does run well is best learned by asking owners. Ask them.

From the standpoint of both owner and dealer, isn't this the kind of a car to tie up to?

Brush Runabout Co., Detroit

MEMBERS A. M. C. M. A.

N. B.—See Trinkle's Transcontinental Car at the Show

"American — Trucks"

DELIVER THE GOODS

One **Properly Constructed** motor truck will do as much work as two or three teams of horses.

Quicker delivery—better for long hauls—will carry a heavier load

Send for details of trucks. ½ to 5 tons capacity.

Passenger Cars Too!

American Motor Truck Co.

MANUFACTURERS
Lock, Church and Caledonia Sts.
LOCKPORT, N. Y.

Grand Central Palace Space No. 212

Simplicity Economy Reliability

FEATURES OF J. & B. COILS AND IGNITION SPECIALTIES

NEW TYPE J. COILS — ABSOLUTELY FOOL-PROOF

Free Trial Offer

We will furnish samples for test to responsible parties. Send for our 30 day trial offer.

Send for this book on ignition. Mailed Free. Ask for Book M.

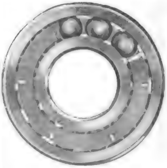
A Complete Working Exhibit will be shown at the
BOSTON AUTOMOBILE SHOW
MARCH 6th to 13th
In Space 523
Dept. F, Mechanics' Bldg

PETTINGELL-ANDREWS CO., BOSTON, MASS.

Exclusive Selling Agents for Jacobson-Brandow Co. of Pittsfield, Mass.

General Offices and Warerooms
Corner Pearl St. and Atlantic Ave.
Boston, Massachusetts

Branch Office
327 Jefferson Avenue
Detroit, Michigan



F & S ANNULAR BALL BEARINGS

are of standard dimensions as regards diameter and width. The balls are of the same diameter as those in other types of bearings. But there are more balls, especially in the new type with die-cast separator, and they last correspondingly longer.

If the ball bearings in your car are unequal to their work, put in a set of

F & S

J. S. BRETZ COMPANY

Sole Importers, TIMES BUILDING, NEW YORK

A Personal Invitation to Every Dealer and Prospective Motorist at the Grand Central Palace Show to Visit the Exhibit of

Simply Perfect

The "Maxwell"

Perfectly Simple

"The Aristocrat of Moderate Priced Cars"

I want you to see the Maxwell at the Grand Central Palace show.

In the making of the Maxwell it has been my belief that we could not afford to use anything but the best materials, because a moderate-priced car, to be as successful as the Maxwell is known to be, must be more durable than the highest-priced cars—because in the very nature of things they receive harder service and less expert attention.

I consider Mr. J. D. Maxwell the foremost automobile designer of the world. Practical to the extreme, Maxwell cars are simple, and because of their simplicity—reliable.

You know the Maxwell principles—principles which have been built in these cars since 1904.

We have issued a magazine; like the foundation of Maxwell success, it is the result of mutual effort. So we call it "The Cooperator." Ask for a copy at the Maxwell booth.

Benj Briscoe *President*

MAXWELL-BRISCOE MOTOR CO.

The Maxwell Principles

Thermo-Syphon Cooling.
Three Point Suspension.
Multiple Disc Clutch.
Unit Construction.
Shaft Drive.
Metal Bodies.

The Maxwell Line—Magneto Equipped

30 H. P. Four Cylinder Touring Car or Roadster	$1,750.00
20 H. P. Two Cylinder Touring Car or Roadster, fully equipped	$1,450.00-$1,350,00
14 H. P. Two Cylinder Tourabout, fully equipped	$825.00
10 H. P. Two Cylinder Maxwell Junior	$500.00

Get posted now—ask for a Catalogue, or better, arrange at our Exhibit for a Maxwell demonstration.

Maxwell-Briscoe Motor Co.

P. O. Box 107
Main Office and Factory: TARRYTOWN, N. Y.
PAWTUCKET, R. I. NEW CASTLE, IND.

The Unisparker

A SIMPLIFIED FORM OF THE ATWATER KENT SPARK GENERATOR

Every owner of a car with batteries and trembler coils has wished for a more reliable ignition system. Those who have tried the Atwater Kent Spark Generator have pronounced it the cure of all their troubles. But to the owner of a car already built the gear-driven Spark Generator is sometimes troublesome to install.

To meet the demand of those wishing a simple and easily applied apparatus we have arranged the Contact Maker—the vital element of the Spark Generator—in a form attachable to any convenient half-time shaft, exactly like the ordinary timer. Combined with it is a compact Distributor. The Coil is separate and goes on the dashboard. On it is a kick switch with special contact for starting on the spark.

The greatest merit of the Atwater Kent Spark Generator in not its battery economy, high though that is, but its extraordinary *reliability*. In the UNISPARKER we place that unique advantage within the reach of every owner of a car.

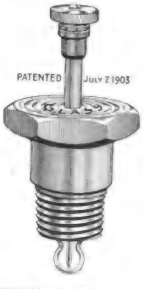
Prices of UNISPARKER and Coil:

6-Cylinder, $50. 4 and 3 Cylinder, $45. 2-Cylinder (Switch not self-starting). **$35.**

Collar for attaching to half-time shaft, 50 cents additional.
Specify size of shaft and direction of rotation (clockwise or counter-clockwise) when ordering.

Atwater Kent Manufacturing Works 48 NORTH SIXTH ST.
PHILADELPHIA, PA.

ANDERSON GLASS PLUG



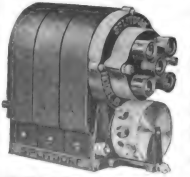
It is a demonstrated fact that the Anderson Spark Plug increases very materially the speed of the machine using it, for the reason that it SPARKS EVERY TIME, ALL THE TIME, and ALWAYS ON TIME.

W. E. HUTTON

Distributor

348 Fulton Street
Brooklyn, N. Y.

Don't Buy a Cheap Magneto



IT IS DEAR AT ANY PRICE

Anything of real value costs money—always did, always will.

The buying of a cheap Magneto is not only a waste of money, but a sure cause of trouble and disappointment.

There is a "best" in everything. While the

SPLITDORF MAGNETO

costs more than others, it is for REAL VALUE

The Most Moderate Priced Magneto Extant

Once and for all there is no Magneto as good as a SPLITDORF
Equip your car with it and your ignition troubles will vanish

C. F. Splitdorf

Walton Ave. and 138t. St., New York
BRANCH: 1690 Broadway

Chicago: 319 Michigan Ave.
San Francisco: 520 Van Ness Ave.
Detroit: 886 Woodward Ave.
Boston Motor Mart: 220 Pleasant St.

THE
MARION
FLYER

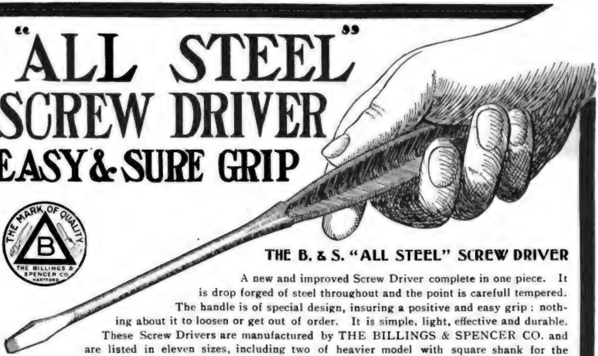
THE CAR WITH CLASS

1 H. P. to Every 52 lbs. of Actual Weight
Detachable Toy Tonneau
or Five Passenger Touring Car

$1,850.00

We shall Exhibit at Grand Central Palace
December 31st to January 7th

Marion Motor Car Sales Co.
INDIANAPOLIS, IND.



"ALL STEEL"
SCREW DRIVER
EASY & SURE GRIP

THE MARK OF QUALITY B THE BILLINGS & SPENCER CO. HARTFORD

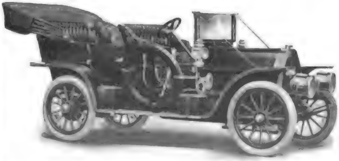
THE B. & S. "ALL STEEL" SCREW DRIVER

A new and improved Screw Driver complete in one piece. It is drop forged of steel throughout and the point is carefull tempered. The handle is of special design, insuring a positive and easy grip; nothing about it to loosen or get out of order. It is simple, light, effective and durable. These Screw Drivers are manufactured by THE BILLINGS & SPENCER CO. and are listed in eleven sizes, including two of heavier model with square shank for the application of a wrench.

THE BILLINGS & SPENCER CO.,
HARTFORD, CONN.

October 15, 1908.

The Non Skidding Car
The "JEWEL 40"



Specifications:

Hedgeland Non-Skidding Device.
Wheels—36 inches.
Wheel Base—120 inches.
Tires—36x4 in. Front, 36x4 in. Rear. Any make.
Engine—"Rutenbur" 4 cylinder—bore and stroke, 4¾x5 inches.
Ignition—Double system with Bosch Magneto, Connecticut Coil and Exide Storage Battery.
Lubrication—Self contained system in the crank case. No outside oil pipes.
Bearings—Adjustable Timken Roller Bearings throughout.
Front Axle—One piece drop forging.
Rear Axle—Full floating type.
Body—Seven passenger.
Price—$3,000.00, complete with top, side curtains, large Prest-O-Lite Gas Tank, trunk rack, tire irons, clock and speedometer.

Agents wanted in unoccupied territory

The Forest City Motor Car Company
12 CANAL STREET, MASSILLON, OHIO, U. S. A.

Special Notices

Want, For Sale and similar advertisements only inserted under this heading at the rate of 20 cents a line of ABOUT SEVEN WORDS, PAYABLE IN ADVANCE. Copy for this department should be in our hands not later than the Monday morning preceding the issue for which it is intended. Nothing less than two lines accepted. Four or more consecutive insertions 10 per cent. discount. Answers addressed to HORSELESS AGE will be forwarded if postage is enclosed.

FOR SALE.

ONE Pierce-Racine one cylinder touring car in good running order; price $100 if sold at once. Easton Auto Company, Easton, Pa.

SACRIFICE—1907 Thomas Flyer, 1906 Acme, new 1907 Reo touring car, second hand Model "R" Ford, 1907. Address Flyer, care H. Age.

TWO cylinder Darracq runabout; just overhauled and in good running order; $150 to quick buyer. Address Easton Auto Company, Easton, Pa.

1,000 MICA SPARK PLUGS, guaranteed or money refunded, 75c. each, postpaid. Robert Instrument Company, 55 Shelby ave., Detroit, Mich.

FOR SALE—New two passenger Try car, 10 horse power, double opposed; a bargain at $300. Try Car Company, 49 Hastings street, Detroit, Mich.

ONE Model K Winton touring car, with top and glass front; tires in good condition; entire car in perfect running order. Address Model K, care of Horseless Age.

TALK WITH PARSONS—Bargain in second hand cars (all makes), supplies, auto painting, vulcanizing and repairing. See Parsons, 1711 Broadway, New York City.

FOR SALE—Four cylinder Type F. Franklin light touring car with top; only run one year; in perfect running order; price $400. Address Easton Auto Company, Easton, Pa.

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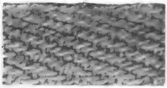

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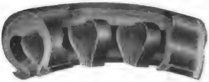

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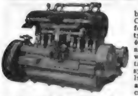

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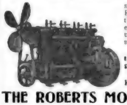

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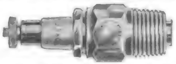

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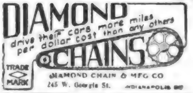

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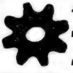

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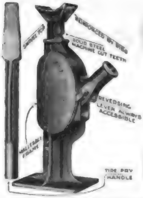
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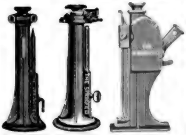

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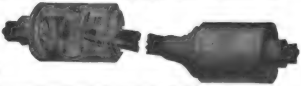

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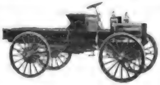

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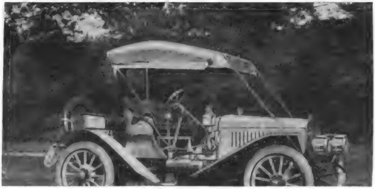

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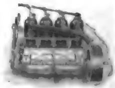

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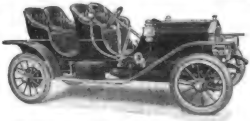

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With both single and double rumble; gas lamps and high tension magneto.

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The car in which more attention is given to the small details than most other manufacturers give to large details.

The car wherein all superfluous detail has been eliminated, where comfort and staunchness reign combined with power and speed, whose finish is not excelled by any.

Don't forget, cylinders are offset one-half inch from center of crank shaft.

Don't forget, that crank case is not called upon to withstand the force of power strokes, but that steel studs run from cylinders to crank shaft bearing caps, which are manganese bronze, with nickel babbitt bearings.

Don't forget, that crank shaft has five bearings which have a combined length of from fifteen to eighteen inches in the various sized motors.

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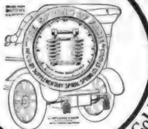

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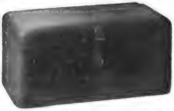

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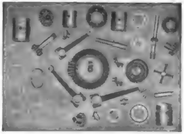

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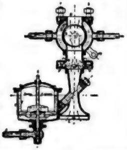

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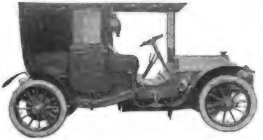

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Nickel steel is used to give lightness and strength. Imported F. & S. ball bearings exclusively. Bosch high tension magneto and multiple disc clutches. Drop forged I-beam front axle—four-speed selective type, sliding gear transmission with direct drive on third speed. All brakes equalized, all expanding type and on rear wheels. Universal joints on all steering connections. Shaft driven, all moving parts enclosed in dustproof cases.

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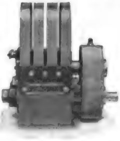

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GEAR DRIVEN AT ENGINE SPEED,

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GUARANTEED TO START WITHOUT BATTERIES.

The Model G K-W Magneto was designed with the sole purpose of replacing the complicated, High Priced, High Tension Magnetos of other makes that go wrong. It has standard base, and will fit in place of Magneto you take off, or in place provided for Magneto on your motor.

READ THIS:

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GENTLEMEN—Wish to say that I have a K-W Magneto installed on my Pierce-Arrow car, and there are no words too good to use in connection with this outfit. It is giving perfect satisfaction, and in fact giving much better results than it was possible to obtain from a high priced Magneto which has been installed and taken off from the car in question. Enough said. Yours very truly,

(Signed) S. S. JOHNSON.

We can show thousands like this.

It's what they all say.

The Model G is just like all other K-W Magnetos, but has a transmission to run it at the desired rate of speed, when driven at crank shaft speed.

The cheapest Ignition System that is good—the best at any price.

We make seven other model Magnetos for make-and-break, and jump spark ignition in belt, friction and gear drive—something for every car.

Get our catalogue.

The best coil made for both the K-W Magneto and for batteries because it is made right.

DO YOU KNOW?

that the average quad coil contains a teaspoonful of water after winding. We take all this out by the advanced K-W system of coil building, giving an anhydrus coil, and a coil with a quick time constant. A coil you cannot break down. Has a good fast Hammer Break Vibrator that gives a good hot spark.

The K-W Coil is the best that can be made at any price, and the price is extremely low for such a high grade coil. No unfair discounts, but true value:

Plain box coils (marine coils or unit coils)	$6.00
Single cylinder mahogany dash coil with switch	12.00
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For synchronized coils add to above	10.00
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The K-W synchronized coil is like the regular K-W coil, and has an extra unit which contains the Synchronizer or Master Vibrator, and has a shunting device on the individual vibrators to short circuit them when the Master Vibrator is in use, so you can use either the Master Vibrator or the individual vibrators at your will, thus giving two systems in one, either of which is better than you are now using. Its advantages are too numerous to mention here.

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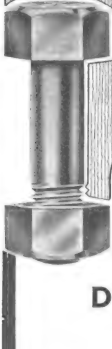

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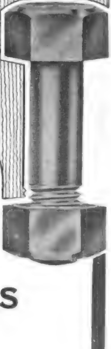

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30 YEARS MAKING SCREWS AND SCREW MACHINE PRODUCTS

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30 THIRTY

$1,250

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MAGNETO Included—of Course

If You've Decided to Buy an Automobile

AN AD-FULL OF ADJECTIVES—a page of pretty platitudes will not suffice to appease your craving for facts and figures—if you've made up your mind you will buy a car, and it's now only a matter of deciding which car will best suit your particular needs.

YOU WANT INFORMATION—some facts you can tie to—some points you can compare—and the more the better—with similar points in other cars.

SO WE WON'T WASTE WORDS in this ad—we'll give you facts boiled down in the form of complete specifications showing just how the E-M-F "30" is made, of what, and why.

YOU'LL FIND BY COMPARISON that this car is a full-sized, 5-passenger automobile. Same dimensions as other cars selling for twice as much, and larger—much larger—than any other car selling for the same price.

IF YOU ARE VERSED in the mechanical lore of motor car construction, you will find all you desire here. If you don't know, then you know someone who does know—and the more he knows about points that spell superiority in a car the stronger will be his verdict in favor of the E-M-F "30."

AFTER YOU HAVE DIGESTED THIS thoroughly look up the nearest E-M-F "30" dealer—there are 500 of them—and arrange for a demonstration. That will settle the question.

SPECIFICATIONS:

MOTOR—HORSE POWER—30.

TYPE. 4 cylinder, Vertical, 4 cycle. Cylinders cast in pairs with water jackets integral. *Water space between cylinders* ensuring uniform expansion and contraction. Valves all one side. Mechanically operated. Interchangeable.

CYLINDERS. Bore 4". Stroke 4½". Compression—moderate. All experience has proven these cylinder dimensions to be nearly ideal for all kinds of service. They give a motor of moderate speed—which means long life. Cooling, lubricating and all other troubles which arise from short stroke, excessive bore, small exhaust valves and short bearings are entirely eliminated in the E-M-F. "30."

CRANK CASE. Cast from highest grade aluminum. Hand hole covers, stamped steel. Instead of the usual cast aluminum arms for supporting motor in frame the E-M-F. motor is carried on pressed steel members in "U" section—no heavier—three times as strong.

VALVES. Are extra large—2⅛"—made from special steel, drop forged. Stems and seats ground. Valve guides machined and pressed into place instead of being cast integral with cylinders—easily replaced when worn.

All engineers agree that large valves not only make for efficiency, but also for economy. A four cylinder motor of 4" x 4½" may, by scientific design, accurate workmanship and large valves be made to develop 30 to 35 horse power at 1,000 revolutions per minute, or it may develop 16—if valves are under-size or the design faulty in other ways.

VALVE PORTS. Inlet and exhaust passages very large and unobstructed—eliminating all chance of eddy-currents, ensuring maximum power efficiency and perfect cooling qualities.

VALVE OPERATION. Single cam-shaft made from high grade steel, drop forged with *all cams integral*. After milling, cam-shaft is case hardened, and all cam surfaces as well as bearings are ground to micrometrical accuracy—guarantees silent running and consistent performance at all times.

CRANK SHAFT. *Is off-set ¾"* from centre line of cylinders—still another increase in power efficiency with minimum of wear on cylinder walls and pistons. Crank shaft, drop forged from special steel. Three main bearings—all large and extra long. *All bearing surfaces ground.* Flange, forged integral on crank shaft carries fly-wheel—ground to ensure perfect centre. Fly-wheel is also given a *running balance* at maximum motor speed to ensure accuracy and absence of vibration.

CRANK SHAFT BEARINGS. Special babbitt ("White metal" alloy) in accordance with best modern practice. Cam-shaft bearings, phosphor-bronze.

CONNECTING RODS. Drop forged steel. I-beam cross section. Crank-pin bearing equal length each side of centre—not off-set. Piston pin bearings, phosphor-bronze. Wrist pin bearings, marine type—not hinged. Lined with die-cast babbitt. Shims provided for adjustment, which is easily made through large hand holes in bottom of crank case.

PISTONS. Extra long—5"—ensuring good compression and long life. Each piston ground, fitted with four rings, and *each set is weighed* to ensure perfect balance of reciprocating parts—a talking-point with some makers—a matter of course with us.

PISTON RINGS. Eccentric type; ground on periphery-face to conform to exact bore of cylinder; also on both sides.

PISTON PIN. Special case-hardened steel ground; drilled hollow to ensure perfect lubrication. Pistons, connecting rods, crank shafts and *all reciprocating parts are mechanically balanced* to eliminate vibration.

LUBRICATION. Splash—automatic, vacuum feed—reliable and economical. Oil reservoir cast integral with aluminum crank case. After having tried countless mechanical "positive feed" oiling devices and found them all wanting in some particular, foremost engineers have decided that the only really positive feed is by gravity; and experience proves that no amount of piping to cylinders and bearings will ensure the same liberal oiling to all moving parts as the old, original splash system, by which the entire mechanism is kept constantly bathed in oil. The one shortcoming of the gravity feed system was the necessity for throttling the feed to prevent flooding, and the tubes frequently became clogged at the valves.

By our system of vacuum regulation—the utilization of one of the simplest principles in nature—we are able to use large tubes, ¼". This absolutely insures free flow of oil from the reservoir, and a constant level in the crank case. Radius: on one filling of oil reservoir, 300 to 500 miles according to road conditions.

COTTER PINS, lock-nuts, keys and taper pins are used at every point to guard against any part getting loose.

OIL CUPS. Are provided for every joint that may at any time require lubrication—steering knuckles, spring connections, operating shafts, etc., etc.

IGNITION. Double system, consisting of (a) magneto, (b) battery. The magneto is not an extra or "special equipment." It is as much a part of the E-M-F. motor as the valves, and is included in the list price of the car. Gears and all moving parts enclosed in oil tight, dust and water proof case. In this regard the E-M-F. car sets a pace for the world, high priced cars included.

ENGINE GEARS. Cam-shaft and Magneto gears all enclosed and separated from crank chamber. Gears lubricated by non-fluid grease—not cylinder oil.

COOLING. Is by large centrifugal pump—high efficiency at slow engine speeds ensuring cooling in hill climbing and hard pulling over muddy roads. Belt driven, stamped steel fan mounted on engine—not attached to radiator. Eccentric belt adjustment.

CARBURETOR. Improved simple float, single jet—our own design. Very flexible and economical. Carburetor is located on driver's side of motor, away from hot exhaust pipes and other parts—readily accessible.

CLUTCH. Improved expanding-ring type. Leather faced. Contained in flywheel. Oil groove in fly-wheel with holes drilled for escape of oil obviates all liability of clutch slipping from this cause. Takes hold gently—and holds when engaged. Adjustment, accessible and easy.

TRANSMISSION. Type—Selective sliding gear. Gear case integral with differential housing in rear axle—"the unit power transmission system" so generally approved by engineers of late. Gears made from E-M-F. formula special steel. Accurately cut and oil treated. Instead of squared shaft for sliding gears, round shaft with four keys integral has been adopted—key-ways milled and *ground*. *Gear centres also ground* to ensure perfect alignment on shaft and silent running—details of construction heretofore known only to the highest priced cars.

SPEEDS. Three forward and reverse—direct on third.

GEAR RATIO. Standard, 3¼ to 1. Speed of car, 50 miles an hour, down to 2 (you won't believe it till we show you) on high.

DRIVE. Direct through universal jointed propeller shaft to bevel gear on differential. Two universal joints. Pressed steel torque shaft. Gears extra large, accurately cut and made from special alloy steel.

DIFFERENTIAL. Bevel gear type—four pinions—another feature heretofore considered too expensive for any but high priced cars.

REAR AXLE. E-M-F. exclusive design. Right and left housing sections drawn from sheet steel and heat treated, giving extra strength. Fitted with truss rods. Hyatt Roller Bearings in hardened and ground removable sleeves carry load. Differential thrust bearings, babbitt between ground steel washers. No balls to split—no adjustment to get out of order. Made right to stay right. Thrust of drive pinion supported by Timken Roller Bearing

Autogenous welding — acetylene-oxygen process — discussed so much in engineering circles and trade journals of late, is used in this axle as well as in several other parts of the car.

Thanks to drawn steel, autogenous welding and "clean" design this axle is lighter than any other live or floating axle on cars of similar weight and power—notwithstanding the entire transmission mechanism is incorporated in it.

All gears—transmission and differential—as well as all shifting mechanism, are immersed in an oil bath. And the transmission-axle case as well as motor crank-case are absolutely oil tight—no mucking of floor boards or dripping on pavements. Provision is made to prevent the oil working out at the axle ends when the car is left standing on an incline. Liberal road clearance.

FRONT AXLE. I-beam type. Drop forged in one piece—not welded in centre. Heat treated. Spring perches forged integral. Liberal safety factor. Spindles off-set back of yoke-posts—scientifically correct—affords easy steering, with tendency to go in straight line. Steering knuckles and all connections drop forged from steel—no castings. Two-point ball bearings in hubs and all joints bronze bushed.

STEERING GEAR. Irreversible, worm and sector made from special steel case hardened. All bearing surfaces ground. Connection from steering arm, at right to left knuckle arm, obviates all tendency to "crankiness" on rough roads.

CONTROL. Gear-shift lever at right of driver. Throttle and spark levers on left side of steering post, below wheel—operated by fingers of left hand without releasing grasp on wheel. Right hand free for emergency brake and gear shifting—the ideal control, rapidly superseding the fad for levers on top of wheel. Auxiliary foot accelerator. Clutch operated by left foot, service brake by right foot. Emergency brake by hand lever on right—ratchet lock.

WHEELS. Artillery type. Large spokes—12. Spokes and felloes first grade second growth hickory.

TIRES. 32" x 3½" on all wheels. Morgan & Wright. Universal quick-detachable rims.

BRAKES. Four—all acting on rear hubs—none on transmission. Service brake, contracting steel bands, camel-hair lined, acting on pressed steel drums integral with rear hubs. Emergency brakes, internal expanding rings in same drum—metal-to-metal. Both sets double acting. Grip on drum is intensified by motion of car after brakes have been applied. Service brakes being on outside renders adjustment easy. Pressed steel disc closes drum, making it dust proof.

SPRINGS. Front, semi-elliptic. Rear, full elliptic. Extra wide for this weight of car—2". Driving thrusts and braking strains taken by two radius rods—not by springs.

FRAME. Pressed steel—U-section. Side members straight—weakened neither by off-setting nor dropping.

MUFFLER. E-M-F. design, silent. Silences by radiation—not by obstruction. Absolutely no back-pressure.

FENDERS. Enameled steel in the newest style, most approved enclosed-full-length-of-the-car type.

MATERIALS. Cylinders made from special formula highest grade, fine grain, gray iron. Intake pipe, brass. Exhaust pipe, gray iron. Crank case, aluminum. Frame, gears, springs, axles and driving shafts all made from special steels—each from an alloy best suited to its peculiar service, and all from E-M-F. formula. Operating levers, spring supports, spring clips, shackles, brackets rod-ends, etc., steel, heat treated. All smaller parts, not drop forged, are pressed or stamped steel—*no malleable castings* enter into the construction of the car—maximum strength with minimum weight, and *absolute assurance of* the safety factor desired.

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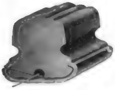

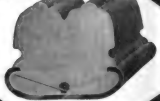

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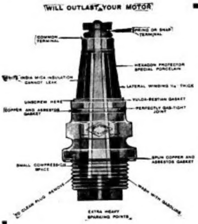
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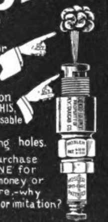

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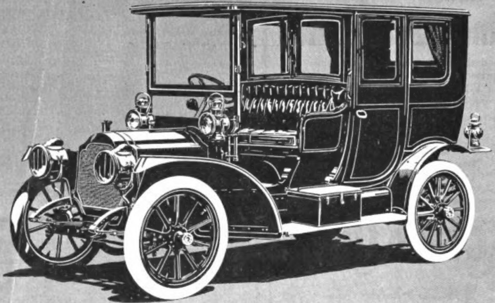

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